PROTECTING POLLINATORS

The Role of State Managed Pollinator Protection Plans in Reducing Toxic Honey Bee Pesticide Exposure

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I. Introduction

Pollinator populations in the United States are declining rapidly. While in the 1940's the number of honey bee colonies stood at 5 million, that number has since decreased to 2.5 million, despite increasing commercial demand on the pollinator.[1] Furthermore, by 2015, the honey bee colony loss in the United States was measured at 42.1%.[2] Over time, it has become clear that pesticides toxic to bees play a significant role in reducing pollinator populations.[3] Managed pollinators are intentionally brought to locations that are treated with the very agents that lead to the pollinators' demise, and these lethal impacts extend to non-managed pollinators within a two-mile radius of application.[4]

This issue is significant because the honey bee, particularly in its domesticated and managed form, is an integral part of modernized farming for one third of the popular crops grown world-wide.[5] The honey bee pollinates crops such as almonds, squash, blueberries, and watermelon, just to name a few favorites. Within the United States they are estimated to support $234-$577 billion worth of annual food production, and to hold a separate $300 million market for honey alone.[6] Of the commercial crops grown, insects pollinate 80-85% of these, and studies have shown that at least 39 of these crops would see a serious decline in production without a healthy pollinator population.[7] Furthermore, at a

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[1] *Survey: Lower Winter Losses, Higher Summer Losses, Increased Total Annual Losses*, U.S. Dep't of Def. (May 12, 2015), http://www.ars.usda.gov/is/pr/2015/150513.htm

[2] *Id.*

[3] *Id*; *Country-Specific Effects of Neonicotinoid Pesticides on Honey Bees and Wild Bees, Science*. Woodcock, B.A. et al (June 30 2017). https://science-sciencemag-org.libproxy.uoregon.edu/content/sci/356/6345/1393.full.pdf

[4] *Pesticide Toxicity to Pollinators: Exposure, Toxicity, and Risk Assessment Methodologies; Stanley, Johnson, Preetha, Gnanadhas.* Springer Nature. (Aug 13 2016). https://link-springer-com.libproxy.uoregon.edu/chapter/10.1007/978-94-017-7752-0_3

[5] *The Beeconomy: Economics and Insect Pollination: The value of pollinators to ecology and the economy, Modern Agriculture* (April 27, 2018). https://modernag.org/biodiversity/beeconomy-economic-value-pollination/

[6] *Id*.

[7] *Valuing Insect Pollination Services with Cost of Replacement, Allsopp, Mike, Lange, Willem, Veldtman, Ruan, PlosOne*, (September 10, 2008). https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0003128

time when human activity is driving one million species into extinction, protecting this species for its inherent value, in addition to its human ecosystem benefits, is yet another compelling reason to organize around pollinator protection.[8]

In recent years, there has been a greater push worldwide to protect pollinators through stricter regulation of pesticides proven to be overtly and acutely toxic to bees. In 2013 the EU restricted the use of three Neonicotinoids, a pesticide proven to be toxic to bees, on all flowering crops, and in 2018 expanded this ban to all field crops.[9] France went even further and banned all five neonicotinoids they had on their markets and Canada is following suit; in 2018 the country imposed a three-year plan to phase out all Neonicotinoids.[10] Notably absent from this movement to ban pesticides toxic to bees is the United States. Despite heavy pushes from concerned experts, scientists, and the general public over EPAs role in governing the registration and use of pesticides dangerous to bees, including extensive comments on rules to re-approve problematic pesticides, and despite several lawsuits against EPA on its regulation methods, the harmful pesticides remain actively used in agriculture. This paper therefore seeks to look at a mechanism outside of the legal system that help bring together concerned stakeholders—from beekeepers and environmentalists to farmers who recognize protecting pollinators means protecting their yield.

Specifically, this paper will research State Managed Pollinator Protection Plans (MP3s) as a collaborative platform outside of the legal system that addresses pesticide use in direct regard to pollinator health. The paper will introduce the concept and role of MP3s, and the paper will help contextualize their importance in the larger framework of pesticide regulation. Importantly, this research will describe MP3s as an important communication and cooperation tool within the regulatory framework; while not legally binding, these plans facilitate the difficult conversations between the predominant actors in the state who have a dedicated relationship to pollinators. Therefore, these findings

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[8] *HUMANS ARE DRIVING ONE MILLION SPECIES INTO EXTINCTION: LANDMARK UN-BACKED REPORT FINDS THAT AGRICULTURE IS ONE OF THE BIGGEST THREATS TO EARTH'S ECOSYSTEM*, *NATURE* (May 6, 2019). https://www.nature.com/articles/d41586-019-01448-4

[9] *THE CURRENT STATUS OF NEONICOTINOIDS IN THE EU: EUROPEAN COMMISSION* (May 30, 2018). https://ec.europa.eu/food/plant/pesticides/approval_active_substances/approval_renewal/neonicotinoids_en

[10] *CANADA JOINS THE LIST OF COUNTRIES TO BAN THE USE OF NEONICOTINOID-BASED PESTICIDES; AGRONOMAG (*November 21, 2018). https://agronomag.com/canada-joins-the-list-of-countries-to-ban-the-use-of-neonicotinoid-based-pesticides/

can benefit any state that seeks to create coordination and collaboration between stakeholders, mainly between Growers/ Pesticide Users and Beekeepers/ Environmentalists, to view how other states have created a platform for coordination and crafted language to appease all parties while ultimately advocating for better protection of pollinator health against toxic pesticides.

More specifically, this paper will include:

- A literature and policy review that includes:
  - how pesticides impact pollinators
  - the different interests and strategies of the stakeholders concerned with pollinator health
  - what is and is not being done to regulate pesticides harmful to pollinators at the federal level
  - an introduction to MP3s
- An overview of this paper's research question and methods
- The findings of a content analysis of four state MP3s, which compares and contrasts the elements of each plan
- A conclusion and recommendation section for other states who may create MP3s

II. Literature and Policy Review

To provide context to MP3s and their important role in protecting pollinator health within the regulatory scheme, this literature review will explain how chemicals are toxic to bees, who is in charge of regulating the chemicals toxic to bees, what the shortcomings are of these regulations, and why coordination at the state level is therefore important. Further, the literature review will explore the unique relationship between farmers and environmentalists around pollinators, which further underscores the importance of a unifying guidance document like the state MP3 to better facilitate the interests of all stakeholders. This section will therefore start with an explanation of the academic

literature describing how pesticides are toxic to bees, and how this impacts the relationship between Growers/ Pesticide Users and Beekeepers/ Environmentalists. Then, this section will introduce and describe the federal framework and its shortcomings, and the federal conceptualization of state plans, to further emphasize the importance of management at the state level.

A. Literature Review

i. Pesticides Toxic to Pollinators

While more than 1,000,000 invertebrates pollinate plants, the Hymenoptera species, and specifically the honey bee, is considered to be one of the most efficient pollinators of the most efficient species, and their domestication and management worldwide leaves them responsible for 80%-85% of the world's agricultural pollination services.[11] Further, the contribution of the honeybee to increased seed yield, as seen in the table above, has been proven across several important crops, with the most impressive result showing a 46% increase in crop yield of canola seed as compared to fields with no honeybee pollinators.[12]

Table 1: Honey Bee Pollination and Crop Yield

Impact of planned honey bee pollination in different crops

Crops	Percent increase		
	Pod set	Seed set	Seed yield
Radish	19.33	11.93	20.41
Broccoli	12.51	16.61	28.67
Chinese cabbage	13.49	11.73	12.01
Knol-khol	14.93	10.95	21.77
Mustard	18.60	17.75	12.23
Coriander	–	27.84	16.81
Fenugreek	16.54	18.30	18.51
Onion	–	25.19	24.40

[11] *Id.*

[12] *Id.* at 1.1: Insect Pollinators; TABLE: *Pesticide Toxicity to Pollinators: Exposure, Toxicity, and Risk Assessment Methodologies; Stanley, Johnson, Preetha, Gnanadhas.* Springer Nature. (Aug 13 2016). https://link-springer-com.libproxy.uoregon.edu/chapter/10.1007/978-94-017-7752-0_3

While honeybees are undeniably important for pollination and crop yields, so is the use and prevalence of pesticides as a crop-health management tool. By definition and design, pesticides "prevent, destroy, repel, or mitigate" pests, and unfortunately, pollinators are the most affected non-target organism of pesticide application poisoning.[13] The class of pesticides most toxic to pollinators are Neonicotinoids.[14] Neonicotinoids affect the central nervous system of insects, and cause paralysis and death at the right dosages.[15] Bayer introduced the first commercially viable neonicotinoid, *imidacloprid*, in 1986, and as early as 1994, European farmers noticed the negative correlation between neonicotinoid application and honeybee die offs. [16] In 2006, the U.S. also noticed a catastrophic dip in its honeybee population, and scientific studies began to question the correlation between neonicotinoids and Colony Collapse Disorder (CCD).[17] Colony collapse disorder (CCD) is characterized when a majority of the worker bees in a colony suddenly abandon a hive, leaving behind the queen that cannot survive without her workers.[18] While scientists have identified several influences on CCD such as pathogens, parasites, monoculture seasons, and natural habitat degradation, an increasing number of studies point to the collective effect of micro-dosages of neonicotinoids on foraging honey bees as the major factor in Colony Collapse Disorder (CCD).[19]

Despite this noted correlation, neonicotinoids remain the largest seller of insecticides worldwide with a global market share of 40% in normal sales, and 77% of treated seed sales.[20] The U.S. uses neonicotinoids on its major crops,

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[13] *What Are Pesticides: Basic Information about Pesticide Ingredients*, EPA (Accessed May 29, 2019). https://www.epa.gov/ingredients-used-pesticide-products/basic-information-about-pesticide-ingredients; *Pesticide Toxicity to Pollinators: Exposure, Toxicity, and Risk Assessment Methodologies; Stanley, Johnson, Preetha, Gnanadhas.* Springer Nature. (Aug 13 2016). https://link-springer-com.libproxy.uoregon.edu/chapter/10.1007/978-94-017-7752-0_3

[14] *Chemicals Implicated*, Beyond Pesticides, http://www.beyondpesticides.org/programs/bee-protective-pollinators-and-pesticides/chemicals-implicated (last visited Jan. 10, 2016).

[15] *Id.*

[16] Evan Jensen, *Banning Neonicotinoids: Ban First, Ask Questions Later*, 5 Seattle J. Envtl. L. 47, 55 (2015); Benjamin W. Reynard, *The Producer-Pollinator Dilemma: Neonicotinoids and Honeybee Collapse Disorder,* http://repository.upenn.edu/cgi/viewcontent.cgi?article=1050&context=mes_capstones (last visited Jan. 10, 2016).

[17] *Id.*

[18] *Colony Collapse Disorder*, Environmental Protection Agency, http://www.epa.gov/pollinator-protection/colony-collapse-disorder (last visited Jan. 10, 2016).

[19] *Honey Bee Health and Colony Collapse Disorder*, U.S. Dep't of Agric. (Nov. 5, 2015). http://www.ars.usda.gov/News/docs.htm?docid=15572

[20] *Systemic Pesticides*, The Task Force on Systemic Pesticides, http://www.tfsp.info/systemic-pesticides/ (last visited Jan. 10, 2016); *Report: Pesticides & Honey Bees, State of the Science*, Pesticide Action Network (May 2012). http://www.panna.org/issues/publication/pesticides-and-honey-bees-state-science

applying the pesticides to 95% of corn and canola crops, and on about half of all soybean crops.[21] The most commonly used neonicotinoid is *imidacloprid*, and the most popular mode of *imidacloprid* application is seed coating; this makes the pesticide systemic to the plant. [22] A systemic pesticide means the pesticide is transported from the seed to every plant tissue—flowers, roots, stems, leaves, pollen and nectar.[23] When an invertebrate ingests any part of the plant, it will ingest a micro-dose of the neonicotinoid that coated the seed.[24] Therefore, when the honey bee forages on pollen and nectar from a neonicotinoid treated plant, it ingests and carries the pesticide.[25] While this ingestion occurs at a sub-lethal dosage, these doses severely degrade a bees homing ability, which means the bee's receptors that control foraging activity, olfactory memory, and overall navigation are degraded.[26] On a daily basis, an exposed bee has a 34% less chance of ever returning to the hive.[27]

While a colony can survive a 10% to 30% reduction of worker bees, when this number is exceeded the hive becomes vulnerable.[28] Therefore, when many bees in a hive do not return due to neonicotinoid exposure—which is particularly relevant for hives near heavily treated fields—it pushes the hive towards collapse.[29] Hives that are close to fields with neonicotinoid-coated seeds are at risk even if the crop is one such as corn that bees do not pollinate; the dust produced by neonicotinoid seed treatment becomes airborne and reaches the bees, which creates the same lethal effects

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[21] *Id.* at iv
[22] Emily Knobbe, *The Problem with Pesticide Registration*, 1 Western Environmental Law Land Air Water Oregon 11, 11; *Systemic Pesticides*, THE TASK FORCE ON SYSTEMIC PESTICIDES, http://www.tfsp.info/systemic-pesticides/ (last visited Jan. 10, 2016)
[23] *Id.*
[24] Evan Jensen, *Banning Neonicotinoids: Ban First, Ask Questions Later*, 5 Seattle J. Envtl. L. 47, 57 (2015).
[25] Mickaël Henry et al., *A Common Pesticide Decreases Foraging Success and Survival in Honey Bees*, 336 Science 348, 348 (2012), accessed at: http://www.sciencemag.org.libproxy.uoregon.edu/content/336/6079/348.full
[26] *Id.*
[27] *Id.*
[28] David Fischer, Thomas Moriarty, Pesticide Risk Assessment for Pollinators: Summary of a SETAC Pellston Workshop, Setac Press 7 (January 2011), http://c.ymcdn.com/sites/www.setac.org/resource/resmgr/publications_and_resources/executivesummarypollinators_.pdf?hhSearchTerms=SETAC+and+Pellston+and+Workshop
[29] Mickaël Henry et al., *A COMMON PESTICIDE DECREASES FORAGING SUCCESS AND SURVIVAL IN HONEY BEES*, 336 Science 348, 348 (2012), accessed at: http://www.sciencemag.org.libproxy.uoregon.edu/content/336/6079/348.full

that lead to CCD.[30] Studies have also found that neonicotinoids are the potential catalyst for other factors influencing CCD; exposure to neonicotinoids is responsible for lowering the bees' immune systems, which makes the hive more vulnerable to pathogen and parasite invasions.[31] Eliminating neonicotinoids would therefore also decrease a hives vulnerability to parasites and pathogens.[32] While neonicotinoids have the most conclusive science tied to pollinator deaths, other pesticides are also toxic to bees, and there is no slowing of the pesticide industry; the market is predicted to more than double by 2050.[33] As a result, it is important to look toward the players on the ground interacting with pollinators and pesticides, to determine how their coordination could benefit pollinator health.

ii. Growers, Pesticide Applicators, and Beekeepers: How are interests balanced to benefit pollinator health and protect crop vitality

While pesticide use is a farming practice growers will employ for the foreseeable future, as is noted in the Bero's *Approaching the Pollinator Problem Through Human-Bee Relations*, pollinator health is vitally important to growers as well, and pesticide applicators who work in direct relationship with growers have a genuine interest in protecting pollinators.[34] These concepts will be described below, in the form of a general discussion of a case study on the relationship dynamics in the beekeeping/ farming world in regard to bee health, and in a description on the growing push for Integrated Pest Management strategies that deemphasize the use of pesticides.

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[30] *Assessment of the environmental exposure of honeybees to particulate matter containing neonicotinoid insecticides coming from corn coated seeds*, Andrea Tapparo et al., 46 *Environ. Sci. Technol.* 2592–2599 (2012), http://www.ncbi.nlm.nih.gov/pubmed/22292570; Tom Philpott, *Leaked document shows EPA allowed bee-toxic pesticide own scientists' red flags*, GRIST (Dec. 11, 2010), http://grist.org/article/food-2010-12-10-leaked-documents-show-epa-allowed-bee-toxic-pesticide/

[31] *Colony Collapse Disorder Progress Report*, U.S. Dep't of Agric., 5 (June 2012). http://www.ars.usda.gov/is/br/ccd/ccdprogressreport2012.pdf; *State of the Science*, Pesticide Action Network, 15, (May 2012), http://www.panna.org/issues/publication/pesticides-and-honey-bees-state-science

[32] *Id.* 402

[33] *The Potential Impact of Insecticides on the life-history traits of bees and the consequences for pollination: Brittain, Claire, Potts, Simon: Basic and Applied Ecology, Vol. 14, No 4* (June 2011).

[34] *Approaching the Pollinator Problem Through Human-Bee Relations: Perspectives and Strategies in Beekeeping,*: Bero, Ursula: University of Ottawa. (July 2017). https://ruor.uottawa.ca/bitstream/10393/36511/1/Bero_Ursula_2017_thesis.pdf

a. Discussion of Grower, Pesticide User, Beekeeper Relationship

Bero's *Approaching the Pollinator Problem Through Human-Bee Relations*, mentioned above, takes a qualitative look at the relationships between crop-growers and beekeepers in south-eastern Ontario, Canada. In her study she conducted several interviews with these two stakeholders; with beekeepers, she found that groups across the board were interested in reducing pesticide use, and she found that hobbyist beekeepers and beekepers for managed-bees on larger farms both felt that agricultural chemical inputs threatened long-term hive health.[35] She also included farmers in her study, as she noted they also "mobilize strategies to ameliorate the human-bee relationship."[36] Other research supports this inclusion of farmers, noting the "contributory expertise" of agricultural workers, and the importance of including these stakeholders in the discussions over environmental concerns.[37] While Bero conducted a small community sample, with mostly small-scale growers, it is clear from her research that there is an overall awareness amongst farmers of the impact pesticides (the type and the prevalence of them) are having on bees, and there is also some understanding of the impact collective efforts could have on approaching pollinator health issues. Farmers in the area were aware not only that pesticides were over-applied and it was impacting the vitality of bees, but also that the threat to pollinators was a direct threat to their economic output; consequently, many of the farmers stated that while divestment from the current level of pesticide use would be difficult, it was a necessary step. Some farmers even mentioned neonicotinoids by name as a pesticide of concern for pollinator health. Another interesting piece of feedback was the concern the smaller farmers had in regard to big agriculture as a the largest threat to pollinator health, particularly with the application of pesticides; they saw this larger scale of the same industry as the determinative

[35] *Id., BE(E)COMING EXPERTS: THE CONTROVERSY OVER PESTICIDES IN THE HONEY BEE COLONY COLLAPSE DISORDER, SURYANARAYANAN, SAINATH, KLEINMAN, DANIEL: SOCIAL STUDIES OF SCIENCE, VOL. 23, NO. 2, P 212* (April 2013).
[36] *PERSPECTIVES AND STRATEGIES IN BEEKEEPING,:* BERO, URSULA
[37] *BE(E)COMING EXPERTS: THE CONTROVERSY OVER PESTICIDES IN THE HONEY BEE COLONY COLLAPSE DISORDER, SURYANARAYANAN, SAINATH, KLEINMAN, DANIEL: SOCIAL STUDIES OF SCIENCE, VOL. 23, NO. 2, P 212* (April 2013).

player and felt somewhat powerless against reducing pesticides or otherwise protecting pollinators when the largest contributors were not part of the reduction effort.

This feedback reinforces the role state MP3s can have in communities; as this study shows, when asked, many stakeholders appreciate the same issues and have shared goals in protecting pollinators, but as individual units do not feel empowered to act or make a change. Therefore, having a tool for coordinated effort around common issues—such as a reduction of neonicotinoids or pesticides in general and other mechanisms for protecting pollinators—could go a long way in potentially also looping in those large-scale farmers and setting goals and establishing best management practices that benefit not just all of the stakeholders, but the pollinators as well. The next section of this paper will look at one of the popular strategies stakeholders such as small and large scale farmers can take to reduce the amount of pesticides in use.

b. Discussion of Integrated Pest Management (IPM) Strategies

One tool with growing popularity as a means of benefiting all stakeholders around pollinator health is the use of Integrated Pest Management (IPM) to decrease the amount of chemical inputs in farming. While IPM has a number of definitions and a set of suggested guidelines, there is no mandatory scheme and this approach is meant to adapt to the needs of the user. The main tenants, however, are: soil preparation, strategic planting, forecasting, pest trapping, monitoring, thresholds for pest damage level, cultural controls, biological controls, chemical controls, and recordkeeping.[38] Notably, chemical controls are next to last on the list, and as the IPM Institute of North America states, "Application of pesticides are always the last resort in an IPM program."[39] As many models for IPM emphasize, these is no easy one size fits all model for IPM, and "no single configuration of technologies, inputs, and ecological

[38] What is Integrated Pest Management? IPM Institute of North America (2019). https://ipminstitute.org/what-is-integrated-pest-management/
[39] *Id.*

management is more applicable than another;" rather, implementation and success is entirely dependent on the context of the crop/farm dynamics.[40]

This can be daunting for farmers and underlies the importance of providing extension services to farmers dedicated to transferring to IPM strategies. As Pretty emphasized in her work, IPM systems "depend on new configurations of social capital, comprising relations of trust embodied in social organizations, horizontal and vertical partnerships between institutions, and human capital comprising leadership, ingenuity, management skills, and capacity to innovate."[41] This underscores the importance of a state-level management tool to facilitate their actual use and introduction in a way that aligns with the needs of beekeepers in maintaining pollinator health and farmers in maintaining their yields, with farmers receiving the support they need from extension services or other area leaders.

B. Policy Review

The previous sections address both how pesticides harm bees and how state-level tools for stakeholder coordination and resource sharing are an important step for protecting pollinator health across fields of interest. This section, a policy review, briefly touches on what federal act controls pesticide regulation and what federal agency has authority over the management of this act. This section then touches on the loopholes, and therefore failures, of both the federal act and the governing agency in their role of regulating pesticides harmful to pollinators. Finally, this section will introduce how MP3s originated and what federal agencies assist in their creation and implementation at the state level. Overall, this policy review orients the paper to the legal framework that creates not only the literal conception of MP3s, but also the needs for them in light of federal and agency shortcomings in regard to pollinator protection from pesticides.

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[40] *Integrated Pest Management for Sustainable Intensification of Agriculture in Asia and Africa*: The Sustainable Intensification of Agriculture, Pretty, Jules, Bharucha, Zareen: Insects, Vo. 5, No. 1 (March 2015).

[41] *Id.*

i. Federal Regulations and Loopholes

Pesticide regulation occurs at many levels. At the Federal level, the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) is the controlling statute, and the Environmental Protection Agency (EPA) is tasked with management and enforcement of FIFRA. Unfortunately, several loopholes have been exposed in this regulatory system via EPAs use of FIFRA's conditional permitting system, and with a definitional technicality that omits treated seeds from EPA regulation. Conditional permitting, allowed via an amendment to FIFRA, degrades pollinator protection because it allows pesticides on the market while the scientific studies are still being conducted, which defies the procedural safeguards for human health and the environment embedded in FIFRA section 136(a)(c).[42] This is a significant loophole because of the approximately 16,000 pesticides now on the market, 65% had been approved through conditional permitting, including four of the current neonicotinoids on the market.[43]

Coated seeds are a complicated regulatory topic because EPA technically loses regulatory authority of a pesticide once it is converted to a seed coating.[44] This occurs because EPA regards coated seeds as "treated articles" under 40 CFR 152.25 – Exemptions; a pesticide of this character does not require FIFRA regulation.[45] This degrades pollinator safety because studies have found that up to 90% of the pesticide coating can scrape off or blow away as dust in the planting process, seeping into the soil and groundwater.[46] These studies also show the presence of the pesticides in the entire crop, soil, dust, water, non-crop vegetation, and non-target organisms around areas planted with pesticide-

[42] 7 U.S.C. § 136(a)(c)(5); *Conditional Pesticide Registration*, ENVIRONMENTAL PROTECTION AGENCY, http://www.epa.gov/pesticide-registration/conditional-pesticide-registration (last visited Jan. 10, 2016).
[43] Jennifer Sass, *Superficial Safeguards: Most pesticides are approved by flawed EPA process*, Natural Resources Defense Council (Mar. 2013), http://www.nrdc.org/health/pesticides/files/flawed-epa-approval-process-IB.pdf
[44] *Pesticide Registration Manual: Chapter 13 – Devices*, ENVIRONMENTAL PROTECTION AGENCY, http://www.epa.gov/pesticide-registration/pesticide-registration-manual-chapter-13-devices (last visited Jan. 10, 2016).
[45] 40 C.F.R. § 152.25 (2006).
[46] *Id*. at 6

coated seeds.[47] Further, as stated before, neonicotinoids make up to 77% of treated seed sales, meaning much of this seed-treated contamination is toxic to bees.[48] Despite great pressure from the scientific and environmental community, and several law suits, EPA has not changed its position. This loophole in regulating pesticide coated seeds, and the abuse of the conditional permitting system, further emphasize the need for other steps for pollinator protection, with collaboration amongst stakeholders outside of a legal framework being one of them. An introduction of a mechanism for this type of collaboration will be described below, in the creation of State Managed Pollinator Protection Plans.

ii. Origin of State Managed Pollinator Protection Plans (MP3s)

MP3s came into being through a Presidential Memorandum (Memo) on Pollinator Health dating back to the 2014 Obama Administration. Within this Memo, the former president, among other things, called for the creation of the facilitation of public-private partnerships, which eventually formed the concept of MP3s.[49] In the Memo, EPA was tasked with aiding the creation and implementation of MP3s, and EPA was awarded an earmarked fund of $500,000 on the 2016 annual budget toward this task, showing the administration's intent in facilitating the creation of state plans.[50] EPA brought on FIFRA's Issues Research and Evaluation Group (SFIREG) and the Association of American Pesticide Control Officials (AAPCO) to help draft a guidance document on what these MP3 state plans could look like, to help facilitate implementation along a vaguely standardized framework that was deemed to be the most beneficial for all stakeholders surrounding pollinators and pesticide application.[51]

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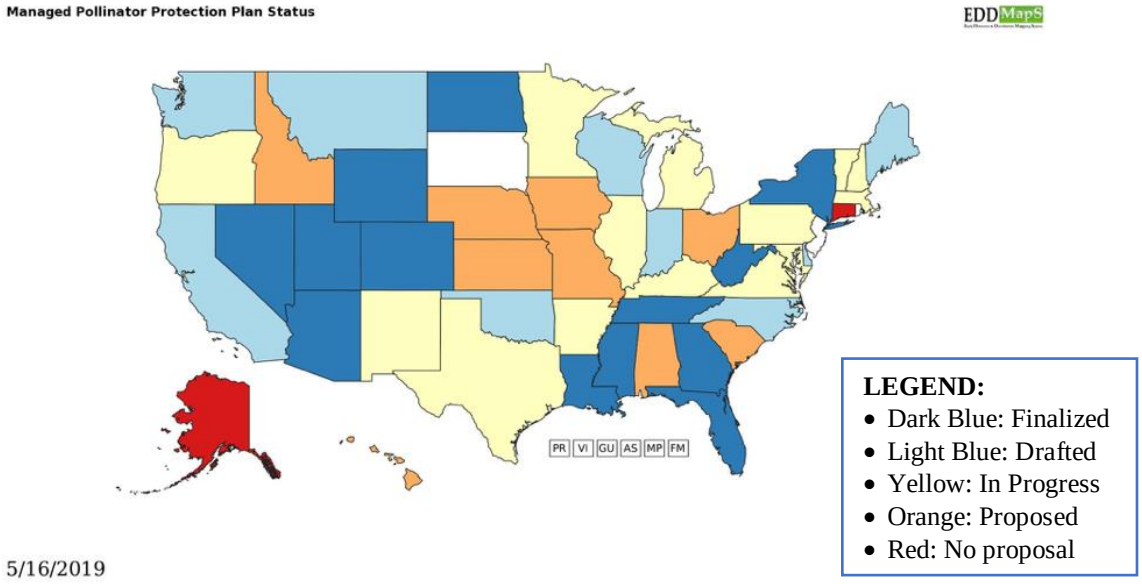
[47] *Id*.
[48] *Systemic Pesticides*, THE TASK FORCE ON SYSTEMIC PESTICIDES, http://www.tfsp.info/systemic-pesticides/ (last visited Jan. 10, 2016); *Report: Pesticides & Honey Bees, State of the Science*, PESTICIDE ACTION NETWORK (May 2012). http://www.panna.org/issues/publication/pesticides-and-honey-bees-state-science
[49] Pollinator Partnership Action Plan, The White House Pollinator Health Task Force, p7 (June 2016) https://www.whitehouse.gov/sites/whitehouse.gov/files/images/Blog/PPAP_2016.pdf
[50] *Id*.
[51] Final Guidance for State Lead Agencies for the Development and Implementation of Managed Pollinator Protection Plans: SFIREG (June 2015) https://aapco.files.wordpress.com/2015/08/sfireg-mp3-guidance-final.pdf

While all final MP3 products are different, the AAPCO describes the critical elements to be included in an MP3 as: a stakeholder participation process, a mechanisms for applicators to know if there are pollinators near a treatment site, a way for applicators to contact bee managers before application, best management practices to minimize overall risk to bees, a plan for outreach, a process to review and revise, and a way to determine how effectiveness of plans.[52] MP3s are therefore intended to create a systematic, cooperative model that relies on communication and the mutual respect of stakeholders to reduce bee losses from pesticide exposure.[53] The current progress of states' MP3 implementation along the lines of the guidance document can be seen below.

Figure 1: Managed Pollinator Protection Plan Status



Source: AAPCO, MP3 Status

[52] *Id.*
[53] *Id.*

As will be described in greater detail below, this paper reviews four of these implemented MP3s from Nevada, Utah, Colorado, and Wyoming. The paper analyzes how the plans compare to one another; the analysis is conducted to give guidance to other states who may consider implementing their own MP3s to bring together their state's unique multitude of pollinator stakeholders. In doing so, this paper aims to provide an example to other states on who to involve, in what way to involve them, and on what categories and language can be included in their implementation of a plan—mainly, it should demonstrate the importance of MP3s in bringing together many stakeholders, and often stakeholders with very different end goals, to the same table to discuss how to best cooperate and coordinate for the overall benefit of pollinator health *and* successful crop management.

III. Research Question

The background research makes it clear that, while farmers and beekeepers have been historically at odds on the topic of chemical inputs and the impact on bees, there is a growing desire for communication and coordination between these stakeholders under the increasing pressure of bee die-offs, which harm all parties involved. After reviewing the problem, what does and does not work as a regulatory framework, the climate of the relationship between stakeholders, and the potential of using state MP3s as a launchpad for stakeholder coordination and implantation of IPM plans that all parties approve of, this paper asks the following research questions:

- What terms do MP3s actually discuss, and to what extent?
    - How does this differ between states, and is it clear why different states include or exclude different elements?
- Do all state MP3s have IPM plans?
    - If so, how are the plans described or introduced?
    - Is there information on how to implement IPMs, or is it left open-ended?

- What stakeholders are involved?
    - Is there a system for continued input and edits?
- Is it clear what stakeholder have the most power?
- Were there specific communication tools introduced by the MP3s
    - What are they, to what extent and what authority are they present?

IV. Methods

To answer my research question, I completed a deductive content analysis on the MP3s of four states: Nevada, Utah, Colorado, and Wyoming. I used AAPCO/SFIREG's MP3 Implementation Guidance Document to select my first set of terms/topics to search within each state plan.[54] These terms are:

Critical Plan Elements:

- Head Agency
- Stakeholder Participation
- Communication between Applicators and Beekeepers
    - A. how do applicators know bees are there
    - B. how can applicators give beekeepers warning
- Inclusion of best practice language/ Who the BMPs are addressing:
    - A. labeling requirements
    - B. controlling flowering weeds
    - C. apply when bees are less active
    - D. more targeted application methods/reduce drift

[54] *State FIFRA Issues, Research, and Evaluation Group Final Guidance for State Lead Agencies for the Development and Implementation of Managed Pollinator Protection Plans,* June 2015: EPA, SFIREG. https://aapco.files.wordpress.com/2015/08/sfireg-mp3-guidance-final.pdf

    - E. use products less toxic to bees
    - F. create/utilize IPM plans
    - G. Other
- Public outreach/ other outreach
- Review/ Modification (incorporate stakeholder feedback, timeline and process for review, timeline and process for modification)
- Measuring Effectiveness (measure by changes in behavior, by bee exposure events, by overall pollinator health)

Recommended Elements:

- Communication with crop advisors and agricultural extension services
- Written contracts between landowners and beekeepers
- Crop Specific or Site-Specific Plans

I added some additional terms to this list to make the findings as comprehensive as possible:

- What state players are responsible for *managing/enforcing* MP3s?
- Which provisions are binding v. voluntary?
- Are Neonicotinoids specifically mentioned, by name or by reference?
- Are other plans mentioned?
- Are other state or federal laws regarding pesticides mentioned within the MP3?

The full, completed table with the inclusion of these terms as they were found in each state MP3 can be found in Appendix A of this paper.

V. Findings

Overall, Nevada, Utah, Colorado, and Wyoming utilized and omitted the same elements from the SFIREG implementation guidance documents, with slight variations based on the unique needs or set ups of the states. In the next section, I will first briefly explain the layout of each state plan before discussing the similarities and differences of the four plans within the following three categories: 1. Stakeholder Engagement and Outreach, 2. Binding v. Voluntary Language, Communication Between Stakeholders, 3. Enforcement Mechanisms, Effectiveness Measurements, and Review/Modification of MP3s. The comprehensive content analysis with the data for these findings can be found in Appendix A of this paper.

A. General Overview of Each State's MP3

This section breaks down the general characteristics of the MP3s for Nevada, Utah, Colorado, and Wyoming.

i. Nevada

Nevada introduced its MP3 by emphasizing the importance of timely communication and coordination amongst stakeholders, and the plan identifies beekeepers, growers, landowners, and applicators as its target audience. The MP3 also opens by stating, that while the plan is written in the context of managed pollinators, the honey bee, the state plans to expand the MP3 to a non-agricultural setting and to other pollinators, as the state has mainly hobbyist beekeepers and does not heavily rely on pollinators for crop services. Even so, Nevada has two state laws that mandate certain pollinator-related actions; first, Nevada codifies FIFRA's label directions requirement into its own state law, and Nevada is the only state reviewed that has a *notification* requirement placed on pesticide applicators to alert beekeepers within 24 hours of a pesticide application within "pollinator awareness zones," which are defined as hives within 1-2 miles of a treatment site.

On the flip side, beekeepers are also required to notify all pest control licensees in the area of the location of their hives. Nevada Department of Agriculture's etymology staff makes this communication easier by maintaining a voluntary web-based apiary registration database. While this part of the MP3 is robust, the rest of the plan mostly contains general BMP language found in the AAPCO/SFIREG MP3 guidance document, and it does not show much unique development by the state, with the exception being the further training and outreach section. Nevada does have a unique education outreach program in place; NDA, in conjunction with the University's extension school, created a pesticide safety training and certificate program for professional applicators, citing the importance of training and education.

ii. Utah

Utah's plan starts out by emphasizing the importance of promoting collaboration between beekeepers and agriculture in the state, noting that while the plan did not aim to ban pesticide use, it did plan to bring together stakeholders to better manage pesticide use. In Utah's MP3, both beekeeper hive registration and grower/applicator application notification are voluntary; thus, communication depends on buy-in to the system. The plan emphasizes person-to person communication and a visual walk through of application sites, and the Utah Department of Agriculture and Food (UDAF) maintains an online database with beekeeper contact information, if provided by beekeepers.

While Utah's MP3 does not include much information on the stakeholders involved at the start of the plan, it includes information on who is involved in the plans for outreach and education to help implement the plan and educate relevant stakeholders on the plan's elements. For example, the MP3 details UDAF's Apiary Program's plan to work with the University's extension school to create programs to educate the general public on pollinator health, in addition to teaching master gardeners about pesticide concerns relating to honey bees. In terms of educating applicators, the plan

identifies meetings on BMPs for mitigating pesticide exposure to honey bees with the Utah Nursery Landscape Association and the Utah State Horticulture Association. In another approach to educating applicators, the MP3 discusses UDAF's plan to create continuing education credits on the topic. As a whole, Utah has great mechanisms for moving the plan out into the world, reaching those who will actually be impacted by the BMPs.

iii. Colorado

The introduction of Colorado's MP3 sets the tone from the start: its plan is about regulating the proper use of pesticides, so they are used with the least amount of harm to improve pollinator habitat—it is not a plan about pesticide removal or bans. Colorado had a unique stakeholder engagement process; as a state law, the Pesticide Applicator's Act mandated who was to be included on the Pesticide Advisory Committee, and it was this committee that drafted the MP3 in conjunction with the Colorado Department of Agriculture.

The state took a detailed and methodical approach to creating its BMPs; it designated seven different target groups and created BMP strategies to suit each unique group. In this process three different types of applicators were identified—aerial, agricultural, and urban—and the plan also included BMPs for homeowners and for national structural pest management workers who would be operating in Colorado. While many of the BMPs were the same across similar groups, there were a few unique elements for each unique applicator, which gave this plan an added level of detail. Colorado also had one of the more advanced beekeeper and grower/applicator tools, Driftwatch, to facilitate easier communication in the event of pesticide applications. Use of this tool was optional, however; and while there were detailed suggestions on how beekeepers could additionally make their hives more visible and their contact information more accessible, all of the language was voluntary. Similarly, all of the language on when growers/applicators should contact beekeepers (24-48 hours, and if the spray was within 2 miles) was optional, and the notification was even further qualified as necessary only if the application was liquid, not granular.

The state's MP3 did, however, have some of the more detailed information on how to reduce pesticide drift and use more targeted pesticide application methods, and also, like Wyoming, specifically called out the extra care needed with pesticide coated seeds. Colorado also had an extensive Integrated Pest Management section in its plan, with an emphasis on pesticide application being the last resort. Colorado did not have much information on future mechanisms for plan review or modification based on public feedback.

iv. Wyoming

Wyoming frames its MP3 as being very important to the economic landscape of the state; Wyoming grows hay, barley, wheat, beans, sugar beets, corn, alfalfa, honey, and has 431 beekeepers with over 48,000 colonies. Wyoming also relies on a native pollinator, the leafcutter, to pollinate the states extensive number of alfalfa crops. While not all of the crops economically viable to the state require pollination, Wyoming notes that because the state is so rural, and so many citizens are farming on adjacent land, pesticide application has a great likelihood of impacting crops that do rely on pollinators. As a result, Wyoming strongly promotes a collaborative environment where the state balances protecting pollinators while also maintaining its position as a leading supplier of agricultural products.

This collaboration is reflected in the extensive plan formation process, where the Department of Agriculture held over eight multi-stakeholder meetings, representing 15-20 different groups and interests. Wyoming also included a plan to work with its University extension services to hold another round of meetings to listen to and incorporate more stakeholder feedback later on in the process, though a specific date was not listed. Furthermore, Wyoming has a robust framework in place for communication between beekeepers, growers, and pesticide applicators, in addition to a strong enforcement mechanism for reported bee kills. Registration of hives is regulated by the state via the Wyoming Apiary Law, which has a long list of requirements for beekeepers that mandate clear and precise communication with growers and applicators. While notification requirements for growers and applicators are voluntary, the MP3 strongly urges the

customary 48 hours-notice if application is occurring within 2 miles of a hive. Wyoming provides an excel sheet with beekeeper contact information and the GPS coordinates of all hives that can be downloaded onto a device or mapping program; this makes notification very easy for growers and applicators. Wyoming did not have much information on future mechanisms for plan review or modification based on public feedback.

B. Comparisons Across State MP3s

With a general understanding of each state plan, this section will now address how different elements of each plan compare and contrast in the categories of: 1. Stakeholder Engagement and Outreach, 2. Binding v. Voluntary Language, Communication Between Stakeholders, 3. Enforcement Mechanisms, Effectiveness Measurements, and Review/ Modification of MP3s.

i. Stakeholder Engagement and Outreach

a. Stakeholder Involvement in MP3 Development and Implementation

Nevada, Colorado, and Wyoming, in adopting the structure of the SFIREG guidance document, addressed similar groups of stakeholders at two different levels of their plan. Utah, on the other hand, did not provide much information on the stakeholders involved in plan formation.

Table 2: Stakeholder's MP3 Development

	Nevada	Utah	Colorado	Wyoming
Stakeholder Participation	**Beekeepers:** State Beekeepers Mason Valley Beekeepers Southern and Northern NV Beekeepers **Applicators:** Washow Vector Control Aerial applicators Clark County Vector Nevada Pest Management Association **Government/University:** Inter-Tribal Council of Nevada NDA Board of Agriculture Washoe Tribes Environmental Dpt. UNCE **Other:** BeyondPesticides.Org, Simplot, ITCN	**Government/University:** Utah Department of Agriculture and Food-Apiary Program OSU Extension School	**Pesticide Advisory Committee** *(Must Include By Law):* **Beekeepers** 1 state/national. beekeeping association **Growers/Farmers:** 1 Agr., ornamental, and structural industries 1 agricultural worker 1 organic agricultural producer **Applicators:** 1 Commercial applicator 1 Pesticide formulator 1 Limited commercial applicator 1 Public applicator **Government/University:** 1 Colorado Dpt. of Agr. 1 Colorado State University 1 CO Dpt. Pub. Health and Enviro. **General Public:** 2 general public (1 active in urban-agr. prod.)	**Beekeepers:** WY beekeepers association **Growers/Farmers:** WY Alfalfa seed growers association WY Crop improvement association WY Grounds keepers and growers association WY Ag-Business association **Applicators:** WY Mosquito management association WY Weed management association WY Weed and pest control WY Commercial pesticide applicators **Government/University:** WDA- Technical Services Division University of WY- Extension

As seen in the table to the right, the managing agency for each state was the Department of Agriculture, and each Department of Agriculture cast a wide net out to organic and non-organic farmers, beekeepers (agricultural and hobby), in some isntances tribes, Pest Management Associations, master gardeners, commercial and public pesticide applicators, grounds keepers and growers, and the like to be a part of the discussion on how to shape the states' MP3. In Colorado, the stakeholder group was legally dictated under the state's Pesticide Applicator's Act, which created the Pesticide Advisory Committee and thus explicitly codified a list of the *type* of people would help promulgate rules and regulations regarding pesticides, including the state MP3, though the MP3 did not include specific organizations or people. Interestingly, Utah discussed stakeholders in the form of outreach more than implementation, so it was not clear from the plan who helped the Utah Department of Agriculture and Food develop and implement the plan, thought the stakeholders involved in outreach are clearly included later in the plan. Wyoming, on the other hand, conducted eight

different multi-stakeholder discussions over the course of the year, which created a long and inclusive list of participants.

b. Stakeholders Addressed by MP3s

Second, the Best Management Practices (BMPs) all, aside from Nevada's general list, contained at least the same three core groups: Beekeepers, Growers/Landowners, and Pesticide Users/Applicators. With this being said, there were different levels of detail and additional groups targeted for BMPs based on the unique demographic of the state.

Table 3: Who BMPs Adress in MP3s

	Nevada	Utah	Colorado	Wyoming
WHO are BMPs addressing?	Only Generalized list with no specific, targeted groups	Beekeepers Growers Pesticide Applicators Hobby Beekeepers	Beekeepers Agricultural producers Aerial Applicators Agricultural applicators Urban Pesticide Applicators "National Structural Pest Management" Homeowners	Beekeepers Growers Pesticide users Separate BMPs for "bees" and "leaf-cutter bees" ((with leafcutters: grower/ landowner/ beekeeper/ Pesticide user usually the same person))

In Wyoming, for example, there was a separate BMP category specifically for a native pollinator, the Leafcutter Bee, as it was vital for pollinating the abundant and economically important alfalfa crop, and the pollinator is more sensitive to pesticides than the honeybee and other managed pollinators, and has very different foraging and habitat traits. In Colorado, the BMPs were expanded out to target three distinct types of pesticide applicators—Aerial, Agricultural, and Urban—as to better address the specific needs of the different types of application, and it also included extra categories for homeowners and "national structural pest management" applicators.

While many of the BMPs were redundant across the board, there was at least one unique BMP per state MP3, and the care of separating them out and explicitly addressing each different group helps for clarity, communication, and a more defined sense of responsibility for each user. Utah had an additional BMP category for hobbyists, as the MP3 notes the state has an abundance of hobby beekeepers. Nevada had the most generalized BMPs out of all of the plans, but the introduction noted this was because bees did not play a large role in the state economy so the plan applied mostly to hobbyists, but the plan also interestingly emphasized that while the SFIREG guidance document was set up to favor agricultural BMPs, Nevada hopes to expand its plan to non-agricultural settings and to other, non-managed pollinators.

c. Similarities and Differences in BMP Language

Overall, there is very similar language between the four state MP3s. Each state included at least some language for each suggested SFIREG guidance document category of labeling requirements, controlling flowering weeds, applying pesticides when bees are less active, using more targeted application methods and avoiding drift, using products less toxic to bees and creating and utilizing an Integrated Pest Management (IPM) plan, with the exception of Wyoming not including language on controlling flowering weeds. The level of detail for each strategy varied by state; Nevada had the least robust BMP section as it merely mimicked the guidance document language without re-structuring the strategies to fit the unique dynamics of the state, while Colorado and Utah had the most information and provided more detailed explanations for each BMP strategy.

d. IPM Plan Language

As discussed in the introduction, research and some applied studies have targeted IPMs as a helpful tool for reducing pesticide application without significantly reducing crop production. The table to the right shows the extent of IPM inclusion in the four state plans.

	Nevada	Utah	Colorado	Wyoming
f. create/utilize an Integrated Pest Management (IPM) plan	"Use IPM to decrease the overall number of pesticide applications"	**Beekeepers**: Practice IPM in hive ("use genetic, cultural and mechanical practices to manage Varroa) **Growers**: ~Mentioned in "challnge for growers;" timely applciation of chemicals must be part of IPMs (3) **Pesticide Applicators**: Take IPM approach, use "economic threshold," if application needed, use less toxic, shortest risidual toxicity, in formulation safest for bees	**Beekeepers:** learn how to kee phive healthy and use holistic methods to mitigate pesticide use **Agricutlrual Producers**: "uwilize exonomic threshold and other IPM practices to determine if crop protection is warranted *(this language is more bee friendly than UT)* **General**: Use IPM: 4 principles: proper pest/disease identification; monitor and scout crops/plants routinely; proper plant culture, fertility, care; manage pests and disease *only when* they rise above "exonomically damaging threshold levels" by using an integrated approach which includes: culture controls, mechanical controls, biologial control, chemical control (*listed last to be presented like last resort option*)	**Pesticide User**: Use IPM: utilize economic thresholds and IPM to determine if insecticides are required to manage pests

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Table 4: MP3 Integrated Pest Management Strategies

Utah, Colorado, and Wyoming, in their balance of protecting bees from toxic pesticides and protecting crop profitability, all mentioned economic thresholds as part of their IPM Plan, though they introduced the concept in slightly different ways. In Utah, the MP3 introduces chemicals as a necessity, stating that "timely application of chemicals must be a part of IPMs," with the economic threshold being the indicator of when the chemicals are used. The plan then directs applicators to *try* to use the least toxic pesticide, with the shortest residual toxicity, and in the formulation safest for bees. Colorado, on the other hand, introduces its IMP economic threshold as something to be utilized "to determine *if* crop protection *is warranted*," which reads much more bee-friendly. Further, Colorado lays out a more specific IPM roadmap of four steps, where chemicals are listed very last under the language: "4. Manage pests

and disease *only when* they are above an 'economically damaging threshold level' by using an integrated approach which includes: culture controls, mechanical controls, biological controls, and chemical controls." Here, even when including pesticide application as part of the IPM, it is presented as a last resort option to be used and balanced with other methods. Wyoming has much more neutral language, stating: "Utilize economic thresholds and IMP to determine if insecticides are required to manage pests," whereas Nevada's IPM merely states "Use IPM to decrease overall number of pesticide applications" without mention of an economic threshold.

Interestingly as well, despite the MP3s being a reaction to Colony Collapse Disorder which is correlated to Neonicotinoids, the plans make no direct mention of Neonics or Neonic bans. Colorado and Wyoming seem to inadvertently reference Neonics in their BMPs for treated seeds, though, as most seeds treated with pesticides are indeed coated with Neonics, and it is this seed coating that is so dangerous to bees. Colorado and Wyoming address this issue by suggesting landowners/growers, when planting seeds treated with insecticides, utilize alternatives to talc/graphite when available, as the plans acknowledge talc and graphite can create insecticide-containing dust that can drift onto bees and flowering plants. Wyoming conditions finding alternatives to "if available," while Colorado uses a more crop-friendly phrase "if alternative will provide the performance needed to assure accurate seeding." While it is notable at least two states have best practice measures in regard to treated seeds, they are both conditioned, and voluntary, and thus do not rise to fill in any of the gaps seen at the federal level and still leave the dangerous pesticides on the market.

e. Interaction with extension services and experts; Public outreach and outreach for continuing education

Nevada, Utah and Wyoming all explicitly mention their utilization of extension services via the University system, whereas Colorado's plan only mentions the University as a member of its state mandated Committee board. Nevada and Utah explicitly mention their University extension services as providing support on crop and pest

management decisions on both the field and landscape level, but there is no further explanation on what these suggestions are and if or where they are expressed in the MP3. As far as BMPs for expert support, Utah and Wyoming both include language that agronomists and other crop experts must consider pollinator issues when they make pesticide recommendations, including pesticide selection and timing; this language is seemingly included to be explicit that these decisions should not just be made based on crop yield.

The state MP3s vary greatly in their inclusion of public outreach and continuing education on MP3 provisions. As far as public outreach goes, Utah's MP3 identifies the most concrete mechanism for reaching the public with their BMPs, identifying the ODAF Apiary Program and the OSU Extension school as vehicles for holding workshops, programs and meetings about pesticide concerns relating to honey bees, and the plan targets Master Gardeners classes and horticulture outreach programs as platforms to spread the message. Nevada included a plan to post public outreach and MP3 plan advertisements on the Nevada Department of Agriculture website, Wyoming says it will hold presentations open to the public to solicit feedback but does not give more information, and Colorado does not mention any public outreach tactics. As for continuing education, Nevada implemented a specific pollinator protection, pesticide application safety training and certification program for professional applicators. Utah's UDAF Apiary hosts events to help better educate applicators on MP3 BMPs, with scheduled events at the Utah Nursery Landscape Association, Utah Pest Control Lawncare Association, and the Utah State Horticulture Association. Utah's UDAF Apiary also created a continuing education course specifically on protecting pollinators from toxic pesticides/ the MP3 BMPs, further expanding the likelihood of voluntary plan adoption by pesticide applicators.

ii. Binding v. Voluntary Language, Communication Between Stakeholders

There was binding language present across all states for following label directions, as this compliance is mandated by federal law.

Table 5: MP3 and State Labeling Requirements

	Nevada	Utah	Colorado	Wyoming
a. Labeling Requirements	State law: NAC 555.440.4	**Beekeepers**: follow labels when using miticides so you don't poison your own bees, **Pesticide Applicators**: if a label prohibits application of product when bees are foraging, must comply (law, BMPs compliment label instructions, never replace them), Read and strictly follow labels	**Aerial/Agricultural/Urban Applicators**: follow labels; never apply in bloom unless label says otherwise, **Beekeepers**: use caution and follow label when using pesticides to control insect pests such as ants and flies around bees, should use only EPA-registered products for use in/ control of parasites/ disease in apiaries **agricultural producers**: read label thoroughly, check for language regarding risk to pollinators in enviro hazard section or with bee hazard icon	**Beekeeper (non-leafcutter bees)**: Comply with all restrictions, precautions, and directions on label (urges ppl to contact WDA if confused) **Beekeeper (leafcutter)**: be careful to use correct labels for alfalfa *seed* and not alfalfa grown or forage, and be very careful about application as leafcutters are very sensitive **Pesticide User:** Use according the label-- its illegal not to, many have label restrictions prohibiting application when bees are foraging in treatment area, some prohibit application when crops are blooming, some require applicator to notify beekeepers beforehand --> users are bound by directions, precautions, and restrictions on labels

Colorado references mandatory compliance with label directions and directs users to the environmental hazard section of the label to look for any information or labels regarding toxicity to bees. Utah also uses "must" language when referencing labels, but the MP3 does not explicitly link label directions to federal law. Utah does, however, make it clear that its BMPs are never to replace label instructions, rather just compliment them. Wyoming includes further language in its BMP section on pesticide labels; its MP3 reminds users it is illegal to ignore not just the directions, but also the precautions and restrictions found on the labels. Wyoming also codified these federal label requirements in its state law, the Wyoming Apiary Law. Nevada similarly codified the label direction requirements in its state law, NAC 555.440.4.

Other binding language is seen in Wyoming and Nevada's Beekeeper registration and notification systems. In Nevada, NAC 555.470 states pesticide applicators *must* give beekeepers 24-hour notice if they are applying pesticides known to be harmful to bees. On the other side of the interaction, beekeepers *must* notify all applicators with a pest control license of the location of their bee colonies, including if/when they move them. Outside of the mandatory notification between parties, Nevada has a voluntary state-wide web-based apiary registration database, run by the NDA etymology staff, where beekeepers can input their colonies geographically. In Washoe County, the county runs a slightly more sophisticated database with actual GPS coordinates. The state is pursing funding to implement FieldWatch state-wide, which would provide sophisticated information for all stakeholders. As of now, aside from these systems, Nevada's BMPs also suggest marking the hives with a flag and placing clear contact information on the hive.

Similarly, in Wyoming, Beekeepers, through the Wyoming Apiary Law and via an "Apiary Registration Form," *must* register with the Wyoming Department of Agriculture with their hive GPS coordinates, *must* get permission from landowners to place hives on land, *must* put contact information on all hives, and then *must* get WDA approval. Interestingly, on the other end of this communication and unlike Nevada, pesticide users are not required to notify beekeepers before pesticide application, but the BMPs *urge* applicators to give beekeepers 48-hour notice if the application is within two miles of a hive.

This voluntary guidance is more like the language included in Colorado and Utah's BMPs, where beekeepers, landowners, and applicators are asked to work together, and mechanisms are provided to do this, but the actors not required to collaborate. In Utah, for example, beekeepers are urged to register hives with UDAF which stores the information in an online database accessible by pesticide users, in addition to clearly marking hives with a contact or registration number. Pesticide users are urged to work with landowners to find contact information if it is not readily available on the hive, and to provide 48-hour notice within a 2-mile radius.

Colorado has detailed and specific voluntary guidance on registration and notification, with a sophisticated database, DriftWatch, for storing apiaries contact info and location. The MP3 urges beekeepers to, in addition to submitting info to DriftWatch, mark their hives with name, address, telephone number, brand, in 2-3 inch lettering so it may be viewed from a distance, and contact area contractors and applicators and growers each year to update them on the location of their apiary. Pesticide applicators are urged, in addition to checking DriftWatch, to physically circle the area being treated to check for hives, and to contact the Beekeepers at least 48 hours ahead of time, especially if the pesticide application is in liquid form. While all of the plans have a mission statement about balance between stakeholders for the good of all, all BMPs urge people to seek out one another, the use of technology seen in Wyoming and Colorado makes the communication between landowners/growers, pesticide applicators, and beekeepers more efficient and collaborative. The web-based databases used by Wyoming and Colorado allow this communication to

	Nevada	Utah	Colorado	Wyoming
Communication b/w Applicators and Managed Pollinator Beekeepers	**State Regulations**: NAC 555.440.4 must follow label directions, NAC 555.470 if applying pesticide known to be harmful to bees must give 24 hour notice AND beekeeper must notify pest control licensees about location of bee colonies **State Policies**: voluntary hive/ apiary registration system that identify locations of colonies geographically, markers like bee flags, or other notification system (Washoe County District Health, Vector Control has one), some specific with GPS coordinates, others township/section/range, hope to get FieldWatch, in the meantime a website managed by EDA etymology staff ("web-based apiary registration database")	**Beekeepers**: work with landowners to find a hive location, discover needs of landowner, collaborate with landowners when informed of a spray, clearly mark hives (At least one hive with large registration number), register hives with UDAF **Growers**: work with beekeeper to chose hive location, speak with agro renters about beekeeping, grower urged to communicate with contracted applicator who will notify beekeepers **Pesticide Applicators**: If pesticides are labeled toxic to bees, notify and identify beekeepers of application within 2 miles and 48 hours before (notification does not exempt applicators from label requirements)	heading "foster communication between beekeepers and applicators" (language is demanding but not actually binding but there is a resource to make communication easier), should contact as soon as possible after being contracted to spray (48 if possible, no less than 24, most important for liquid form, need not be given with granular) There is a tool! Called Driftwatch (https://www.colorado.gov/pacific/eggplants/driftwatch) another tool called VDACS?	Mandatory Registration via WY Apiary Law: **beekeepers** MUST register with WY Department of Agr., get landowner permission to place hives on land, then must get WDA approval, and must provide GPS coordinates and put contact info on hives and make hives visible such as white paint color-- all via the "Apiary Registration Form" **Beekeepers** SHOULD get applicator numbers from landowners and alert them **Pesticide Users** are URGED to notify beekeepers 48 hours beforehand and within 2 miles of application, but they are not required by law to do so

Table 6: Beekeeper and Applicator Communication

happen faster and with less error, as applicators and beekeepers do not have to rely on word of mouth, middle-women landowners/growers, or visual ques or contact information found on hives to alert one another. The binding and voluntary language for the states can be seen in Table 6, above.

iii. Enforcement Mechanisms, Effectiveness Measurements and Review/Modification of MP3s

Of the four states, Wyoming's MP3 has the most robust enforcement mechanism in place. Wyoming offers a Wyoming Department of Agriculture Hotline to call with suspected pollinator pesticide exposure and bee kills. The MP3 states the agency will "respond to complaints, including collecting and analyzing the location for pesticide residues," and emphasizes that timely reporting helps the investigation. In addition to this information, the MP3 includes a specific section on *Laboratory Analysis for Pesticides or Pesticide Residues Regarding Bee Kill*, which states: "this policy is to provide direction to the Technical Services Staff and Analytical Services Staff for addressing laboratory analysis for pesticides or residues when investigating alleged bee kill causes by pesticide applications." After describing the techniques for analysis, there is a four-part procedure with enforcement measures in the instance of a proven kill. It also reminds stakeholders that there are other consequences for violations under the Wyoming Apiary Law and under federal law, though these consequences are not specifically listed. Interestingly, this section includes a list of pesticides to test for in connection with bee kills, and none of these pesticides are neonicotinoids. The enforcement measures in Colorado and Utah are similar and far less robust, guiding aggrieved parties to contact the state agency immediately and include the name of the suspected applicator, but the plans do not explain what happens after this step. Nevada merely directs MP3 readers to contact the EPA or the National Pesticide Information Center, who will then contact Nevada.

Throughout the MP3s of the four states, any process to measure effectiveness or to have any kind of review or modification of the plan was notably vague or absent. Nevada references the metrics for measuring effectiveness listed

in the SFIREG guidance document (measuring changes in behavior, measuring bee exposure events, measuring overall pollinator health), but it does not settle on a method or describe a timeline of implementation or review. Utah, Colorado, and Wyoming do not have any language referencing these categories. Based on what each state does have implemented, the states with more robust stakeholder communication and plans for stakeholder outreach, such as Nevada which has identified future meeting groups and locations, would benefit most from a metric such as behavior change. Wyoming, with such a strong enforcement mechanism, could potentially use bee exposure events as a metric, since they are potentially being reported consistently and accurately. Ideally the states would use multiple metrics, but some states are set up better than others for more efficient implementation of different measurements.

VI. Conclusion and Recommendations

Emphasized in the introductions of all four plans, and at the heart of all four MP3s, the spirit of connection and collaboration is found; this accurately describes the main benefit of state-level managed pollinator protection plans—a platform for parties concerned with pollinator health to come together and create rules and means for communication that ultimately benefit all, including pollinators. Wyoming perhaps says it the most emphatically, stating:

> "The WY MP3 was developed in response to a growing need for a balanced public policy that mitigates risk to managed pollinators, while minimizing the impact of that mitigation on production agriculture…working together-- farmers, beekeepers, pesticide applicators, scientists—Wyoming can protect its pollinators, while maintaining its position as a leading supplier of food, feed, fiber, and fuel for our nation and the world"

Indeed, this MP3 mission statement summarizes the role of MP3s well— generally, an analysis of the four plans confirm that MP3s boil down to communication tools, that emphasize the importance of 1) the stakeholders at the table to discuss and edit MP3 content, 2) the level of detail of BMPs and a careful selection of who BMPs will target, and 3)

the use of technology to help facilitate communication and ultimately build trust amongst MP3 participants. States who wish to bring together their multitude of stakeholders over the issue of pollinator protection from toxic pesticides can look at the importance of each of these categories, summarized further below, to better inform their own MP3 creation, implementation, and management process.

Below is a table condensing the recommendations created from this project's research, which includes streamlined strategies for the most successful implementation of the given recommendations. A more robust description of each recommendation follows this table.

Table 7: MP3 Recommendations and Strategies

Recommendation	Strategies
1. Get stakeholder engagement for plan development and implementation early in the process in order to develop meaningful BMPs	• Communicate frequently and effectively so BMPs feel fair and accurate to the beekeepers, growers, and applicators that would be using them • The more people at the table representing the diversity of interests, and the more experts involved in creating the BMPs, the more likely the BMPs will be respected and accepted
2. Make sure there are established and effective channels for outreach, communication, and ongoing BMP education	• BMP reviews could be mandatory for pesticide application renewals; BMP/IPM courses can be added as continuing education credits for beekeepers and applicators • Target leaders for these initiatives in original MP3 plans
3. Utilize new technology as it becomes available	• Pick a point person/team to create online databases with GPS coordinates and contact information to help facilitate beekeeper and applicator correspondences • Use technology for an effective registration, notification, and enforcement system
4. Use communication tools to understand and address the power dynamics that impact MP3 user buy-in	• Bring together parties traditionally at odds, such as small- and large-scale farmers or beekeepers and pesticide applicators • Address power dynamics and tools for collaboration/ equal buy-in

5. Use the SFIREG Committee's newly released Performance Measures document to create goals and concrete metrics for measuring for those goals	• Appoint a person/ team to be responsible for the ongoing evaluation process • Work with as many interested parties as possible to create MP3 outcome goals • Use the document and stakeholder feedback to help set the goals and pick what metrics will be used to assess and measure the progress of these goals • Implement the crucial evaluation tools to assess plan's reach, impact, and/ or success based on the selected metrics
6. Clearly discuss ancillary laws that impact the parties of the MP3	• Include and keep up to date the laws that impact MP3s • Include the current chemical threats to pollinators, even if not yet codified into law • Use MP3s as a platform to include specific language on the danger of Neonicotinoids

- **1. Stakeholder engagement and involvement at the beginning of the process and as a continued participant in implementation and management is a huge part of the success of state plans.** As a review of the MP3s determined, a majority of the content regarding pollinator health in the four states was voluntary, which makes the success of any best management practices and strategies developed, and any type of preferred interaction between parties, completely dependent on people in the fields' knowledge and buy in of the plan. Therefore, the BMPs not only need to actually reach and be taught to the beekeepers, growers, and applicators that would be using them, but they also need to feel fair and accurate for buy-in to be successful. Therefore, the more people at the table representing the diversity of interests, and the more experts involved in creating the BMPs, the more likely the BMPs will be respected and accepted. Further, the greater the level of detail included in the plans, and the greater the number of specific end-users targeted (for example, how Colorado breaks its pesticide applicators into three different categories of aerial, agricultural, and urban), the more likely the eventual recipients can feel relevantly addressed, and hopefully, therefore, the more seriously they will put the BMPs into practice. Said another way, the more specific the plan gets, the less it feels like a generalized piece of bureaucracy, and more like a tool that is helpful to the specific industry targeted.

- **2. The importance of appropriate stakeholder engagement in the MP3 creation process also emphasizes the importance of effective outreach, education, and communication of the MP3 contents.** Without reaching its audience, and without meaningful education on what the points mean and how they should be utilized, the plan loses its potential strength. Strategies such as creating a continuing education credit for pesticide applicators that is in specific regard to pollinator protection BMPs, or a mandatory segment on pollinator protection BMPs in renewing a pesticide application license, are efficient ways to educate end users. Similarly, reaching growers and beekeepers can be accomplished through some noted MP3 strategies of holding meetings with master gardeners or at extension schools, or similar courses for beekeepers requiring MP3 BMP review for a license. In order to ensure this outreach and education occurs, it is important for states to concretely assign leaders to specific outreach initiatives, to create concrete plans with timelines for creation and release of education credits or modules, and to identify any other target audiences and to create timelines for reaching these parties, to ensure successful adoption of the plan, since the provisions are voluntary and depend on buy-in.

- **3. It is also important for states to use emerging technology for communication**. For example, State's should use online databases with GPS coordinates and contact information to help facilitate beekeeper and applicator correspondences in a way that moves beyond just word of mouth and physically circling a site. These systems will allow for more efficient notification, which in turn gives beekeepers more time to respond and protect their hives, and all around fosters more collaboration and respect between parties often at odds. Therefore, states who are looking to implement their own MP3 should create a comprehensive registration system that utilizes the efficiency of modern technology. The communication should require both a Beekeeper

hive registration system (which could be abstracted to a degree to protect hives), and a notification system for Pesticide Users to give 48-hour notice to beekeepers within a two-mile radius of the application site.

- **4. Use communication tools to understand and address the power dynamics that impact MP3 user buy-in**; this gets back to the initial case study in the literature review. In this study, many smaller farmers, when asked about their role in improving pollinator health, felt there was no point in taking action when larger, industrial farmers overshadowed any meaningful action taken on their smaller scale operation. With a plan like the MP3, the different levels of farming and application can be addressed, in a way where all parties are aware of the obligations, so it feels more like a collaborative effort that everyone is embarking on together. This would apply to the relationship between beekeepers, growers/landowners and applicators as well—if each party is aware of the obligation of the other party, and if each party shows up with a genuine spirit of collaboration over a shared end goal, the entire system can work more efficiently with less conflict, to the benefit of pollinator health. Therefore, it is an important takeaway for other states to ask these types of power dynamic questions from the start, perhaps through a survey or a well-attended and diverse stakeholder meeting, to make sure these issues are addressed through the MP3 so there is ground-level buy-in.

- **5. States should consult the SFIREG Committee's newly released document on performance measures which sets out the different goals loosely introduced in the SFIREG MP3 Guidance document and gives objective measurements and metrics for determining if the goals are met.** Of the four states studied, none of the states had any clearly stated method for measuring if their plan was successful. A method of evaluation is crucial for either continuing or improving the MP3, and therefore any states in the planning stage of creating a MP3 should consult the new SGIREG guidance document to create their own goals/ measurements/ metrics that

works best, and it would be best advised to establish a timeline for conducting the measurements. On a similar path, the states should place a strong emphasis on public and stakeholder outreach as a means for changing or updating the MP3, and the states could provide actual meeting locations and timelines to support this outreach and ensure its implementation.

- **6. While MP3s are not the vehicle for authoritative regulations, they are the eventual mechanism for communicating what the laws are—therefore, this paper recommends other states ensure MP3s clearly reference the laws that impact each party** (such as federal label laws, and then any additional state laws as was seen in Nevada and Wyoming). The states should make sure the laws are always up to date and accurate on communicating what laws do impact MP3s, and what the current chemical threats to pollinators are, even if not yet codified into law. To this end, including more specific language on the danger of Neonicotinoids and the importance of not using them should make their way into MP3s. Furthermore, states newly adopting MP3s would benefit from having an enforcement tool that responds to bee exposures or bee kills form pesticides, such as seen through Wyoming's plan, as an important element for showing there is a certain degree of accountability via a procedure in the MP3, where the plan responds to an apparent breakdown in communication between beekeepers and pesticide applicators that leads to a bee-kill.

Overall, MP3s are an important communication piece that guide Best Management Practices for pollinator health and protection against toxic pesticides at the state level. The state plans studied in this paper can serve as a tool to other states, currently without plans, who are looking to bring together their own stakeholders in an effort to protect pollinator health across interest groups. While MP3s are not laws, they are an important response to federal and state failures to take more direct action; therefore, MP3s are a meaningful piece of the regulatory puzzle for

protecting America's pollinators, and with the elements and some of the modifications discussed above, interested states can effectively create their own plans to help protect pollinators at the state-level.

Appendix A

	Nevada	**Utah**	**Colorado**	**Wyoming**
Guidance Doc: Critical Elements				
Stakeholder Participation	NDA, Beekeepers (State, Mason Valley, Southern and Northern NV), UNCE, Washow Vector Control, NDA Board of Agriculture, NCE/ Southern/Northern Nevada, Aerial applicator, BeyondPesticides.Org, Washoe Tribes Environmental Department, Clark County Vector, Nevada Pest Management Association, growers, Simplot, ITCN, Humboldt Wildlife LLC	Utah Department of Agriculture and Food- UDAF Apiary Program, OSU Extension School, Master Gardeners, National Resource Conservation Service (mentioned in terms of outreach more than in terms of participation in making the plan)	Colorado Department of Agriculture's (CDA) Pesticide Advisory Committee: pesticide formulators, commercial applicators from the agricultural, ornamental, and structural industries, limited commercial applicators, public applicators, Colorado State University, 2 members from Colorado Department of Public Health and Environment, an agricultural worker, an organic agricultural producer, a member of state or national beekeeping association, 2 general public (1 must be actively engaged in urban-agr. production)	WDA conducted over eight multi-stakeholder discussions in the past year with landowners, beekeepers, pesticide users, government officials, and others: WY Alfalfa seed growers association, WY beekeepers association, WY Ag-Business association, WY weed management association, WY Crop improvement association, WY mosquito management association, WY weed and pest control, WY grounds keepers and growers association, WY department of agriculture-- technical services division, University of WY- Extension, WY commercial pesticide applicators, Pesticide End-User Meetings

Communication b/w Applicators and Managed Pollinator Beekeepers	**State Regulation**s: NAC 555.440.4 must follow label directions, NAC 555.470 if applying pesticide known to be harmful to bees must give 24 hour notice AND beekeeper must notify pest control licensees about location of bee colonies **State Policies**: voluntary hive/ apiary registration system that identify locations of colonies geographically, markers like bee flags, or other notification system (Washoe County District Health, Vector Control has one), some specific with GPS coordinates, others township/section/range, hope to get FieldWatch, in the meantime a website managed by EDA etymology staff ("web-based apiary registration database")	**Beekeepers**: work with landowners to find a hive location, discover needs of landowner, collaborate with landowners when informed of a spray, clearly mark hives (At least one hive with large registration number), register hives with UDAF **Growers**: work with beekeeper to chose hive location, speak with agro renters about beekeeping, grower urged to communicate with contracted applicator who will notify beekeepers **Pesticide Applicator**s: If pesticides are labeled toxic to bees, notify and identify beekeepers of application within 2 miles and 48 hours before (notification does not exempt applicators from label requirements)	heading "foster communication between beekeepers and applicators" (language is demanding but not actually binding but there is a resource to make communication easier), should contact as soon as possible after being contracted to spray (48 if possible, no less than 24, most important for liquid form, need not be given with granular) There is a tool! Called Driftwatch (https://www.colorado.gov/pacific/eggplants/driftwatch) another tool called VDACS?	Mandatory Registration via WY Apiary Law: **beekeepers** must register with WY Department of Agr., get landowner permission to place hives on land, then must get WDA approval, and must provide GPS coordinates and put contact info on hives-- all via the "Apiary Registration Form" **Pesticide Users** are urged to notify beekeepers 48 hours beforehand and within 2 miles of application, but they are not required by law to do so

a. How do applicators know bees are there	web-based apiary registration database (with phone numbers and email addresses) or more tight regs such as in Washoe County (southern NV already has a voluntary database of beekeepers) "Pollinator awareness zones" within 1-2 miles of treatment site are "protected," and *should* put contact info on their hives	UDAF website, ask landowners who should have had communication with beekeepers, visual scan **UDAF says "beehive locations will be made available to applicators" without saying how (10), but they are exploring need and funding mechanisms for a "prior notification software system"	Driftwatch, "applicators should circle the area being treated before spraying to check for bee yards," and beekeepers should mark hive with name, address, telephone number, brand, in 2-3 inch lettering so it may be viewed from a distance, and contact area contractors and applicators and growers each year to tell them location of apiary (in urban areas, beekeepers should tell neighbors), agricultural producers should figure out how to best communicate with beekeepers and do so, and pass this info along to anyone they contact with or rent to, use "VDACS" online tool (outdated? is it now driftwatch?)	All hives are registered and WDA has GPS coordinates, contact info is clearly posted on all hive locations, and beekeepers have to notify WDA if they move the hives, and are urged to get applicator numbers from landowners to let applicators know as well, hives must be visible, should be painted white or another color that stands out
b. How can applicators give beekeepers warnings	Notification law NAS, NDA etymology website (for reporting and for accessing information)	via landowners, can get registration number from hives which has contact info, no specific system mentioned but assume UDAF has this info	Driftwatch; get contact info and contact beekeepers, work with beekeepers to map apiaries, ask the farmer for contact info of beekeepers in area, notifications is most important with liquid, *not necessary with granular formulations*	WDA has beekeeper contact info as part of registration; there is a downloadable excel spreadsheet on WDA's website with locations and data can be installed onto most GPS devices and mapping programs updated every year

WHO are BMPs addressing? How many provisions per group? And Inclusion of BP language, such as:	Only Generalized list with a list of links other people have put together as training resources (National pest management association and national association of landscape professionals), otherwise jus leans heavily on following label directions	Beekeepers (11), Hobby Beekeepers (9), Growers (7), Pesticide Applicators (6)	Aerial Applicators (10), Agricultural applicators (9), Urban Pesticide Applicators (10), "National Structural Pest Management (5)," Beekeepers (12), Homeowners, agricultural producers	Beekeepers, growers, pesticide users-- separate BMPs for "bees" and "leaf-cutter bees," with leafcutters, grower/ landowner/ beekeeper/ Pesticide user usually the same person **General Goals**: 1) ensuring positive relationships and peaceful co-existence among beekeepers, landowners, and pesticide applicators, 2) reducing pesticide exposure and subsequent risk of pesticides to pollinators, 3) ensuring both a robust apiary industry and agricultural economy, 4) continued high compliance with state pesticide and apiary requirements, 5) outlining available resources and tools for communication and information sharing between beekeepers and pesticide applicators

a. Labeling Requirements	State law: NAC 555.440.4	**Beekeepers**: follow labels when using miticides so you don't poison your own bees, **Pesticide Applicators**: if a label prohibits application of product when bees are foraging, must comply (law, BMPs compliment label instructions, never replace them), Read and strictly follow labels	**Aerial/Agricultural/Urban Applicators**: follow labels; never apply in bloom unless label says otherwise, **Beekeepers**: use caution and follow label when using pesticides to control insect pests such as ants and flies around bees, should use only EPA-registered products for use in/ control of parasites/ disease in apiaries **agricultural producers**: read label thoroughly, check for language regarding risk to pollinators in enviro hazard section or with bee hazard icon	Beekeeper (non-leafcutter bees): Comply with all restrictions, precautions, and directions on label (urges ppl to contact WDA if confused) Beekeeper (leafcutter): be careful to use correct labels for alfalfa seed and not alfalfa grown or forage, and be very careful about application as leafcutters are very sensitive Pesticide User: Use according the label-- its illegal not to, many have label restrictions prohibiting application when bees are foraging in treatment area, some prohibit application when crops are blooming, some require applicator to notify beekeepers beforehand --> users are bound by directions, precautions, and restrictions on labels

b. Controlling flowering weeds	"control flowering weeds in a crop"	**Growers**: control weeds before they bloom; if in bloom, get rid of them mechanically or with non-toxic herbicide	**Aerial Applicators**: encourage growers to mow or if they can't mow, plant a buffer field or other buffers **Urban Pesticide Applicators**: same as above, but with ornamental plants, cover with tarp or plastic sheeting during spray when possible **"National Structural Pest Management"**: familiarize yourself with plants in the area and those common near structures, be able to determine when in bloom even if hard to see, send personnel to inspect property Beekeepers: agricultural producers	None
c. apply when bees are less active	"make application when bees are less active, before dawn and after dusk"	**Pesticide Applicators**: Avoid application when bees are actively foraging (actively forage in daylight and above 55 degrees), therefore sunset to sunrise is best time, but always check to see if bees are foraging	**Aerial/Agricultural Applicators**: apply in the morning (before 8am), evening (after 6pm), below 50 degrees **Urban Pesticide Applicator**s: before 8am, after 6pm, no mention of temperature "National Structural Pest Management": Beekeepers: agricultural producers	**Pesticide User**: apply early morning or evening and below 55 degrees

d. more targeted application methods/ reduce drift	"use application methods that are more targeted, like drip irrigation "minimize or reduce pesticide drift" "avoid using pesticides that come in the form of dust, wetable powders, or micro-encapsulated pesticides"	**Pesticide Applicators**: use formulations that present less risk to bees (dust/powder highest risk, granular and liquid better); don't allow pesticides to drift to non-target areas	**Aerial/ Agricultural/ Urban Applicators**: never apply in a manner where off-target movement occurs outside of the treatment area onto blooming crops or weeds --> cease application/ modify target area or change application pattern when bees are located down wind or weather will likely create off target movement **"National Structural Pest Management"**: do not apply to blooms, careful application to other parts of plant if label allows and it doesn't get pesticide reside on blooms or foliage, take into account weather conditions, use low pressure, coarse spray application, use granular form if there is wind **agricultural producers:** "abide by spray drift advisories," when using treated seeds, use alternatives to talc/graphite if alternative will provide the performance needed to assure accurate seeding, as talc/graphite can come off and form dust that drifts and impacts bees	**Landowner/Grower:** When planting seeds treated with insecticides, utilize alternatives to talc/graphite when available as talc and graphite can abrade the insecticide treatment off the seeds, creating insecticide-containing dust that can drift onto hives and flowering plants **Pesticide user:** avoid dusts and wettable powder insecticides, as they leave a powdery residue that sticks to bees, granular and liquid are safer
e. use products less toxic to bees	"use products less toxic to bees when possible" "use pesticides with a low/short extended residual toxicity (ERI)	**Growers**: Urged to read label and if toxic to bees try to find a different pesticide, and also keep in mind pesticides like bloom thinners can be toxic to bees even if label doesn't say **Pesticide Applicators:** "choose products that have a lower residual toxicity to honey bees... AND... (formulation)	**Aerial/ agricultural/ urban Applicators**: use product with low extended residual insecticide (Non-ERI) agricultural producers: select products with low toxicity to bees, with that are repellent to bees, or have short residual activity	**Pesticide User:** if necessary under IMP strategies, pick least toxic, short residual toxicity, and ones with repellent properties toward bees

f. create/utilize an Integrated Pest Management (IPM) plan	"Use IPM to decrease the overall number of pesticide applications"	**Beekeepers**: Practice IPM in hive ("use genetic, cultural and mechanical practices to manage Varroa) **Growers**: ~Mentioned in "challenge for growers;" timely application of chemicals must be part of IPMs (3) **Pesticide Applicators**: Take IPM approach, use "economic threshold," if application needed, use less toxic, shortest residual toxicity, in formulation safest for bees	**Beekeepers:** learn how to keep hive healthy and use holistic methods to mitigate pesticide use **Agricultural Producers**: "utilize economic threshold and other IPM practices to determine if crop protection is warranted *(this language is more bee friendly than UT)* **General**: Use IPM: 4 principles: proper pest/disease identification; monitor and scout crops/plants routinely; proper plant culture, fertility, care; manage pests and disease *only when* they rise above "economically damaging threshold levels" by using an integrated approach which includes: culture controls, mechanical controls, biological control, chemical control (*listed last to be presented like last resort option*?)	**Pesticide User**: Use IPM: utilize economic thresholds and IPM to determine if insecticides are required to manage pests

g. Other	Training and education is equally important, UNCE/NDA have implemented a pesticide safety training and certification program for professional applicators UNCE outreach programs try to reach non-professionals via master Gardner classes and other community horticulture outreach programs designed for the general public Forage: Encourage voluntary planting of vegetation attractive to pollinators	**Beekeepers:** Responsibility of beekeepers to put hive in most responsible place, move if application must occur **Growers**: plant for pollinators, especially on fields away from crops or in areas required by pesticide labels (untreated vegetative buffer strips) **General**: Advice for municipalities, counties, homeowners on how to plant for pollinators, managed and native	Colorado gives general pesticide safety for pollinators in accordance with guidance document before breaking out into more detail for each stakeholder (above), but they first list: 1. use IPM and first try to consider alternatives to pesticides (link given), 2. Choose least toxic when possible (link given), 3. Avoid applying during bloom, 4. always follow label, 5. avoid drift, 6. if there is no other option, spray sunset to sunrise when under 50 degrees **Forage:** Also gives advice for planting pollinator forage **"National Pest Management Best Management Practices for Structural pest management,"** recommend moving honey bee colonies from the structures before application **Beekeepers:** Responsibility of beekeepers to put hive in most responsible place, move if application must occur	**Forage and Habitat:** gives municipality, county, and homeowner tips for increasing forage habitat, for managed bees and for wild pollinators
Public Outreach	NDA plans to hold meetings with organized stakeholder groups, trade associations, commodity groups and beekeeper organizations and the general public, and public outreach and advertisements of the plan will be prominently posted on NDA website	As part of the ODAF Apiary Program and OSU extension, programs to educate general public and master gardeners about pesticide concerns relating to honey bees	None	there will be presentations open to the public which solicit feedback (vague)

Other Outreach	None	**Outreach to Beekeepers:** Utah Honey Bee Inspectors will educate beekeepers on using IPM strategies to avoid miticides **Outreach to Applicators**: UDAF Apiary program already looking at events to better educate applicators about BMPs of mitigating exposure (Utah Nursery Landscape Association, Utah Pest Control Lawncare Association, Utah State Horticulture Association); UDAF- AP will also hold continuing education credits specifically on this topic	N/a	will work with the University Extension to hold fall/winter meetings with stakeholder associations to incorporate more feedback (at least a partner and general time is listed, but still vague)
Review/Modification	Still developing exact plan based on stakeholder feedback, but the plan will be reviewed and modified at least every three years	None	None	None
a. incorporate stakeholder feedback	"revisions will be based on stakeholder feedback:	N/a	N/a	N/a
b. timeline and process for review	"at least every three years"	N/a	N/a	N/a
c. timeline and process for modification	"at least every three years"	N/a	N/a	N/a
Measuring Effectiveness	NV says they need them and lists all of the ones below provided by EPA guidance document but is waiting for specifics from EPA on *how* to implement metrics	None	None	None

a. Measure by changes in Behavior (more communication, cooperation, etc.)	N/a	N/a	N/a	N/a
b. measure by bee exposure events	N/a	N/a	N/a	N/a
c. measure by overall pollinator health	N/a	N/a	N/a	N/a
Guidance Doc: Recommended Elements				
Communication with Crop Advisors and Agricultural Extension Services	in talks with UNR Cooperative extension (UNCE) and Restricted Use Pesticide (RUD) Dealership for input on cropping and pest management decisions on both field and landscape level	Yes: coordinated with OSU Extension School; **Growers**: "advice from agronomists should incorporate pollinator concerns; [experts] should consider the effects of management recommendations on pollinators, including advice on pesticide timing and selection"	N/A	**Landowners/growers:** Ensure that agronomists and crop consultants consider pollinator issues when making pesticide recommendations, including product choices and pesticide timing decisions
a. Field level and/or landscape level	No	No	No	No
Crop-Specific or Site-Specific Plans	Not yet but interested in developing these	None	None	None

Written Contracts Between Beekeepers and Growers	Literally just copy and pasted guidance info on this into this section and said "looking into it"	None	None	None
Potential contract info: expectations, roles, responsibilities, notification, hive placement, time frames, etc.	None	None	None	None
Implementation				
State agency Name	Nevada Department of Agriculture	Department of Agriculture and Food	Colorado Department of Agriculture	Wyoming Department of Agriculture
Management				
State Agency Involvement	NDA etemology staff (for website registration and notification management)	Department of Agriculture and Food	Colorado Department of Agriculture	WDA
Stakeholder Involvement	Not Specified	Not Specified	Not Specified	Not Specified
Authroity				

Binding Language	Yes (via prior state laws, not plan itself, but mentioned in the plan) Federal: 12(a)(2)(g) of FIFRA says must follow label directions State: NAC 555.440.4 must follow label directions, NAC 555.470 if applying pesticide known to be harmful to bees must give 24 hour notice AND beekeeper must notify pest control licensees about location of bee colonies	No other than vague reference to label laws (via "must" langauge, not actual regualtion or law names)	Reference Pesticide Applicator's Act (PAA) Section 35-10-125 C.R.S	WY Apiary Law which requires apiary registration, compliance with label laws for pesticide users
Voluntary	Voluntary BMPs ("MP3 will reference laws/regulations but will talk in more detail about voluntary BMPs")	"voluntary best management practices"	BMPs voluntary	BMPs voluntary
Enforcement				

State Agency/ Stakeholder role	Federal, not state: EPA which forwards to NDA, or, Ecological Incident Reporting Portal on website of National Pesticide Information Center (so not really)	Beekeepers: if bees exposed to pesticides report suspected applicator to UDAF immediately (5)	Beekeepers: "if a beekeeper should experience bee mortality which they believe is pesticide related, they should inform the CDA, grower, and applicator, if known, as soon as possible (why/what remedy?)	"WDA is the lead pesticide regulatory agency in the state. The WDA will respond to complaints, including collecting and analyzing the location for pesticide residues… timely reporting will aid the pesticide investigation." --> can call the WDA Hotline Message Line Specific section on "Labratory Analysis for Pesticides or Pesticide Residues Regarding Bee Kill" ... "this policy is to provide direction to the Technical services Staff and Analytical Services Staff for addressing labratory analysis for pesticides or residues when investigating alleged bee kill causes by pesticide applications" --> Four part procedure is given with enforcement measures which includes other measures to be taken if WY statute or label directions were violated (list of pesticdes tested for does NOT include Nenonics)
Content				
Neonicotinoids Mentioned?	No	No	Not by name, but here: when using treated seeds, use alternatives to talc/graphite if alternative will provide the performance needed to assure acurate seeding, as talc/graphite can come off and form dust that drifts and impacts bee (neonics make up majority of pesticide treated seeds)	No (5 pesticides listed and none are neonics), BUT, do talk about treated seeds which are mainly neonic coated
Are Other Plans Mentioned?	No	UDAF License webpage, beekpers urged to to keep hives current, seems to be the actual tool for contact for sprays other than word of mouth/ visits to land/sites	Driftwatch, VDACS(?)	WDA registration

Other State Laws Regarding Pesticides?	FIFRA, NAC	None mentioned in plan	Pesticide Applicator's Act (PAA) Section 35-10-125 C.R.S., this is what created the Pesticide Advisory Committee	WY Apiary Law: 2 feet between hives, registered with WY Department of Agr., landowner permission, WDA approval, provide GPS coordinates-- all via the "Apiary Registration Form"
NOTES	"The primary purpose of the MP3 is to reduce pesticide exposure to bees through timely communication and coordination among key stakeholders, including beekeepers, growers, pesticide applciators and landowners." reads more bee friendly than utah and colorado -> states bees do not play a big role in crop production, mainly for hobbyists, so hope to evenutally expand the plan to non-agricultural settings and other pollinaotrs in general	First sentence "The objective of this plan is NOT to eliminate use of pesticides near beehives, nor is it to restrict the use of bee-keeper applied miticides" (3) Instead…framework in which prroblems faced by all parties involved can be resolved collaboratively (3) **Strengths**: legit effort in getting stakeholders to communicate and to get information on BMPs out there via workshops and CECs, tought without enforcement, how effective is it to reprot exposure to UDAF? **Weakensses**: no review, enforcement, measurement, effectiveness provisions mentioned	"The Colorado Department of Agruculture supports the use of integrated hive management to promote proper hive hygiene, mite and disease management, regulates the proper use of pesticides and promotes improved habitat for all pollinators" --> also makes it clear it is not about pesticide removal or bans but about how to use them with the least amoutn of harm -sets tempt to 50 v. 55 to provide a safeguard?	"The WY MP3 was developed in response to a growing need for a balanced public policy that mitigates risk to managed pollinators, while minimizing the imapct of that mitigation on production agriculture…working together-- farmers, beekeepers, pesticide applicators, scientists-- WY can protect its pollinators, while maintaining its position as a leading supplier of food, feed, fiber, and fuel for our nation and the world" WY grows hay, barley, wheat, beans, sugarbeets, corn, alfalfa, honey, and has 431 beekeepers with over 48,000 colinies, the leaf-cutter bee pollinates alfalfa, WY is rural so colonies are by crops, need coordination Also pretty bee friendly -- "Growers and pesticide users... can help with reducing (hive) exposure to pesticides and improving the quality of forage available... a strong colony can handle the pressure of [Varroa] better than one exposed to various pesticides and poor forage that weaken the hive." ...."growers face difficult decisions when panaging pests and minimizing impacts to pollinators...this plan can demonstrate how to do both"