

WORKING DRAFT

ACCELERATING SUSTAINABLE PEST MANAGEMENT: A ROADMAP FOR CALIFORNIA

◆ **DEVELOPED BY:**

Members of the Sustainable Pest Management Work Group & Urban Subgroup

◆ **IN COLLABORATION WITH:**

California Department of Pesticide Regulation
California Department of Food and Agriculture
California Environmental Protection Agency

◆ **FACILITATED BY:**

Ag Innovations Network

JULY 2022

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EXECUTIVE SUMMARY

In the Spring of 2021, as part of the State of California's commitment to accelerating the transition away from high-risk¹ pesticides toward adoption of safer, sustainable pest control practices, the California Department of Pesticide Regulation (DPR), the California Environmental Protection Agency (CalEPA) and California Department of Food and Agriculture (CDFA) launched the Sustainable Pest Management (SPM) Work Group, with a focus on production agriculture, and the Urban Subgroup, which was formed to address pest management in urban settings.

Over a period of 18 months, the SPM Work Group and the Urban Subgroup respectively sought to build a shared understanding of, and align on, a path forward that would address the multitude of needs, interests, and intersecting challenges in the field of pest management. By design, the Work Group and Urban Subgroup members span wide-ranging interests in the system, and include thoughtful leaders from production agriculture, farmworker and rural communities, Tribes, urban communities, impacted and disadvantaged communities, the pest control sector, chemical input companies, government, supply chain, academia, environmental sciences, public health, and technical assistance.

The recommendations in the Roadmap were designed to achieve the North Star, which is that by 2050, pest management approaches in both agricultural and urban contexts in California will promote human health and safety, ecosystem resilience, agricultural sustainability, community wellbeing, and economic vitality. The implementation of these approaches will help steward the state's natural and cultural resources, enabling healthy lives and an abundant, healthy food supply for future generations.

If the Roadmap recommendations are sufficiently resourced and effectively implemented as a set, we expect to see a 90% decrease in the use of a yet-to-be-decided group of pesticides (see Appendix 2). We expect a 90% decrease in toxic air and groundwater contaminants, as well as a 90% reduction in both acute and chronic pesticide-related human illnesses. We also intend to see a 90% decline in pesticide residuals in offsite water, land, and air, and in pesticide residues on food that are in excess of the permissible tolerance. Specific to the agricultural context, we expect to see every farm, regardless of crop type or size, having equal and adequate access to the support and resources necessary to develop and implement their own SPM system in a way that effectively manages pests, minimizes adverse impacts to humans and the environment, and is economically viable for both farmers and consumers. And, we expect that sustainable pest management practices are being implemented on 90% of farms and at least 90% of crop acreage in California. Specific to the urban context, we expect all California residents to have equitable access to the information and resources necessary to understand and effectively implement SPM.

Alongside, and supporting, these outcomes are a significantly expanded biosecurity and pest prevention program that has succeeded in proactively preventing the establishment of new invasive species, and a significantly expanded health and environmental monitoring infrastructure that enables accurate metrics toward these outcomes.

¹ For the purposes of this Roadmap, the term "high-risk" is used broadly to capture the full range of adverse environmental and human health impacts from pesticides when used in California. As described in the 2050 goals, California will evaluate its progress in reducing pesticide risks through a number of outcomes, including decreasing use, illness tracking, and environmental monitoring.

Achieving these goals will require significant investment and a coordinated effort by the whole field focused around a set of key strategic focal points. The shift to SPM across both urban and agricultural settings will require:

1. A reinvestment and up-leveling in California’s state-of-the-art pest prevention and exclusion systems so that we can meaningfully mitigate pest problems before they take hold;
2. An improvement in pesticide registration and continuous evaluation in order to support innovation and getting emerging tools into the hands of pest management decision makers and applicators; and
3. State leadership that is appropriately resourced to coordinate this change, in collaboration with leaders from across the system who will support accountability, adaptive management, and bridge to the wider ecosystem of change-makers to maximize coordination.

Sustainable pest management in agricultural settings will additionally require:

4. Successfully enhancing SPM knowledge, research, and technical assistance through closely connected networks of researchers and practitioners that bridge theory and practice and make sure that innovation is serving the highest needs;
5. Reducing economic and operational risks for growers transitioning to SPM by cushioning the risk borne by transitioning to something new and making this shift viable, effective, and compelling; and
6. Activating markets to drive the shift to SPM.

Sustainable pest management in urban settings will additionally require:

7. Enhancing data collection about pesticide use and its impacts;
8. Advancing urban SPM research and outreach;
9. Taking action to make SPM the preferred choice for licensed and unlicensed users; and
10. Refocusing urban design, building codes and regulations to enhance pest prevention.

The SPM Work Group and Urban Subgroup put forth this Roadmap to contribute to a meaningful shift towards safer and more sustainable pest management in California and call on all Californians to join together to champion this work.

IMPORTANT NOTICE REGARDING THIS DRAFT

It is important that readers understand that this document is a draft and the following goals and recommendations are still in development and do not necessarily reflect consensus statements by the entire SPM Work Group and Urban Subgroup. There are several topics that the members have not aligned on yet, and further discussion is underway to address these. The intention is to share this draft with the public and collect input for the SPM Work Group and Urban Subgroup to consider as they continue developing and finalize their goals and recommendations over the next few months.

As a working document, we are aware that there references and links that still need to be entered and that some typos may still exist. We will continue to refine the document and appreciate your understanding.

INTRODUCTION

We live in an era of great, and growing, uncertainty and complexity, and face multiple, intersecting crises that threaten our ability to survive and thrive into the future. Already, the severity of these problems, combined with inequality, mean that many Californians are struggling. Pests, as well our responses to them that employ high-risk pesticides, are a significant feature in this landscape, posing a risk to healthy natural, agricultural, and urban ecosystems.

California serves communities well beyond our borders by producing the fruits, nuts, and vegetables needed to combat hunger and global obesity-related health issues, but this comes with the responsibility to exclude, prevent, control, and manage pests in ways that also support the people and ecosystems that make up a healthy California.

While much progress has been made in the past decades – by California state agencies, the agricultural community, researchers and farm advisors, urban pest management leaders, and many others – to transition to safer and more sustainable pest management practices, more work is clearly needed to accelerate that transition at a systemwide scale in urban, agricultural, and wildland settings, while preventing pest problems in the first place through pest exclusion and prevention.

We need smart, systemic ways forward that attend to a wide range of needs—food security, the health and livelihoods of our agricultural and urban communities, and healthy soils and ecosystems. The Roadmap seeks to address compounding factors related to new pest threats, climate change, resource conservation, inequity, human health impacts, and emerging science, among others. There is a call to increase the focus on urban pest management issues, focus on a systems approach to farming that prioritizes building healthy and resilient farm systems, and ensure that all users and practitioners have the knowledge and tools they need to safely and effectively manage pests. And, now more than ever, we must find a way to do it together and create a systems approach that truly integrates the needs and interests of all those invested in and impacted by pest management.

The Sustainable Pest Management (SPM) Work Group and Urban Subgroup are navigating the diverse interests and concerns of the stakeholders they represent to recommend a Roadmap to accelerate systemwide SPM. The Roadmap articulates a vision for pest management that promotes human health and wellbeing, environmental health and resilience, and economic viability for all, and is an invitation and a call-to-action for all Californians to join the effort to co-create a healthy, thriving California with safer, more sustainable pest management.

The Charge of the SPM Work Group

The California Department of Pesticide Regulation (DPR), in collaboration with the California Department of Food and Agriculture (CDFA) and California Environmental Protection Agency (CalEPA), convened the SPM Work Group to develop a prioritized Roadmap. The group was given the following charge to:

- A. “minimize the reliance on use of toxic pesticides** and deploy traditional and new agronomic practices to protect and preserve soil health, water resources, air quality, and biodiversity; provide safe and resilient food systems; and ensure economic viability for growers and consumers;
- B. identify additional solutions** needed to protect the health and safety of communities and agricultural and pest management professionals, and eliminate racial and other disparities associated with traditional pest management approaches; and,
- C. engage, educate and promote collaboration** among growers, pest managers, scientists, farmworkers, government agencies, environmental programs, and urban and rural communities around safe, sustainable pest management practices.”

The SPM Urban Subgroup was formed to develop guidance on where and how to focus DPR resources, as well as other recommendations for ways that DPR, or other entities, might support the evolution of urban pest management in California. The Urban Subgroup was asked to consider issues across urban areas of the state, as well as across application areas (indoor and outdoor), users (professionals and non-professionals), and various types of products.

The agricultural strand of the Roadmap builds directly upon the collaboratively developed [Roadmap for Integrated Pest Management](#) published in 2018 by the UC Division of Agriculture and Natural Resources (UCANR) Integrated Pest Management Program and the [five-year action plan](#) of the Chlorpyrifos Alternatives Work Group convened in 2019-2020. While the Chlorpyrifos Alternatives Work Group’s charge was to identify alternatives to chlorpyrifos following the state’s announcement of its cancellation, numerous members of that group identified the need to continue a robust, focused discussion on long-term strategies to transition from chemical pesticides.

The Roadmap furthers DPR’s strategic goal to accelerate the development and adoption of SPM systems and presents an opportunity for California to achieve bold goals and implement a new framework to identify, evaluate, and implement SPM practices.

The Scope of the Roadmap

The SPM Work Group² was tasked with addressing pesticide use in production agriculture, with a focus on crop agriculture. The Work Group focus excluded animal agriculture and forests and other natural lands.

The Urban Subgroup examined the wider landscape of pesticide use outside of production agriculture to clarify its scope. Uses that fall outside of production agriculture include both “non-agricultural use” (use in homes, industry, institutions, structural pest control, veterinary, and vector control districts that share a common theme of benefitting congregated populations and infrastructure that are most often associated with urban and suburban environments) and “non-production agriculture use” (e.g., use in watersheds, rights of way, landscaped areas, parks, recreation areas, golf courses, and cemeteries, and in habitat management in urban and rural contexts). These categories are further detailed in Appendix 2.

This group focused on “non-agricultural use”, but given that many of the “non-production agricultural uses” listed above also occur in or are associated with urban and suburban environments, the Urban Subgroup also considered some uses in the “non-production agriculture use” category. Ultimately, through this process, the group developed its own framework identifying different classes of pesticide users and uses, summarized in Appendix 4. This framework is helpful in understanding the full breadth and complexity of pesticide use in California. For the purposes of this document, the use of the term “urban” (use, pest management, Subgroup, etc.) includes both “non-agricultural” use and some types of “non-production agricultural” use. More specifically, Urban Subgroup work did not explicitly focus on forests, transportation corridors, parks, habitat management, aquatic weed control and disinfectants.

While recognizing the ongoing importance of effective pest management in agriculture, a key interest of the Urban Subgroup is to call attention to the need for DPR and other agencies to increase focus on supporting urban SPM, while considering the extremely diverse and complex nature of pest management in this context. Analysis of pesticide sales data and pesticide use reports reveals that a significant amount of pesticides sold in California are not used in production agriculture. Some professional non-agricultural uses are reported (e.g. structural pest control, landscape maintenance); however, most nonagricultural pesticide uses are not reported. Much of this unreported pesticide use, such as the application of retail insecticides, herbicides, and antimicrobials, occurs in urban contexts. This use of pesticides in urban areas, coupled with the challenges specific to urban pest management (enumerated in Appendix 5), points to the need for an increased focus of attention and resources on urban SPM.

While distinct in many ways, agricultural and urban pest management do not happen in isolation from one another. For example, pests that damage agricultural crops can originate in neighboring parks or urban areas and pesticides applied in a field can migrate to nearby neighborhoods.

² Each workgroup was not representative of the full breadth and scope of stakeholders or issues from any entity engaged in pest management in CA.

Definition and Approach to SPM

WHAT IS SPM?

Sustainable Pest Management (SPM) is a holistic approach that prevents and minimizes pests in a way that protects human health and is environmentally sound, socially equitable and just, and economically viable. Pests are managed by combining biological, cultural, physical (including the use of new technologies that can improve detection, precision, and resistance to pests), and, only when absolutely necessary, chemical tools, in a way that minimizes economic, health, and environmental risks.

At the heart of SPM is the *prevention* of pest problems and the intent to foster natural and managed ecosystems, including farms, cities, homes, and gardens that are resilient in the face of pests in order to minimize pest impacts and lessen the need for pesticide use or other pest control actions.

The priority outcomes for SPM are reducing human and environmental risks from pest management activities, while also providing effective pest management solutions.³

SPM IN AGRICULTURE

In agricultural settings, SPM is rooted in an agroecological approach that considers the whole farm as well as the wider landscape in which it sits. SPM is supported by a range of practices and products that range from the use of traditional ecological knowledge to modern technologies (See Appendix 6 for a list of examples on-farm SPM practices), and aims to build healthy, pest-resilient agro-ecosystems that require few or no chemical inputs.

Agricultural SPM takes a systems approach to pest prevention and management, while considering environmental health, social equity, and economic viability each step of the way. Therefore, SPM ideally facilitates, where possible, an enhancement of the following co-benefits:

- A. *Improving soil health⁴, water quality, use efficiency, and supply, air quality, and biodiversity*
- B. *Advancing climate mitigation and adaptation*
- C. *Increasing nutrient density in crops while maintaining yields*
- D. *Improving land management practices*
- E. *Improving farmer and farmworker working conditions*
- F. *Increasing community health and well being*

SPM is not an end point, but rather an ongoing process in a spectrum of continual improvement that integrates an array of practices and products aimed at creating healthy, resilient ecosystems, farms, communities, cities, landscapes, homes, and gardens. SPM is about stepping back and looking at the interconnectedness of pest pressures, ecosystem health, and human wellbeing. SPM asks each one of us, whether working at the State, regional, commodity, field, building, or garden scale, to become an active participant and an informed steward in the effort to co-create a healthy, thriving California.

³ Human risks include exposures that lead to both acute and chronic illnesses. Environmental risks include both direct and indirect impacts to plants and animals, water, air, soil, and ecosystems, infrastructure, and other assets more generally.

⁴ While not every aspect of soil health is directly linked to SPM, soil health is foundational to successful SPM implementation in agricultural settings.

This approach requires the inclusion of all stakeholders that are invested in and impacted by pest management in agriculture. Growers, farmworkers, Indigenous land stewards, community members, researchers, advocates, policy makers, commodity groups, supply chain partners including processors, input suppliers, shippers, and distributors – everyone is needed to understand the wide range of needs, access the necessary knowledge and expertise, and scale up SPM in the field.

SPM IN URBAN ENVIRONMENTS

In urban settings, SPM looks broadly at the urban environment as a whole and aims to manage pests as effectively as possible, while also achieving a range of other outcomes, including protecting public health and the environment, assets, quality of life, and aesthetics.


Pest management in urban contexts is subject to a unique set of conditions that distinguish it from agricultural pest management. Urban pest management is carried out by a much wider diversity of users, ranging from residents to pest management service providers, with varying degrees of knowledge about pesticides and their impacts. (See Appendix 4 for a fuller description of pesticide users and uses in urban settings.)

The diversity of pesticide uses and users in urban settings, and gaps in the oversight and reporting of pesticide use, further undermine our ability to collect and interpret meaningful data about how and where pesticides are used as well as their associated health, environmental, and other unintended impacts. Our limited understanding of urban pesticide use patterns as a result of the limited data hinders informed product design, identification of SPM solutions, and science-based and complete regulatory evaluations of pesticide products.

Furthermore, the public—primarily local governments—is bearing the burden of mounting costs of compliance with state and federal laws and regulations as well as addressing the problem (e.g., water purification).

Only a small portion of urban pest applicators are trained and licensed to apply pesticides. Although the directions on home-use product labels provide safe handling and use instructions, data show they are rarely fully read and adhered to and these safe handling directions are very difficult to enforce.

Decisions about pesticide use in urban settings are influenced by a wide set of interests, including the desire to maintain aesthetic landscapes, protect structures, satisfy individual tolerance thresholds for pest presence, and mitigate real and perceived health risks posed by pests. The urban environment creates additional unique challenges for SPM, such as substandard housing conditions that harbor pests, higher population density, and emerging climate-friendly water reuse infrastructure that may increase exposure to pesticides. Appendix 5 provides additional detail about the set of challenges unique to urban SPM outlined above.



“In short, it’s about keeping pests away from where you don’t want them, but doing so in a way that protects you, others, and the environment.”

- SPM Work Group member

SPM VS. IPM: WHAT’S THE DIFFERENCE?

Sustainable Pest Management (SPM) incorporates Integrated Pest Management (IPM) into the broader framework of whole-system, long-term sustainability. IPM has provided tremendous benefits over the last several decades, but more can be done by placing pest management within a larger context of economic, environmental, and social sustainability.⁵ Pest management is inextricably connected to all three of these sustainability pillars, and reframing IPM within this context helps to highlight these intersections.

Like IPM, SPM focuses on long-term prevention of pests and their damage through a combination of techniques, such as biological control, habitat manipulation, modification of cultural practices, mechanical control, and use of resistant plant varieties, with chemical pesticides used only when other methods aren’t adequately managing the target organism.

SPM goes beyond IPM in that...

- broader community and equity focus is a point of emphasis in SPM,
- SPM considers the economic costs and benefits of inputs and outputs, and
- SPM includes considerations all of the environmental impacts of pests and the practices used to manage pests.

⁵ See for example Deguine, JP., Aubertot, JN., Flor, R.J. et al. Integrated pest management: good intentions, hard realities. A review. *Agron. Sustain. Dev.* 41, 38 (2021). <https://doi.org/10.1007/s13593-021-00689-w>

SPM and Climate Change

Climate change is expected to meaningfully influence the “biology, distribution and outbreak potential” of pests. Climate-related changes, such as higher temperatures and extreme weather events, may directly increase pest pressures and may also indirectly increase urban and [crop susceptibility to pest problems](#) by creating conditions that favor new or invasive pests, or that adversely impact natural pest predators, thereby creating new uncertainties and challenges for pest management, as well as new potential human and environmental exposures to pesticides. As climate change advances, pest prevention and building resilience to pests is more critical than ever.

Importantly, in the agricultural context, many of the approaches that build the resilience of agricultural systems to climate stressors may also enhance resilience to pest pressures and support community health in rural areas. Because agricultural ecosystems are complex, special care must be taken to implement practices that are locally and situationally appropriate and minimize unintended consequences. California will inevitably see crop distribution evolve because of climate change, and a focus on SPM can build greater resiliency and support a transition that creates more resilient agro-ecosystems.

In the urban context, climate change can increase the range and seasonality of some significant pests, including mosquitoes, rats, fleas, ticks, termites, and others. Several urban pests transmit human pathogens in their natural habitat, so an improvement in favorable conditions, especially temperature, outside their typical range can increase the incidence of vector-borne diseases. Invasive species can move into new areas previously unfavorable to the pest’s biology, impacting home, garden, and landscape situations as well as nearby agriculture. Climate change and pest management intersect in other ways to create challenges for public health. For example, water supply challenges are driving potable reuse of wastewater and stormwater runoff, yet the technical challenges and cost of removing pesticides from these waters could limit future access to potable water.

PATHWAY TO SPM: GOALS AND RECOMMENDED ACTIONS FOR CHANGE

To achieve these aspirational goals, the SPM Work Group and Urban Subgroup identified the following key focus areas to advance the State of California towards a future of sustainable pest management.⁶

FOCUS AREAS TO ADVANCE BOTH AGRICULTURAL AND URBAN SPM⁷

- Update California’s pest prevention and exclusion systems
- Improve California’s pesticide registration and continuous evaluation processes
- Strengthen coordinated SPM leadership structures

FOCUS AREAS PROPOSED BY THE SPM WG FOR AGRICULTURAL SPM⁸

- Enhance knowledge, research, and technical assistance
- Align pest control advisors with SPM
- Reduce economic risks for growers transitioning to SPM
- Activate markets to drive SPM

FOCUS AREAS PROPOSED BY THE URBAN SUBGROUP FOR URBAN SPM⁹

- Enhance data collection for urban pesticide use
- Advance research and outreach on urban pest management issues
- Make SPM the preferred choice for both licensed and unlicensed users
- Refocus urban design, building codes and regulations to enhance pest prevention

In each of these focus areas, the SPM Work Group and Urban Subgroup identified more specific goals, priority actions, and, in some cases, additional actions that are needed to help transform California’s approach to pest management to deliver safer and more sustainable pest management. In many cases, the groups also included design guidance to help inform future work on the actions. This design guidance is an integral part of the recommendations. Building true SPM is not just about what should happen, but how it can be implemented to maximize systemic impact and reduce unintended consequences. The design guidance sections spell out considerations that must be addressed during implementation of the recommendations in order for them to be successful.

No one recommendation—or even one focus area—will, on its own, bring about systemic change, nor will one entity be able to drive change alone. Rather, to meet any one of 2050 Goals, the full breadth of the following Roadmap must be implemented. The goals and recommendations throughout the Roadmap are inherently interconnected, and can only be effectively implemented if the entire system is working together to create the conditions necessary for these outcomes to be realized.¹⁰

6 The following items are not listed in order of priority

7 The goals and recommendations in these focus areas were developed by both the SPM Work Group and Urban Subgroup

8 The goals and recommendations in these focus areas were developed by only the SPM Work Group

9 The goals and recommendations in these focus areas were developed by only the Urban Subgroup.

10 Example: We cannot expect to see a 90% reduction in the use of high risk pesticides if we don’t develop the research and outreach systems, on-farm support mechanisms, and access to alternative products and practices that are effective against pests and support farming to be economically viable.

North Star

By 2050, pest management approaches in both agricultural and urban contexts in California will promote human health and safety, ecosystem resilience, agricultural sustainability, community wellbeing, and economic vitality. The implementation of these approaches will help steward the state's natural and cultural resources, enabling healthy lives and an abundant, healthy food supply for future generations.

We want to see a future for California where there has been a significant reduction in pesticide-associated risk - where pesticides are not contributing to human illnesses or environmental degradation. We believe that by implementing the Roadmap, California will be able to achieve the following goals by 2050.

2050 Goals for California Pest Management

- 90% reduction in acute and chronic¹¹ pesticide-related human illnesses
- 90% reduction in pesticide residuals in offsite water, land, and air
- 90% reduction in pesticide residues on food that are in excess of the permissible tolerance
- 90% reduction in the use of a yet-to-be-defined group of pesticides (this goal has not been finalized – see the next page for a description of the different perspectives on the Work Group related to a pesticide use reduction goal).
- A significantly expanded health and environmental monitoring infrastructure that enables accurate metrics for all of the above
- A significantly expanded biosecurity and pest prevention program that has succeeded in proactively preventing the establishment of new invasive species

Additional 2050 Goals Specific to California's Agricultural Pest Management:

- Every farm, regardless of crop type or size, has equal and adequate access to the support and resources necessary to develop and implement their own SPM system in a way that effectively manages pests, minimizes adverse impacts to humans and the environment, and is economically viable for both farmers and consumers.
- Sustainable pest management practices are being implemented on 90% of farms and at least 90% of crop acreage in California.

Additional 2050 Goals Specific to California's Urban Pest Management:

- All California residents have equitable access to information and resources necessary to understand and effectively implement SPM

¹¹ Currently, chronic illnesses are not something that are measurable, but the groups believe it is an important outcome, and hope to see further research and development of mechanisms to measure this over time.

A note on the 2050 Goal: “90% reduction in the use of a yet-to-be-defined group of pesticides”

There remain different perspectives on how to define the group of chemical pesticides that cause significant harm. The Work Group is aligned on a 2050 goal that calls for a 90% reduction in a yet-to-be-defined group of pesticides.

Most of the Work Group members would like to see the following groups of pesticides included: restricted materials (3 CCR 6400, as defined by FAC 14004.5), toxic air contaminants (3 CCR 6860), and groundwater contaminants (3 CCR 6800(a)). In addition to these pesticides, some members of the Work Group would also like to include pesticides that cause cancer, endocrine disruption, or developmental and reproductive harm. While the full Work Group agrees that reducing these kinds of impacts is important, the Work Group hasn't yet agreed on the way in which to define pesticides with those impacts.

Some members recommend using existing lists of harmful chemicals, such as the US EPA list of carcinogens, the European Union list of endocrine disruptors, and/or the Japan Globally Harmonized System (GHS). Others suggest creating a new system for determining the risk¹² levels of the hazardous chemicals listed under Proposition 65. Others recommend including, in addition to pesticides that present human health risks, those with ecosystem biodiversity and pollinator populations impacts.

Some members are concerned that adding pesticides based only on hazard and not on risk is inconsistent with the state's risk-based assessment process, does not recognize the measures frequently used in agriculture to mitigate risk when applying hazardous materials and could cause undue burden managing pests. Others believe we should be working to minimize the use of all highly hazardous pesticides because risks are difficult to define, measure, and manage effectively.

The Work Group is still working to resolve these issues and come to an agreed-upon group of pesticides for the pesticide use reduction goal.

12. Risk is considered a combination of “hazard,” which is seen as an inherent property of a chemical, and “exposure,” which is the likelihood of coming into contact and being impacted by the chemical. See here for more information: <https://www.epa.gov/risk/about-risk-assessment>



NORTH STAR

Pest management approaches in both agricultural + urban contexts in California will promote human health and safety, ecosystem resilience, agricultural sustainability, community wellbeing, and economic vitality.

2050 GOALS FOR CALIFORNIA PEST MANAGEMENT

90% reduction in pesticide residues on food that are in excess of the permissible tolerance

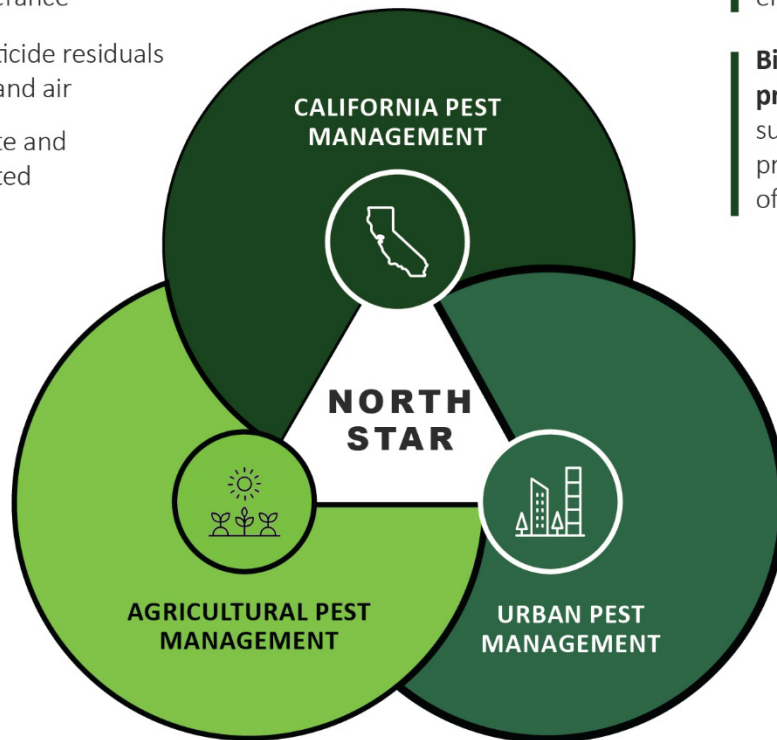
90% reduction in pesticide residuals in offsite water, land, and air

90% reduction in acute and chronic pesticide-related human illnesses

90% reduction in a yet-to-be-defined group of pesticides

Health and environmental monitoring infrastructure that enables accurate metrics.

Biosecurity and pest prevention program that has succeeded in proactively preventing the establishment of new invasive species



Sustainable pest management practices are being implemented on 90% of farms and at least 90% of crop acreage in California.

Every farm, regardless of crop type or size, has equal and adequate access to the support and resources necessary to develop and implement their own SPM system in a way that effectively manages pests, minimizes adverse impacts to humans and the environment, and is economically viable for both farmers and consumers.

All California residents have equitable access to information and resources necessary to understand and effectively implement SPM

ADVANCING SPM IN BOTH AGRICULTURAL AND URBAN CONTEXTS

Update California's Pest Prevention and Exclusion Systems

Successfully preventing pest outbreaks is the foundation of an effective sustainable pest management strategy and limiting the need for pesticides in the first place. Systematic detection, prevention, surveillance, exclusion, and proactive planning are essential to keeping pests in check. However, pest monitoring and exclusion has long been underfunded,¹³ and in addition, funding has been significantly cut in recent years, severely diminishing critical biosecurity infrastructure. In 2011, CDFA was required to make approximately \$32 million in cuts to General Fund pest prevention programs, including completely cutting weed programs and significantly scaling back others. As a result, California has experienced a concomitant increase in pest infestation problems. Coupled with growing invasive pest pressures exacerbated in part by climate change, the decline in funding increases California's vulnerability to pest problems. A top priority of the SPM Work Group and the Urban Subgroup is to build state-of-the-art biosecurity infrastructure to successfully proactively detect, exclude, and prevent outbreaks of invasive pests.

GOALS

- 1. State efforts:** By 2030, California, coordinating across Federal, Tribal, State, and County programs, has strengthened its biosecurity measures to effectively prevent and eradicate invasive species to protect California's agricultural industry, ecosystems, and natural and cultural resources.
- 2. Regional efforts:** By 2030, every growing region in California has a strong collaborative process in place to prioritize invasive pest prevention and enable coordinated pest detection and exclusion at a landscape scale.
- 3. Farm-scale efforts:** By 2040, all growers understand their role in invasive species detection and reporting.

Priority Actions

- A. Strengthen pest prevention and detection** by securing dedicated, ongoing funding for CDFA to fully build the expertise and infrastructure to implement capabilities for interception, detection, and eradication of potential and actual invasive species of all types, including weeds, insects, diseases, animals, and others. Funding should be based on an analysis of CDFA's funding gaps¹⁴ with respect to pest exclusion and prevention, which CDFA should conduct immediately to determine the funding required to implement programs to maximum effectiveness. Funding should fully cover the following top priorities:
 - i. Expedite completion and fund implementation of the Comprehensive Pest Prevention Program Analysis Update** (Roger's Study 2.0) and periodic reviews. Complete the Pest Prevention Program Analysis Update to assist in identifying actions necessary to achieve the goal. The State should fully fund the recommendations from the study. Carry out reviews of the Analysis every five years, looking to the California Water Plan Bulletin 160 as a model.

¹³ The Rogers' study identified a funding target for CDFA to implement pest prevention, however this target has not been reached.

¹⁴ For example, Los Alamitos medfly rearing facility upgrades (USDA) need 100 million, USDA Wildlife Services 50/50 split needs 1 million for CA, immediate need Fruit fly program cuts to CDFA of 2 million this Fiscal and next, West Coast Canine program-construction of National Dog training academy is 25 million (50/50 split with USDA) with operating cost of 5 million, GWSS 4 million additional to combat uptick in finds, SLF-could use 20 million immediate if found in CA.

- ii. **Finalize the CalTrap initiative**, which is working to transition detection and mapping to a digital platform. This includes securing at least \$500,000 in funding, \$350,000 in annual maintenance and support, and providing training needed to complete this effort.
 - iii. **Fund investments in new technologies** that make it easier to monitor and detect pests such as spatial mapping, precision tools such as smart traps, and communication of pest detections and related activities.
 - iv. **Support growers' engagement in biosecurity**: Initiate a coordinating effort to ensure that, by 2040, all California farmers and farmworkers have received language- and culturally-appropriate information and training in state, federal, and on-farm biosecurity measures pertaining to invasive pests and diseases, including their own role in monitoring for and preventing the introduction of invasive pests. Farmers have easy access to on-farm pest detection training that provides information on current California specific invasive pest issues and related pest detection and exclusion. Develop biosecurity outreach materials and/or short educational modules focusing on "What to Know and What You Can Do to Prevent Invasive Pests on Your Farm" that are available in multiple languages and are accessible on-line and through farmer networks.
- B. Fund High Risk Pest Exclusion (HRPE)**: The statutory mandate of \$5.5 million per Food and Ag Code 2282.5 should be instated; CDFA has only \$3.1 million in their budget for HRPE. This would allow time to complete the Comprehensive Pest Prevention Program Analysis (Roger's 2.0) and bring CDFA back to statutorily mandated funding for HRPE.

Additional Actions

A. Enhance State leadership in state and federal pest prevention:

- i. Continue to engage in interagency collaboration with other agencies (Fish and Wildlife, Boating and Waterways, Water Resources, USDA APHIS) for rapid response/exclusion
- ii. Continue to partner with the Federal government on pest exclusion efforts, particularly at ports, and keep APHIS engaged as a strong partner in pest prevention

B. Initiate education for the public: Implement robust education programs for the general public on need to avoid invasive introductions

C. Develop pest and disease forecasting models: UC IPM develop and share pest and disease forecasting models by region for integration into technology systems used by farmers, considering potential modification of models as climate changes occur. Develop forecasting systems where relevant for non-ag pests. Include incorporation of the latest precision tools such as smart traps and real time quantitative spore detection.

D. Manage pests on fallow agricultural lands: Mitigate pest challenges associated with fallow agricultural land, including addressing the organic loophole in the Abandoned Orchard Food and Ag Code, enhancing support for county Agricultural Commissioners for enforcement, and play a role in regional pest prevention and engaging the California Department of Conservation's [Multi-benefit Land Repurposing Program](#) to creatively address pest issues.

E. Incorporate geospatial technology: Expand pest management efforts managed through geospatial technology, whether about exclusion or about general pest management.

- F. Ease costs to growers:** Develop mechanisms to ease the burden of invasive species on growers and enhance reporting
- i. Provide indemnification for the loss of crops due to invasive species as a mechanism for incentivizing grower transparency and reporting, similar to FAC 9591-9595 Compensable destruction of diseased animals.
 - ii. Develop pathways for the State to cover the cost of eradication efforts once invasives have been identified.
- G. Model impacts of climate change on pests:** The Department of Food and Agriculture, in coordination with the Department of Pesticide Regulation, should develop a report, modeling the impact of climate change on California pest pressures (including but not limited to changing pest lifecycles, presence of new exotics and invasive species, pest movement and susceptible agricultural commodities), building on the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment [Climate Change Indicators report](#).

Improve California's Pesticide Registration and Continuous Evaluation

Improving DPR's pesticide registration and re-evaluation process is a powerful strategy to facilitate adoption of lower risk materials and advancing system-wide shifts towards SPM. Expediting a transition to lower risk chemicals requires development, approval, and testing for efficacy, both in the lab and in the field, and then approval for use by DPR. These products must be moved through the registration process with as much efficiency as possible, while still maintaining a high standard for scientific rigor and assessment of human health and environmental risks that DPR is committed to. The review process must prioritize the registration of safe and effective alternative products, and in so doing recognize other regulatory actions to facilitate the availability of alternatives that complement these efforts.

With the most robust pesticide registration program of any state, DPR is able to consider California-specific conditions when registering new pesticides. As DPR integrates the latest science and makes continuous improvements in its registration process, each generation of approved products is more sustainable. While this means progress for new products, it also means that pesticides registered prior to DPR's implementation of these and other modern science-based review procedures may not reflect the best scientific understanding of risks, or have appropriate use instructions to address those risks. Through improvements to DPR's continuous evaluation program, DPR will establish a regular and transparent review process for evaluating these risks.

GOALS

- 1. New products:** By 2030, DPR's registration review process prioritizes and expedites alternatives to high-risk pesticides, reflects the goals of SPM, and provides clarity on its scientific review and decision-making process for both the registrants and the public.
- 2. Existing products:** By 2025, DPR has developed a process for evaluating currently registered pesticides, consistent with the recommendations outlined in this Roadmap, prioritizing human health (e.g. carcinogens, endocrine disruptors, and developmental and reproductive toxicants) and environmental risks (e.g. significant impacts to water, air, flora, and fauna).

Priority Actions

- A. Support the adoption of SPM and the fast tracking of alternatives¹⁵** by creating mechanisms to expedite reviews of softer chemistries and biologicals, while improving registration processes generally.

→ **SEE DESIGN GUIDANCE 1: ADOPTION OF SPM AND FAST-TRACKING ALTERNATIVES**

¹⁵ Note that not all alternatives will, or should, require registration through DPR.

B. Streamline coordination with the US Environmental Protection Agency (US EPA) and others to increase instances of concurrent review by:

- i. Ensuring DPR's standards of review are at or above those of US EPA, for greater consistency and efficiency
- ii. Updating the review process so that registrants can submit their application without including all the efficacy data upfront in order to enable concurrent review and therefore greater efficiency in the registration process
- iii. Creating channels for DPR and US EPA to identify shared priorities and how best to advance alternatives in these areas
- iv. Where feasible conduct joint reviews to expedite and improve the efficiencies of the review processes

C. Promote development of alternatives to high-risk pesticides: Communicate to UC, CSU, registrants, applicators, farmers, input suppliers, and other networks of researchers and innovators, such as the Public-Private Foundation (LP1), to encourage research and innovation to prioritize developing alternatives for the highest risk pesticides

D. Issue an annual report for currently registered pesticides in both urban and agricultural areas detailing:

- i. which active ingredients or products had been reviewed in that year,
- ii. whether reevaluation or other mitigation development is necessary, based on human health or environmental risks,
- iii. what mitigation has been conducted pursuant to this process, and
- iv. which active ingredients or products will be reviewed in the upcoming year and the basis for that review.

→ **SEE DESIGN GUIDANCE 2: CONTINUOUS EVALUATION**

Strengthen Coordinated SPM Leadership Structures

One of the most entrenched dynamics undermining SPM across California is the lack of sufficient communication, coordination, and collaboration among leaders with varying interests. Conflict and breakdown in communication means that leaders are not getting a fuller understanding nor the insight needed to move the whole system forward in a productive way. Conflict erodes trust and hinders collaboration, limiting the breadth of these leaders' understanding and ultimately amplifying a range of unintended negative ecological and health consequences that serve to further amplify conflict and breakdown.

To counteract this vicious cycle, intentional forums for collaboration and coordination across difference coupled with leadership and resourcing at both a state and regional level are needed. A consistent understanding of SPM among all relevant agency staff, and adequate staffing and funding for DPR, CDFA, and other relevant State entities are essential for the State to effectively implement the recommendations of the Roadmap.

SPM LEADERSHIP AT THE STATE LEVEL

GOAL FOR SPM LEADERSHIP AT THE STATE LEVEL

- 1. Provide adequate resources to advance SPM:** By 2024, relevant State agencies and departments have the funding, staffing, and mission to advance the goals of SPM.

Priority Actions for SPM Leadership at the State Level

A. Embed SPM principles across multiple agencies, and identify formal, consistent ways to improve coordination to help create and maintain intentional collaboration across agencies and programs for both agricultural and urban pest management

→ [SEE DESIGN GUIDANCE 3: SPM PRINCIPLES](#)

B. Enhance DPR's ability to champion SPM in both urban and agricultural contexts through its activities and programs

→ [SEE DESIGN GUIDANCE 4: DPR CHAMPIONING SPM](#)

C. Enhance health and environmental monitoring to gather accurate metrics for measuring the 2050 goals and other outcomes of this Roadmap

→ [SEE DESIGN GUIDANCE 5: STATE ENHANCING HEALTH & ECOSYSTEM MONITORING](#)

STATE- AND REGIONAL-LEVEL COLLABORATION FOR SPM

GOAL FOR SUPPORTING STATE- AND REGIONAL-LEVEL COLLABORATION FOR SPM

- 1. Coordinate SPM Activities:** By 2024, the State of California should create or revamp multi-stakeholder bodies at the state and regional levels to ensure that activities to advance SPM in agricultural and urban contexts are well-coordinated and collaborative, to reduce unintended negative consequences, and enhance co-benefits.

Priority Actions for State- and Regional-Level Collaboration for SPM

A. Establish a State-level multi-stakeholder working group. Enhance the Pest Management Advisory Committee (PMAC) or create a new, related diverse multi-stakeholder body to advance collaboration, accountability, and impact of SPM. This state-level body will create a regular “meeting of the minds” to share emerging knowledge and developments in the field, and support aligned action for change. This entity will help support the Administration’s plan for implementation of the SPM Roadmap in both agricultural and urban contexts.

Charge: Create focused subgroups and/or conversations to advise on the following themes: agricultural research, urban research, evaluation, and regulation, each of which would benefit from different constellations of leaders. Key functions of each of these groups should include (among other topics):

- i. Prioritization of urban and agricultural issues:** Research and prioritization of specific issues related to pest management and pesticides. These priorities could tie in to grant priorities, registration priorities (i.e., issues that require a multiproduct/alternate analysis approach), and outreach efforts.
- ii. Expand urban research:** This body will focus on advising on how to improve data and science on urban pest management issues as well as building research and advisory infrastructure. Key needs in the field that this body will advise on:
 - a. Consolidating data and identifying data gaps; identifying gaps where there is limited science vs. places where we “don’t know what we don’t know”
 - b. Coordinating and maintaining, and ensuring dissemination of, a list of research needs is generated, disseminated, and maintained.
 - c. Supporting development of a forum or entity that develops and gathers urban pest management technologies, and that has the credibility to vet new technologies
 - d. Securing the resources to conduct strategic outreach for urban pest management applications, bridging research and user communities
 - e. Developing or supporting research on cumulative impacts of pesticide use
 - f. Coordinating and maintaining a shared ‘key research needs’ list to signal direction of research (see National Grape Research Alliance for inspiration)

iii. Agricultural research:

- a. Coordinate and maintain a shared 'key research needs' list to signal direction of research, building on the research needs identified for specific crops through Pest Management Strategic Plans (PMSPs), referenced below, while also integrating the wider systems approach integral to SPM. Historically, the PMSPs have been helpful for supporting identification of key research needs by agencies and researchers, and should be used in the future as a starting point
- b. Advise research and funding communities on key research gaps that need to be addressed

iv. Regulation and registration:

- a. Monitor emerging trends to inform an adaptive regulatory response
- b. Consider additional regulatory and/or policy changes that could support effective pest management and further reduce overall risk from pests and pesticides
- c. Explore and advise on the necessary and appropriate level of efficacy review, with the intention of supporting concurrent reviews and as much streamlining as possible

→ **SEE DESIGN GUIDANCE 6: MULTI-STAKEHOLDER COLLABORATIVE GROUP**

B. Regional pest management collaborative: The Work Group recommends instituting strong multi-stakeholder regional-level forums, networked with the state-level collaborative body, as an important vehicle to coordinate landscape-scale pest management with a focus on prioritizing invasive pest prevention and enabling coordinated pest detection and exclusion at a landscape scale. These collaboratives can build on successes of county-level [Special Districts](#), existing Pest Management Districts, and Pest Management Alliances. The purpose of these collaboratives, more specifically, includes:

- i. Coordinating on mitigation, monitoring, early detection, communication, and response
- ii. Creating organizational and communications structures that facilitate rapid response
- iii. Advancing pest management solutions that require a larger area than the farm-scale to be effective, such as pheromone mating disruption and robust agroecological landscapes
- iv. Experimenting with coordinated alternative pest management approaches
- v. Identifying and advocating for research and other activities that address key local SPM needs, and communicate these priorities to the state-level working group
- vi. Identifying and communicating key risks to SPM in the region
- vii. Fostering grower-to-grower exchanges for shared learning and dissemination of best SPM practices
- viii. Fostering trust and collaborative mindsets as a way to address existing cultural barriers to information sharing in grower and advisory communities

→ **SEE DESIGN GUIDANCE 7: REGIONAL PEST MANAGEMENT COLLABORATIVES**

Additional Actions to Support Regional Pest Management Collaboration

A. Foster regional SPM collaboration, demonstrations, and peer-to-peer learning among agricultural producers, including farmers, farmworkers, PCAs, and others

- i. Support annual regional SPM conferences for farmers that combine information sharing, capacity building, skill sharing, and networking
- ii. Create a CDFA-sponsored peer-to-peer farmer support network that facilitates shared knowledge and advances implementation of on-farm biosecurity measures that helps farmers connect and obtain current knowledge on biosecurity measures and practices
- iii. Incentivize participation in regional grower organizations and gatherings, leveraging, where possible, existing Commodity Marketing Orders, Pest Control Districts, task forces, advisory committees, and boards
- iv. Develop effective messaging that is pitched to growers in relatable, practical terms
- v. Develop detailed crop-, commodity-, and region-specific Best Management Practices in line with pesticide risk reduction and, where possible, other co-benefits and interrelated sustainability goals such as climate mitigation and adaptation, water stewardship, and land conservation practices, and coordinate with various agricultural associations that are addressing similar pest problems

B. Build out the model and promote use of Sustainable Pest Management plans based on the mode of [Pest Management Strategic Plans](#) (PMSPs)¹⁶: Combine the PSMP model, with information funded by Regional IPM Centers (funded by the US Department of Agriculture’s National Institute of Food and Agriculture), to include on the “compounds for substitution,” technology needs or opportunities, knowledge and gaps in ecological farming approaches, and roles for and an expanded consideration of issues that have not been traditionally included, such as ecosystem research and new technologies. This will provide a roadmap for research needs and priorities, and identify where there are SPM practices ready for outreach. This should also be expanded to urban settings to assess key pest issues, current available tools and risks to ongoing use, and prioritization of replacement compounds.

¹⁶ Pest Management Strategic Plans (PMSP) are commodity-specific plans that assess the current risks to and gaps in pest management and pest management tools to prioritize research and outreach needs. The PMSP model has been used by USDA to help growers address possible regulatory changes, but also issues such as resistance development, lack of efficacy, and lack of monitoring tools.



ADVANCING SPM IN AGRICULTURAL CONTEXTS

Enhance Knowledge, Research, and Technical Assistance

One of the key needs to accelerate a transition to SPM is building a knowledge base of alternative tools (including practices, systems, technologies, biologicals, and chemistries) and preventative measures to effectively manage pest problems and reduce pesticide-related risk. This includes speeding adoption of already-known alternative tools, as well as developing new ones. The SPM Work Group envisions a thoughtful, strategic, and coordinated next-generation research and support infrastructure for SPM. In this system, there is a strong coupling between researchers, growers, and farmworkers so that knowledge is applied and research can be informed by on-the-ground needs (see Appendix 7 for additional framing about knowledge systems in sustainable pest management). Research and outreach is holistic, collaborative, and based in the whole farm system. Research institutions and funders incentivize and support research on alternatives, starting with alternatives to high-risk pesticides.

The principles, practices, and tools of SPM must be easily accessible to all growers, regardless of farm size, crop type, language, or socioeconomic background. More public investment into, and structures that support, SPM research in line with vision above will produce a much greater breadth and balance of SPM knowledge in the field, which, coupled with expanded and coordinated outreach centered in SPM, will significantly expand the tools available to growers and farmworkers for adoption of safer pest management approaches.

GOALS

- 1. Expand research and development infrastructure:** By 2030, California has revitalized and expanded the public and private institutional infrastructure, workforce, and processes that meaningfully fund and support SPM research and technology development. The research community is prioritizing pest management options that are viable and are low-risk and low-impact to humans and the environment and adding more alternatives to the suite of available tools. SPM research is regularly and explicitly engaging and integrating farmer, farmworker, and other stakeholder expertise and needs from start to finish, including from traditional and indigenous knowledge sources, to support multi-directional learning.
- 2. Enhance extension and education:** By 2030, every farm in California has access to free or affordable SPM education, training, and independent technical advice that is relevant to its crops, region, farm size, pest pressures, and language needs. By 2040, every growing region in California has successful, trusted, transparent, knowledge-based networks focused on farmer-informed technical assistance and farmer-to-farmer learning.

Priority Actions

- A. Reinvest in research and outreach** for SPM to secure a significant increase in SPM-trained technical advisors per farmers (includes UC Cooperative Extension, Resource Conservation Districts and other advisors) and funding (over 2021 levels) for SPM research and outreach, including human capacity for those programs, that reflect and serve the diversity of California farms and agricultural producers.

Meaningfully enhancing staffing and funding for SPM research and outreach (and the training required to skill up the workforce) to the UC, California State University (CSU), California community colleges (CCC), and other academic institutions, as well as non-profits and other organizations that advance educational efforts, is a critical foundational need to make SPM the standard in California. These efforts must prioritize bringing viable alternatives to the most high-risk chemical pesticides to the field - including both chemistries that are low-risk to humans and the environment and a broader set of approaches that reduce the use of high-risk pesticides (e.g., building resilient agroecosystems, technological alternatives, etc.).

- i. **Increase UC staffing and funding for SPM training, research, and extension:** Secure a tripling of the current ratio of SPM-trained farm advisors per farmers and a doubling of funding (over 2021 levels) for SPM research and outreach.

As part of the academic system focused on pest management research in the State, it is essential that the UC significantly increase the number of researchers and SPM-trained farm advisors in the field. We recommend that UC fully fund, staff up and expand UC Cooperative Extension, prioritizing filling all vacant staff positions and then increasing staffing levels by at least 20%, and to enable an expansion of technical assistance services on SPM by increasing the number of farm advisors/specialists with SPM-related assignments, including but not limited to “organic farming,” “ecological agriculture,” in their position title or description to a minimum of [# TBD - current number is 43].

Provide sufficient and consistent funding for applied research via (1) the UCANR Organic Agriculture Institute at Kearney Agriculture Research and Extension Center, (2) ANR’s plan for a Biological Control Research Center in the upgrade of the Hansen Agricultural Research and Extension Center, and (3) long-term research at Russell Ranch.

- ii. **Leverage the capacity of California Community Colleges (CCC) and California State Universities (CSU)** to develop a sustainable career pipeline, applied research, and advance agricultural technology development and adoption that supports SPM. These institutions not only carry out critical research by top academics but also educate Pest Control Advisors, all current and future generations of farmers, and related agribusiness roles. These systems must be supported in deepening and broadening their research and outreach capacity. Provide sufficient funding for:

- a. CSUs and CA Community Colleges to expand coursework into existing education programs to incorporate SPM principles
- b. CCCs to expand pathways for diverse student populations to access coursework, certifications, and trainings for future PCAs
- c. Grants to CCCs and CSUs for expansion of applied agricultural technology programs (including certificates and curriculum expansion) that support SPM incorporation
- d. CSU University Farms capacity building to expand on-farm research projects, laboratory capacity, and field equipment to advance ag technology development and adoption (precision ag), detection, surveillance and eradication actions that conforms with SPM

- iii. **Increase funding that incentivizes research, outreach and technical assistance providers** beyond the university systems to include governmental, quasi-governmental, nonprofit, business and other entities, to create the conditions for SPM to succeed throughout California.

→ **SEE DESIGN GUIDANCE 8: INVESTMENT IN RESEARCH & OUTREACH**

B. Increase public research: The State of California should investigate ways to increase public research and advisory positions, including considering a large competitive SPM fund that would support endowed chairs, key staff, and/or funding to SPM-focused entities within institutions that all college systems can access

→ **SEE DESIGN GUIDANCE 9: A SUCCESSFUL SPM IN CALIFORNIA**

C. Expand research, demonstration, and outreach grantmaking: CDFA and DPR should expand and restructure existing grant programs to support collaborative and long-term research, implementation, demonstration, and outreach, including, but not limited to

- i. Providing \$3 million in annual funding to expand Biologically Integrated Farming Systems (BIFS) grants in order to increase stability and reach of the program.
- ii. Expanding the Pest Management Alliance Grants Program to make them longer-term and with larger grants in order to support the success of pest management alliances

→ **SEE DESIGN GUIDANCE 10: A SUCCESSFUL CDFA & DPR**

D. Launch a public-private SPM foundation to scale and coordinate investment in SPM: Create a public-private foundation funded with \$1B over 5 years to invest in technologies and techniques (including, but not limited to, biological, technological, chemical, practice based, and Indigenous knowledge) to reduce the impact of pest management on humans and the environment

→ **SEE DESIGN GUIDANCE 11: A SUCCESSFUL SPM FOUNDATION**

E. Promote institutional structures that support SPM research and multi-directional learning: Research institutions should evaluate institutional structures to identify ways to remove barriers to SPM research and better coordinate outreach and applied research for a collaborative, communicative system emphasizing bidirectional learning

- i. Revise institutional structures to foster a paradigm shift in California agricultural research to center systems approaches that combine (a) collaborative, long-term, holistic, landscape-scale, and applied research; (b) outreach and bidirectional learning; and (c) demonstration. Implement incentives (for example a reward system) for field experts to work together in multidisciplinary teams.

→ **SEE DESIGN GUIDANCE 12: A SUCCESSFUL PARADIGM SHIFT**

F. Fund and encourage on-farm demonstration programs to show growers the value of SPM programs, building on the success of PMA, BIFS, the Healthy Soils Program, and the former USDA Interregional Research Project No. 4 ([IR-4](#)) demonstration grant program

Additional Actions

- A. Establish an outreach alliance:** Develop and invest in a public/private/non-profit alliance to deliver technical information to growers. The alliance would be made up of UC campus specialists, Farm Advisors, PCAs, and basic manufacturers of plant production/protection technologies and other agsupport organizations (formal and informal). Members of this network of specialists could be called upon to deliver information, develop systems, and solve problems with growers. Enable current DPR alliance funds to cover this and request that industry members pay a membership fee based on size/revenues.
- B. Develop and share forecasting models:** DPR or UC should develop and share pest and disease forecasting models that include the latest precision technologies, such as real-time spore monitoring and/or encourage regional pest monitoring collaborations, for integration into technology systems used by farmers, taking into account potential modification of models as climate changes occur
- C. Support biologicals, new technology, and Indigenous-knowledge-led initiatives:** Commodity and grower groups and the State should collaborate and help fund projects that vet and validate new technologies and biologicals in high priority areas where new solutions are badly needed to reduce risk or where there is an unmet need, including knowledge and research from Indigenous communities that is not always part of the established research institutions

Align Pest Control Advisors with SPM

As a primary source of pest management advice for agricultural producers, Pest Control Advisors (PCAs) are important messengers of SPM. With adequate training and support, PCAs can be leading agents of change in support of SPM. Licensing currently focuses narrowly on how to use pesticides, and educational opportunities for advisors about SPM are limited. Additional structural barriers to PCAs' ability to champion SPM include consolidation in the chemical input (particularly fertilizer and pesticide) sector, corporate structures in chemical input companies that favor products over services, and commission structures that encourage promotion of chemical inputs have served as additional barriers. Addressing these challenges can prevent the unnecessary use of or over-application of chemical inputs and greatly support PCAs' leadership in sustainable pest management.

GOAL

- 1. PCAs champion SPM:** By 2030, all PCAs have received meaningful training in, and are incentivized to promote, SPM in the field. PCA advice is guided by SPM principles and practices and their recommendations are not commission-driven.

Priority Actions

A. Require all PCAs to become trained in SPM: Specifically:

- Add a new category for continuing education (CE) courses on "Sustainable Pest Management":** Expand the type of content approved for PCA continuing education units to include all aspects of a farm's SPM system, including soil health, irrigation management, nutrient management, beneficials, and enhancing farm biodiversity, and other content applicable to pest management.¹⁵
- Update continuing education (CE) requirements for all license categories:** Update new PCA and QA licensing requirements to a minimum of 3 semester or 5 quarter units of SPM content, and all license renewals to require a minimum of 6 hours of SPM training Continuing Education Units (CEUs)
- Expand academic course offerings:** Academic institutions training PCAs should revise their curricula to include a variety of SPM offerings

→ **SEE DESIGN GUIDANCE 13: SPM TRAINING PROGRAM**

- #### B. Create a new licensing category for SPM for agricultural PCAs and applicators that is required to be passed in order to qualify for a PCA license (similar to the Laws and Regulations category).

→ **SEE DESIGN GUIDANCE 14: NEW SPM LICENSING CATEGORIES**

¹⁵ This recommendation builds on the [Alternatives to Chlorpyrifos Work Group](#) Recommendation 3.2 to expand the range of topics offered for pest control adviser certification and continuing education.

- C. DPR should assemble an ad hoc work group to explore additional ways to remove structural barriers to SPM advice:** The objectives of this group should be to:
- i. Further explore how we might shift incentives from advising chemical pest management (such as commissions for chemical pesticide sales) towards other SPM products and practices (i.e., services and tools associated with SPM such as cover crop seeds, real time pest and pathogen monitoring, robots, software as a service (SaaS)), without adding additional financial burden to farmers
 - ii. Identify ways the State might be able to support accessibility so that independent PCA advice is available to all growers
 - iii. Advise on transparency policy that requires full disclosure of how PCA's are compensated for product recommendations
 - iv. Identify additional ways to build PCA leadership on SPM (e.g., via the SPM Transition Initiative proposed in this Roadmap)
 - v. Explore how we might build on existing research and resources to expedite developing college coursework on SPM and build a greater focus on cultural practices and other non-chemical SPM approaches

Additional Actions

- A. Promote industry training:** Existing grower and PCA trade associations should cooperate in developing SPM outreach workshops for grower members and PCAs via their outreach programs.
- B. Establish scholarship programs:** Create a state-funded scholarship program that would include donations from private sources for students who want to become PCAs or crop consultants that include requirements to take SPM classes. The State could work with, build on, and provide funding for the SUPERSTAR project at CSU Bakersfield and expand it to other state schools. The program could also include creation of State-funded paid internship and scholarship programs for PCA consulting companies for students about to graduate or recently graduated that have SPM requirements for completion. ([Resource](#))
- C. Develop educational materials:** Develop a document or workbooks that comprehensively cover IPM and SPM for all pests and diseases, including chemical, biological and cultural approaches. The absence of one document that covers chemical, biological, and cultural approaches is a current gap in the system
- D. Implement and alternatives assessment:** Develop guidance for PCAs to support follow-through of currently required alternatives assessments. The State could develop a baseline set of values and principles to guide, and be included in, these alternatives assessments
- E. Involve PCAs in research:** Include PCAs in research to enable them to learn new techniques and extend that learning to their clients

Reduce Economic Risk for Growers Transitioning to SPM

California’s agricultural producers are facing growing uncertainty and instability as a result of many pressures such as high input costs, changing land tenure, demands from bank loans and insurance companies, climate change and water insecurity, labor shortages, and an increasingly complex regulatory landscape. Against this backdrop and with many are operating close to the edge of their capacity, growers are particularly hard pressed to take on the additional risks inherent in shifting their operations toward SPM. The SPM Work Group envisions a future where all growers have the support they need to mitigate the operational risks associated with adopting SPM practices and systems. A key intervention in the system to accelerate SPM is support for growers to mitigate these risks and move more growers beyond a “business as usual” mindset into innovation.

GOALS

- 1. By 2030, every grower in California has access to a suite of effective and feasible alternatives to high-risk pesticides where available.** Where not currently available, California has a research and funding infrastructure in place for the development of effective, cost-effective, and efficacious alternative pest management options.
- 2. By 2030, California has implemented a system of incentives and financial risk management** that integrates supply chain partners, educational institutions, private financial markets, and state and federal risk management programs to drive widespread adoption of SPM.
- 3. By 2030, 100% of lands owned and leased by the State of California implement SPM.**

Priority Actions

- A. Launch the SPM Transition Initiative:** Design, fund, and launch SPM Transition Initiative to incentivize and provide sufficient risk management to support growers to adopt SPM. The SPM Transition Initiative would be a State-led effort to support farms and farmers of all sizes, commodities, production types, and socio-economic backgrounds and languages to transition to SPM, and steward public and environmental health, by creating a short-term safety net for participating growers as part of their transition to SPM. Under the Initiative, the State would cover the cost of reasonable lost yields suffered during a fixed period of time during which a farm is moving to adopt and ongoingly implement SPM practices. By creating this powerful incentive for growers to adopt safer and more SPM practices, the State would be making a crucial investment in the health and well-being of the public and the environment. A preliminary program design is outlined in Appendix 6.
- B. Promote SPM on public lands:** Identify opportunities to implement SPM on lands owned and leased by the State of California.

→ **SEE DESIGN GUIDANCE 15: OPPORTUNITIES ASSESSMENT**

Additional Actions.

- A. Encourage State investments:** The State should study opportunities to encourage SPM through its financial investments (such as through CalPERS and CalSTRS) and develop a proactive strategy to implement their findings.
- B. Support near-term grower transition to SPM** by expanding and improving CDFA programs to increase access and funding for farmers, especially for socially disadvantaged farmers. This includes:
- i. An annual budget increase to support the expansion of the Healthy Soils Program and explore ways the Healthy Soils Program can further support SPM (for reference, see [practices supported by the Healthy Soils Program](#))
 - ii. Continue to review grant processes to make them more user-friendly, including working with the California State Auditor's office to streamline paperwork requirements for grantees, and providing language and culturally appropriate Technical Assistance
 - iii. CDFA should ongoingly incorporate farmers' feedback, especially that of small and socially-disadvantaged farmers and farmers of color, in order to help the programs meet the needs of a diverse array of California's farmers
- C. Consider land tenure patterns:** Evaluate the implications for land tenure trends and issues on SPM. The Work Group identified land tenure and land rental agreements as potential factors affecting the adoption of SPM. Further study of this area, as well as opportunities to incentivize SPM through lease agreements, is warranted. Early ideas identified by the Work Group include tax incentives for landowners willing to rent land on certain terms, taking action to ensure that land owners understand that land farmed in alignment with SPM is beneficial for property value, and tapping into the climate change-consciousness of next-generation landowners.
- D. Study risk management barriers and successes:** CDFA and DPR should commission a study of successful private and public risk management programs from around the world and study barriers to implementation in California agriculture and opportunities for implementation.
- E. Leverage crop insurance:**
- i. Request that the appropriate entity, such as the California Insurance Commissioner evaluate agriculture loans offered in the state and consider inclusion of SPM standards as eligible expenses under the program(s) and other ways loans may advance SPM.
 - ii. The State of California should review gaps in Farm Service Agency (FSA) insurance and investigate ways to improve coverage to minimize risk during SPM transition.
 - iii. A multi-stakeholder group representing diverse interests could advocate for California SPM priorities to be integrated into the federal Farm Bill, including changes to the federal crop insurance program to mitigate risk.
 - a. Speak directly to Risk Management Agency
 - b. Environmental advocacy groups and farm interests groups advocating together for these changes to the Farm Bill

F. Promote incentives, such as

- i. DPR expanding the funding for legacy pesticide take-back/collection events, as a way to incentivize both agricultural and urban users to transition to lower-risk chemicals and practices
- ii. Incentives include technical assistance for growers applying for SPM grants
- iii. Helping to incentivize the key influencers like UC and the growers to adopt alternatives that are "shovelready" but lack support, awareness and education for their use
- iv. Developing and funding new equipment lending libraries

Activate Markets to Drive SPM

Strong market demand for California-grown sustainable and socially just agricultural products is an important lynchpin in driving a widespread shift toward sustainable pest management. Buyers of agricultural products can be a powerful engine of change in on-farm SPM approaches by leveraging their procurement power and prioritizing high-standard, California-grown products, but this must be done in ways that align with on-farm conditions and constraints and don't unduly burden growers already stretched thin with complex demands. Strategic and coordinated action to build buyer and market demand for California-grown, socially just, and sustainable food would accelerate SPM and enhance the market for these products.

Ultimately, this would result in a meaningful shift away from high-risk pesticides, benefiting farmworker health and the environment¹⁶ while helping farms by supporting their transition to SPM. With the support of incentive programs and partnerships across government, private, and non-profit sectors, all residents in California can access affordable, sustainably CA-grown fruits and vegetables.

GOALS

- 1. Establish purchasing criteria:** By 2025, the State of California has established purchasing criteria for identifying and validating agricultural products that are grown in accordance with SPM
- 2. Increase procurement:** By 2030, there is 50% increase (above baseline from the 2026 audit) in the purchase of California-grown agricultural products¹⁷ grown in accordance with SPM criteria by California State- owned or State-run institutions (including public universities and colleges), including funds to local educational agencies for pupil meal reimbursement
- 3. Expand presence in retail markets:** By 2030, a diversity of affordable Californian, SPM-grown agricultural products are recognized by national retailers for the value of SPM and accept SPM as meeting supplier approval requirements, including but not limited to ESG (Environment, Social, Governance) buying requirements

Priority Actions

- A. Develop SPM Purchasing Criteria:** By 2023, the Department of General Services, in collaboration with CalEPA, DPR, and CDFG, has established a multi-stakeholder task force to inform the creation of SPM Purchasing Criteria

→ **SEE DESIGN GUIDANCE 16: SPM PURCHASING CRITERIA**

¹⁶ Impacts of pesticides on human health and the environment are widely documented. See for example, Gunstone T, Cornelisse T, Klein K, Dubey A, Donley N. Pesticides and Soil Invertebrates: A Hazard Assessment

Available at: <https://www.frontiersin.org/articles/10.3389/fenvs.2021.643847/full>; Calvert GM, Beckman J, Prado JB, Bojes H, Schwartz A, Mulay P, Leinenkugel K, Higgins S, Lackovic M, Waltz J, Stover D, Moraga-McHaley S. Acute Occupational Pesticide-Related Illness and Injury -United States, 2007-2011. MMWR Morb Mortal Wkly Rep. 2016 Oct 14;63(55):11-16. doi: 10.15585/mmwr.mm6355a3. PMID: 27736824; Curl CL, Spivak M, Phinney R, Montrose L. Synthetic Pesticides and Health in Vulnerable Populations: Agricultural Workers. Curr Environ Health Rep. 2020 Mar;7(1):13-29. doi: 10.1007/s40572-020-00266-5. PMID: 31960353; PMCID: PMC7035203.

¹⁷ According to the Food and Agriculture Code (FAC § 47000.5), "agricultural product" means a fresh or processed product produced in California, including fruits, nuts, vegetables, herbs, mushrooms, dairy, shell eggs, honey, pollen, unprocessed bees wax, propolis, royal jelly, flowers, grains, nursery stock, raw sheared wool, livestock meats, poultry meats, rabbit meats, and fish, including shellfish that is produced under controlled conditions in waters located in California.

- B. **Conduct a market assessment:** Once SPM Purchasing Criteria have been clearly defined, the State of California should conduct a market assessment of agricultural product sales in California to determine a baseline and identify economic mechanisms that incentivize SPM in the long term. Engage the multi-stakeholder purchasing criteria task force to help identify incentives
- C. **Expand State procurement:** The Department of General Services, in collaboration with CalEPA, DPR and CDFA, and in consultation with other state agencies as needed, should take actions to institutionalize and incentivize the purchasing of SPM products within its own procurement processes. These actions should include:
 - i. **By 2026, the State should conduct an audit of institutional purchasing practices** (including state institutions and local educational agencies) of implementation of the CA-grown purchase preference, Buy American requirement, and if possible, SPM criteria met/volunteered on bids ¹⁸
 - ii. **The Department of General Services should:**
 - a. Audit all food procurement contracts for compliance with DGS procurement standards. Include an evaluation of the average price differential between CA-grown bids and out-of-state or non-domestic bids
 - b. Change their Procurement Manual and Purchasing Standards to require that bids reflect SPM and point of origin and incorporate SPM procurement % standards and point of origin (CA)
 - c. Report annually, to CDFA, the Governor and the Legislature, on compliance with the CA-grown and CA-grown SPM standard
 - iii. **Mandate SPM and CA-grown State procurement requirements** by offering CA growers an automatic 25% bid preference (currently at 5%) and CA growers practicing SPM a 30% purchase preference (above non-CA grown bids on institutional contracts)

→ **SEE DESIGN GUIDANCE 17: SPM PURCHASING CRITERIA**

- D. **Enhance school food procurement:** The California Department of General Services (DGS) should facilitate methods for school food buyers to locate and purchase CA-grown, SPM products
 - i. Create mechanisms for local educational agencies to choose CA-grown SPM products with consideration for their budgets for meals
 - ii. By 2030, establish a pilot or enhancement within CDFA's Farm to School Grant programs to offer grant funds to Local Education Agencies on a per pupil meal basis (i.e. \$0.0X/meal) for products used and purchased from CA producers that practice SPM

¹⁸ The State currently offers a 5% purchase preference for California-grown products for State institutional bids/contracts and local educational agencies are required to comply with USDA NSL Buy America standards. Both the purchase preference and Buy America provisions are not enforced or enacted nor does the DGS procurement manual request bids include information about SPM produced commodities.

- E. Create voucher incentives for SPM:** In consultation with the California Department of Social Services, expand incentives to promote the purchase of SPM-aligned products to CalFresh, the California Women, Infants, and Children (WIC) program, and other CA voucher programs. Until SPM Purchasing Criteria are established, enabling WIC recipients to purchase organic foods using vouchers will help achieve SPM goals

Additional Actions

- A. Develop a clearinghouse of information about SPM approaches, information on trade-offs** inherent in pest management, and best management practices to guide both growers and buyers to desired outcomes. The clearinghouse can list buyers that recognize the SPM standards, incentives for SPM standards use (state support, buyer support, business contract support), and promote SPM standard practitioners marketing.
- B. Promote purchasing standards** by 1) creating marketing materials for grower and buyers to highlight SPM benefits and promote purchasing and 2) marketing SPM purchasing standards through CA commodity boards, commissions, and grower group
- C. Incentivize participation** in regional grower groups
 - i. Support regional grower groups to establish programs that are developing SPM farming systems that gets linked into market by some kind of standard
 - ii. CDFA and DPR make presentations at commodity commissions and boards, agricultural trade associations and conventions/conferences about advancing SPM, and important tradeoffs to consider, how to get into the State procurement system, and other relevant topics to advance this Roadmap



ADVANCING SPM IN URBAN CONTEXTS

Enhance Data Collection for Urban Pesticide Use

As outlined in “What is SPM in Urban Environments?” above, there is very little data available about how and where pesticides are used in urban contexts, making it particularly difficult to understand and address problems associated with their use. Efforts to advance urban SPM would be greatly enabled by strengthening and expanding systems to provide the data and science needed for sound regulatory decisions, product design, and effective pest management.

GOALS

- 1. Plan for data collection:** By 2025, the State of California has the necessary commitments, plan, resources, and timeline in place to enable a robust understanding of pesticide use and impacts in urban settings to inform SPM initiatives.
- 2. Collect data on pesticide sales and use:** By 2030, the State of California collects detailed data on how pesticides are actually used in urban areas, maintains a public data management system to make this information available, and periodically performs an analysis of pesticide sales and use patterns in urban settings.

Priority Actions

A. Organize data on urban pesticide use: Develop a system to collect detailed data through surveys or other means, to better characterize how pesticides are used in urban areas every five years, with funds for continued operation of that system

→ [SEE DESIGN GUIDANCE 18: A SUCCESSFUL DATA SYSTEM](#)

B. Expand urban pesticide use reporting: DPR should enhance pesticide use reporting requirements for professionals in urban contexts. The current PUR database covers a limited subset of uses and should be expanded.

→ [SEE DESIGN GUIDANCE 19: URBAN PESTICIDE USE REPORTING](#)

C. Refine the pesticide sales database: By 2030, require DPR’s pesticide sales database to gather more specific data on where products are sold, at the county or more refined level.

→ [SEE DESIGN GUIDANCE 20: PESTICIDE SALES DATABASE](#)

Advance Research and Outreach on Urban Pest Management Issue

Currently, research funding for pest management is heavily focused on applications in production agriculture, resulting in relatively poor investment in research and outreach on urban pest challenges. Particularly given the high proportion of pesticide use in urban contexts, California’s efforts to implement SPM statewide would be greatly enabled by an increase in research, outreach and technical assistance for urban uses.

GOAL

- 1. Support research and outreach on urban SPM:** By 2030, California research institutions have urban SPM research, innovation and outreach infrastructure that aligns with and reflects the volume and impacts of pesticides used in urban contexts

Priority Actions

- A. Expand urban SPM research and outreach:** Provide adequate dedicated annual funding for UC IPM, CSU, and CCCs for urban-focused academics, research, and extension, and consider funding other partners to support communication to priority audiences

→ [SEE DESIGN GUIDANCE 21: FUNDING RESEARCH & OUTREACH](#)

- B. Support urban SPM grants and contracts:** The State should support SPM research, innovation, implementation, and education in urban settings through grants or contracts.

→ [SEE DESIGN GUIDANCE 22: FUNDING GRANTS & CONTRACTS](#)

Make SPM the Preferred Choice for Both Licensed and Unlicensed Users

There are many reasons why urban pesticide users reach for high-risk pesticides instead of choosing sustainable pest management. First, pesticides can be perceived as more affordable and convenient than preventative measures or non-chemical pest removal approaches. Urban users, particularly those who are not licensed, often possess limited understanding of proper pesticide use and environmental exposure pathways and may lack the interest in learning. In addition, opportunities for prevention and non-chemical interventions may not be available to many urban residents. For instance, renters may be unable to secure the necessary building improvements to mitigate pests, and conducive conditions maintained by neighbors may also contribute to experienced pest pressures. Key advisors and influencers, such as health inspectors and code enforcement officers, may also lack the knowledge and tools necessary to make informed recommendations, and education and training opportunities are scarce.

In many cases, ease of access and a quick fix orientation contribute further to widespread use of high-risk pesticides where preventative or alternative pest control measures may be effective in limiting pest proliferation. The “ick” factor among consumers may lead to hasty decision-making on treatments, driving a culture of reliance on quick and convenient solutions. Conventional pest management solutions are also reinforced by a widespread assumption that registered products have no risk, and limited awareness about the different levels of hazard associated with various pesticides.

GOAL

- 1. Support SPM for urban users:** By 2030, California has systems in place that enable both licensees and non-licensees to identify and implement SPM options that meet their needs

Priority Actions

- A. Advance SPM at school sites:** DPR should create a process to identify and implement mechanisms to overcome the barriers that prevent widespread adoption of SPM at school sites. The school sector is one that demands special energy and attention. As custodians of our most vulnerable populations for most of their waking hours, schools have the highest responsibility and opportunity to protect and enhance the health of young children. There are many overlapping jurisdictions, authorities, priorities, and stakeholders. Specific elements that warrant exploration include:
 - i. Every 5-10 years, perform a formal review of the Healthy Schools Act (HSA) of 2000 including responsibilities of school personnel applying pesticides and how these activities relate to the overall IPM program. Produce a written report of findings including any additional HSA improvements, guidelines, or requirements necessary to support SPM implementation at school sites
 - ii. Consider requiring certification or licensing (special category) with expanded annual requirements for pesticide application and SPM training and/or periodic consultation on IPM implementation with DPR for school personnel applying pesticides, to ensure a minimum competence level to implement SPM and continuing education for the latest information on pests and their management

- iii. Provide dedicated ability for DPR to provide customized IPM and SPM compliance assistance and consultation capacity for school sites
- iv. Promote and incentivize HSA implementation and compliance by providing a centralized means for increasing visibility of compliance through a simple, easily understood HSA compliance information interface hosted on-line that provides at-a-glance details on school site compliance

B. Conduct urban SPM outreach: The State should invest in an outreach initiative coordinated by DPR to influence high-leverage messengers to promote and magnify urban SPM messaging. Identify, prioritize, and strategically engage with influencers of key urban pest management decision-making realms to promote lower-risk SPM alternatives and potentially partner in examining and piloting safer alternatives. Targets may include associations of veterinarians for pet products, building managers (i.e. use of antimicrobials in cooling water, pools, fountains, boilers, etc.), golf course managers, paint formulators schools, retailers, nursery and garden centers (address turnover in these industries), homeowner associations, and local governments. Other key influencers that should receive more information on a very consistent basis, with recommendations on how they can contribute to SPM outcomes, include: code enforcement officials, environmental health inspectors, landscape architects, building code officials, and housing agencies.

→ **SEE DESIGN GUIDANCE 23: OUTREACH EFFORT ON URBAN SPM**

- C. Require retail education:** The State should implement pesticide education requirements and programs in the retail sector.
- i. Link retail pesticide sales with an obligation to disseminate reliable information to customers about pesticide alternatives and SPM at the point of sale
 - ii. Prohibit stores from having employees provide any advice to customers on pesticide choices unless the employee is licensed to do so
 - iii. Enhance programs that educate retailers about SPM, such as the IPM Advocates for Retail Stores program (a group housed within CASQA, that could be expanded statewide to work directly with stores)
- D. Initiate a public awareness campaign:** Fund and launch a 3-5 year, \$6-10M public awareness campaign(s) by 2024 focused on building public understanding about pesticide risks and impacts, SPM and its principles, and shifting public mindset about pests. Identify key issues and audiences, research key obstacles and leverage points, and develop high quality campaigns focused on these findings, with metrics and adequate funding. Desired outcomes include:
- i. More visibility for new or little-known research and innovation results and ideas to drive adequate and effective communication
 - ii. User audiences pay attention to and reduce conducive conditions, such as harborage and access to structures and food
 - iii. Brand SPM (or, if/when needed, rebrand IPM) so that it makes sense to the average person
 - iv. Promote public utilization of certified IPM service providers
 - v. Increase the use of social media and apps to build public understanding of pesticide use risks and alternative pest management strategies

→ **SEE DESIGN GUIDANCE 24: PUBLIC AWARENESS CAMPAIGN**

- E. Establish workplace SPM training:** Establish an ongoing program for DPR to partner with state and local regulatory agencies that interact with non-licensed workplace pesticide users with the goal of enhancing training for both agency staff (including inspectors) and workers on their workplace use of pesticides and SPM alternatives. Examples of potential partners include county environmental health regulators, the Occupational Safety and Health Administration, and the Department of Industrial Relations. DPR priorities for implementing interagency partnerships should mesh with its SPM priorities.
- F. Create a mechanism to report violations:** Promote mechanisms available to residents to report concerns about pesticide use or unmanaged pest problems (see for example California Civil Code Section 1941.1, which requires landlords to keep dwellings in habitable condition, including removing harmful insects)
- G. Incentivize SPM:** Build positive incentives and opportunities for urban users to increase their adoption of SPM tools and practices. Such incentives could include grants supporting or offsetting initial implementation costs, social recognition and promotion programs, and streamlined regulatory and administrative requirements.

Priority Actions

- A. Review the continuing education unit (CEU) criteria for approving CEUs and make the following changes:**
 - i. Revise the CEU credit categories which are required by all DPR licenses (PCA, QAL, QAC). Leave Laws and Regulations but change the category currently called “Other” to IPM/SPM.
 - ii. Review the topics included in this category (currently “other”) and expand topics to be broadened to include “non” pesticide topics important to an IPM/SPM discussion including but not limited to topics on non-pesticidal methods to manage pests including proper pruning, soil fertility, plant nutrition, irrigation, exclusion, sanitation, and more etc. All topics should relate back to the pest and not a pesticide/or why a pesticide would be eliminated.
 - iii. Remove the requirement to have “pesticides and pest management” and simply change to pest management
- B. Consider training and licensure requirements:** Consider licensure or training requirements for property managers and “in house” pesticide applicators based on type of business and/or size threshold. (e.g. rental properties of a certain size).
- C. Create criteria for SPM certifications:** DPR and SPCB shall establish criteria for SPM certifications of pest management providers or services that further the goals of this roadmap. These criteria can be applied to new or existing certification programs, for example, EcoWise, GreenShield, and GreenPro

- D. Promote certified pest management services:** DPR and SPCB shall promote qualifying certifications by:
- i. Encouraging pest management providers to become certified
 - ii. Incorporating incentives for certified SPM companies into state contracting language, for example, by offering points to certified companies in requests for proposals
 - iii. Encouraging local public agencies, businesses, and consumers to choose SPM certified companies and services

Refocus Urban Design, Building Codes, and Regulations to Enhance Pest Prevention

The effective prevention of pests is a cornerstone of sustainable pest management, which depends in large part on addressing the conditions that are conducive to pests. A significant focus of conducive conditions in urban areas are deficiencies in the built environment. Such deficiencies can be caused by neglected maintenance and poor operation of existing buildings and landscapes, and/or flaws in design and construction. This section is intended to encourage the development of systems and requirements to enhance the identification and correction of conducive conditions in existing buildings, and to reduce the extent to which poor design and construction practices contribute to persistent pest problems.

GOAL

1. **Advance urban pest prevention:** By 2030, California urban design meaningfully incorporates pest prevention, and pest prevention is a centerpiece in pest management training, licensing, standards and building codes

Priority Actions

- A. **Formalize general pest inspection requirements** (following the model of Branch III wood-destroying organism inspections) that would be offered under Branch II services or separately. This includes general pest inspection requirements being added in state code language

→ [SEE DESIGN GUIDANCE 25 GENERAL PEST INSPECTION REQUIREMENTS](#)

- B. **Formalize licensing:** Formalize another license category under PCA licenses focused on general pest inspections of urban landscapes, including a requirement to assess conducive conditions. SPCB should develop training materials and exam questions to support general pest inspection requirements above
- C. **Update building codes:** Enable a multi-stakeholder task force (including building code experts) to complete feasibility study of incorporating pest prevention into building codes, Cal Green, etc.
- D. **Promote SPM through landscape design:** Create incentives for landscapers and residents to use drought tolerant landscaping that both deter pests and create ecosystem benefits
- E. **Implement SPM at State-owned structures:** The State of California should require state-owned and state-leased buildings to have pest management plans or practices that incorporate SPM
- F. **Reduce conducive conditions:** Identify opportunities and propose action for reducing pest pressure by addressing conducive conditions through regulation by other state agencies and local agencies. (e.g. housing codes, nuisance codes)

LOOKING AHEAD: IMPLEMENTING the ROADMAP

RESOURCING THE FUTURE

Provide adequate State resources to implement Roadmap recommendations

The suite of recommendations contained in this report, from supporting research and technical assistance, to State leadership on SPM, to improving registration processes, to special initiatives, to implementing SPM in government land, buildings, and procurement processes, and beyond, will require significant public funding to implement. This funding is absolutely necessary to support the success of the Roadmap and to achieve a healthy future for all Californians and the ecosystems on which we depend.

The Work Group and Urban Subgroup recommend that the State, with DPR and CDFA's leadership, immediately identify and secure consistent funding¹⁹ and staffing to enable State leaders to successfully implement these actions, including providing leadership on SPM and sufficient staff for the successful advancement of SPM through the State-focused recommendations in this Roadmap. The groups recommend that the State considers funding option and the impacts of those options.

The SPM strategy, and progress toward Roadmap goals, should be reassessed periodically with a comprehensive review every 10 years until 2050 to support accountability.

CONCLUSION

The SPM Roadmap is an ambitious and achievable strategy for sustainable pest management that is vital to our future food security, agricultural vitality, community health and wellbeing, built environment and so much more. Achieving our goals will require not only strong state leadership, but thoughtful collaboration across the system on the focus areas and recommendations laid out above.

Regardless of your sphere of influence, you have an important role to play in shaping the future of pest management. We invite you to consider which goals and recommendations you can help advance and where you can most effectively contribute to safe, sustainable pest management choices.

Please join us in making this bold vision a reality!

²¹ Such as a [Service-based budgeting](#) process that is task-based and labor-focused, and informs the budget based on the time and resources needed to accomplish the tasks.



APPENDICES

APPENDIX 1: DESIGN GUIDANCE

DESIGN GUIDANCE 1: For adoption of SPM and fast-tracking of alternatives to be successful, it should:

Consider the following as potential mechanisms to expedite reviews:

- a. Review redundant, unnecessary, or outdated components of review processes
- b. Use registrant fees to expedite to pay for overtime for employees doing the review
- c. Explore a simplified process for expediting reduced risk alternatives
- d. DPR review their internal processes for inefficiencies to redress
- e. Include system-level analysis to help avoid unintended negative impacts as a precursor to determine which new active ingredients get expedited.
- f. Explore ways to remove barriers for smaller companies
- g. Explore mechanisms to account for available alternative products, including biological control options, when registering new products
- h. Develop a process to prioritize consumer products for evaluation, at the discretion of DPR, with specific attention to equity, other environmental impacts, etc., along with the more typical considerations
- i. Explore modeling after the European Union's "[Candidate for Substitution](#)" approach to help expedite timeframes
- j. Maintain science-based decision-making standards throughout the review process
- k. Take into account resistance management in evaluation of all potential uses and formulations
- l. Provide clarity and transparency on scientific review and decision-making process for both the registrants and the public
- m. Account for additive effects in any update to the review process. For example, a biological pesticide may have higher efficacy if used in combination with other products or practices.
- n. Integrate advice from the state-level multistakeholder work group proposed in this Roadmap.

DESIGN GUIDANCE 2: For continuous evaluation to be successful, it should:

- a. Rely on existing authorities for reevaluation and other mitigation
- b. Consider ways to address the risks from products in urban areas, which may have less data associated with their use
- c. Cover products used in both agricultural and urban settings
- d. Explicitly advance the State's goals on SPM
- e. Be informed by the prioritization process that is outlined under "Strengthening Coordinated Leadership Structures" section
- f. Consider how to address products not currently registered in CA, such as treated products and federally exempt products

DESIGN GUIDANCE 3: For SPM principles to be successfully embedded, the State should:

- a. Provide leadership and help create a culture that fosters greater SPM across state agencies (including DPR, CDFA, CDPH, Structural Pest Control Board (SPCB) and affiliated organizations such as Universities, PCA and Certified Crop Advisors communities, and federal entities (USDA Animal and Plant Health Inspection Service (APHIS) and US EPA)
- b. Include both agencies that perform both regulatory roles and those that have pest management functions
- c. Coordinate outreach, funding grants, and advice to pesticide users about implementing SPM
- d. Improving coordination could include a coordinator, a joint task force, a series of meetings, or other mechanism

DESIGN GUIDANCE 4: For DPR to effectively champion SPM, it should:

- a. Consider the roles and authorities that CalEPA, California Natural Resources Agency, California Department of Public Health, and other relevant agencies, all fill with regard to the aims of SPM, and adjust the scope and mission of DPR in order to address gaps or increase interagency coordination and collaboration, as needed
- b. Ensure that DPR's current authorities of regulation and monitoring are functionally and financially maintained.
- c. Collaborate with other agencies and experts in areas of pest management not explicitly covered by the SPM Work Group and Urban Subgroup, including forests, transportation corridors, parks, habitat management, aquatic weed control and disinfectants
- d. Consider how a change to the scope and/or mission at DPR or another agency can support collaboration with other agencies, such as CDFA, California Department of Fish and Wildlife (CDFW), California State Parks Division of Boating and Waterways, California Department of Water Resources, USDA APHIS, and others
- e. Embed SPM principles throughout DPR branches (e.g. from the people in the field, to the manager, to leadership), including training DPR staff in the basics of SPM
- f. Consider if and how the Pesticide Registration and Evaluation Committee and/or Pest Management Advisory Committee (PMAC) can be used to advance this recommendation
- g. Consider the relationship these entities, in particular DPR, have with the stakeholders and seek to create structures that engage the stakeholder in the most meaningful and effective ways
- h. Any changes need to enable DPR to continue with, if not improve, its ability to serve user communities, including farmers, applicators, and PCAs
- i. Increase attention to SPM in urban settings
- j. Enable County Agricultural Commissioners to:
 - k. advance SPM and consider how to modernize the relationship with Ag Commissioners and the farmers, licensed pest control providers, and communities they serve
 - l. more effectively evaluate and enforce the consideration of alternatives prior to approving restricted materials applications
- m. effectively enforce existing laws and regulations in the urban context (e.g., pyrethroid applications, retail sales)
- n. Align DPR staffing and resources with the current market of products coming in, for example increasing staffing to address an uptick in reduced-risk products
- o. Invest heavily in advancing SPM products, practices, technologies, and systems while being mindful to avoid promoting one product over another
- p. Ensure that out-of-state suppliers (online and those with direct relationships to professionals and consumers) comply with CA sales and licensure laws and regulations

DESIGN GUIDANCE 5: For the State to effectively enhance health and ecosystem monitoring, it should:

- a. Ensure sufficient and/or expanded surface water, groundwater, and air quality monitoring to enable the success of the 2050 goals.
- b. Create better connections with populations who may be underreporting pesticide impacts.
- c. Consider the unique monitoring needs of different regions, and how local groups and growers can partner to help address these.

DESIGN GUIDANCE 6: For this multi-stakeholder collaborative group to be successful, it should:

- a. Ensure that the design and composition of the group (and potential subgroups) take into consideration the unique nature of urban pest management issues, and that these issues are given the time, attention, and resources to be adequately addressed ongoingly
- b. Enable space for creative thinking and honest, authentic dialogue
- c. Have diverse stakeholder representation, including:
 - d. Environmental representatives
 - e. Native American representatives
 - f. Impacted and disadvantaged communities
 - g. Urban-focused stakeholders representing the diversity of urban pest management issues
 - h. Agriculture representing a range of scales and production types, and racial diversity
 - i. Start-ups developing alternative technologies
 - j. Multiple agencies, including local governments
 - k. Universities (important role in third-party vetting)
 - l. Other licensed pesticide applicator groups
 - m. Independent scientists with relevant expertise
 - n. Current stakeholder representation on PMAC
 - o. Public Foundations
 - p. Ag production, Farm Labor
 - q. Non-ag pest user groups
 - r. Pest control advisors, registrants, trade associations
- s. Enable greater connections among research, practice, and policy through a diverse stakeholder mix
- t. Account for time required - be mindful about where we are using volunteers vs. paid professionals
- u. Include focus on challenges at the agriculture-urban interface
- v. Coordinate with any existing resources both in CA and at the federal level

DESIGN GUIDANCE 7: For these regional pest management collaboratives to be successful, they should:

- a. Identify and invite representatives across wide interests through a thoughtful process and be holistic about who is involved. These should include, but not necessarily be limited to, pest management experts, pesticide applicators across agricultural and urban applications, commodity groups, environment, public health, input suppliers, insectaries/pest mitigation, local Tribal leaders, professional associations, coalitions, and other relevant organizations focused on environmental stewardship and pest management. Include County Ag Commissioners and/or a liaison to the Ag Commissioner's office.
- b. Consider starting with pilots but ultimately build out across the state
- c. Ideally has paid coordinators
- d. Learn from other efforts, such as flood management districts collectively managing risk, San Francisco's IPM Technical Advisory Committee, existing regional pest management district, the USSR system for biological pest management in cotton
- e. Structure for adaptability, nimbleness, and flexibility to scale up staffing and funding to address specific emergency eradication efforts
- f. Explicitly design to maximize access and equity, enabling all voices to be heard
- g. Keep a focus on community-wide, cross-functional needs across different crops (rather than being too crop specific)
- h. Focus strategically based on region's best opportunities for SPM

DESIGN GUIDANCE 8:

To be successful, investment in research and outreach (A-C) should:

- a. Train farm advisors in systems-based SPM and crop production with diversity and inclusion in mind to serve a broad base of farmers, both large and small, as well as Indigenous communities.
- b. Include programs that are specifically addressing the needs of women, Indigenous, immigrant, Black Indigenous People of Color (BIPOC) and other socially disadvantaged farmers, as well as formal ongoing
- c. inquiry into how to better engage and serve groups who are traditionally marginalized to ensure the barriers they may face in accessing support in implementing SPM are minimized
- d. Research institutions should explore mechanisms in the hiring process to give priority consideration to experts trained in SPM
- e. There is transparency from the above research institution about budget
- f. Include biosecurity (especially pest detection and prevention) in outreach
- g. Create incentives for research into alternatives to the highest-risk pesticides
- h. Create the conditions needed to attract qualified, diverse applicants to agricultural extension roles (a “pipeline”), including meaningful compensation and other mechanisms and incentives that support agricultural extension as a career, placing particular emphasis on increasing the diversity of trainees by building a pipeline for populations that are underrepresented in entomology, plant pathology and other applied agricultural sciences
- i. Enable all agricultural advisors to receive training in SPM (including UCCE, RCD, and other advisors and non-profits, to reflect and serve the diversity of California farms and farmers
- j. Research funding agencies should ensure that research considers unintended consequences and trade-offs
- k. Include focus areas such as maintenance of germplasm/seed repositories and expansion of breeding programs to provide genetic resistance and resilience, and agricultural engineering and technology focused on tools and equipment for SPM "

DESIGN GUIDANCE 9:

To be successful, the State of California should:

- a. Explore the creation of a \$25 million competitive fund for SPM research/positions among other structures
- b. Consider a range of structures including [cooperative agreements](#) and grants
- c. Not replace or displace funds for existing State grant programs
- d. Make funds available to higher-education institutions who can handle significant initiatives
- e. Create an advisory group that includes farmers, farmworkers, community members (and possibly others) to help oversee how these are being implemented
- f. Create a strong set of guiding requirements that leads institutions to advance a strong framework

DESIGN GUIDANCE 10: For an SPM Foundation to be successful, it needs to:

- a. Have its own expertise, its own multi-stakeholder set of advisors, be able to broadly bring in money from variety of sources, and engage a design that explicitly addresses institutional racism and bias
- b. Have representation from various stakeholders and community leaders on the Foundation
- c. Consider modeling after the [Foundation for Food and Agriculture Research](#) at the federal level or partnering on a FFAR SPM-specific fund for CA
- d. Be based on the philosophy of replacing high-risk pesticides, not removing available tools for producers
- e. Support not just large institutions but more informal training and networks as well
- f. Consider who administers and carries this over time
- g. Design in part to be a pass-through for federal funding
- h. Consider funding specific research positions
- i. Attend to the capacity and funding needs of all entities, with considerations of the challenges of match funding for smaller entities.
- j. Build in structures that incentivize participatory community research
- k. Support ability of community-based organizations and practitioners to be able to fully participate and be funded to do so
- l. Have the flexibility to be able to support non-conventional research and outreach needs

DESIGN GUIDANCE 11: For a paradigm shift to be successful, we need to:

- a. Incentivize or require multi-disciplinary teams
- b. Include a supra-institutional structure that enables collaboration between UC and non-UC institutions so that it's a joint effort building on the best of UC Extension as well as other programs, such as CAFF's lighthouse program
- c. Continue to enable basic research as well as enabling comprehensive, landscape-scale research on key questions to advance SPM that are hindered by current incentive and funding structures
- d. Build in accountability and feedback to ensure that research and outreach also integrate the needs of BIPOC and other disadvantaged growers and communities served
- e. Enhance engagement of women, Indigenous, immigrant, BIPOC, and other socially disadvantaged farmers in research institutions in meaningful positions on research teams and throughout the process
- f. Develop stronger on-ramp and recognition for SPM advisors to support Extension being an attractive profession that pays a competitive wage
- g. Ensure that collaborative or participatory research with community-based organizations do not unduly burden these organizations
- h. Engage existing partner farmer-focused organizations, farmer cooperatives, trade associations commodity groups, in research and learning
- i. Enable support for nonprofit training
- j. Diversify UCCE farm advisors so that it is representational of the diversity of California farmers
- k. Engage academic institutional leadership in statewide SPM meetings to enhance awareness of the momentum, context, funding, etc.

DESIGN GUIDANCE 12: For the SPM training program to be successful, it should:

- a. Streamline the approval process for CEUs to speed up approval for presentation content for conference organizers
- b. Include an expansion of disciplines in CE courses rather than simply the creation of new courses. Traditionally, courses such as soil science, plant physiology and ecology have not counted
- c. Since content such as this is foundational to SPM, consider an expanded array of courses. Cropping adaptability and appropriateness in the context of climate change as it relates to pest management, should also be included
- d. Allow for prior SPM-related CEs and other work to count towards these new requirements
- e. Consider building in an option to appeal denials to enable applicants to explain how a presentation relates to pest management; there are times when alternative approaches are not accepted in CE courses
- f. Address how this might overlap with certified crop advisor (CCA) certificates
- g. Consider ways to make on-demand, low cost, and/or online courses available to low-income and disadvantaged students to fulfill PCA course requirements

DESIGN GUIDANCE 13: To be successful, CDFA and DPR should:

- a. Consider creating a separate, dedicated, specifically-purposed fund for awarding contracts or grants with the specific objective of supporting collaborative and long-term research
- b. Outreach to traditionally underrepresented grant recipients to ensure programs specifically address the needs of women, Indigenous, immigrant, BIPOC and other socially disadvantaged farmers
- c. Include SPM as a consideration in pest management-related grant offerings, for example looking at alternatives for high-risk products will make grants more competitive (e.g. applicant gets extra points)
- d. Institute timelines for grants that reflect the long-term nature of the research (i.e., allow for spending over more than a three-year period)
- e. Prioritize funding that covers systems-based pest management, beyond pesticide testing and development, and multi-disciplinary research collaborations
- f. Increase flexibility in terms of what State offices consider when evaluating grants, and take measures to ensure that non-traditional research needs, projects that integrate research and outreach, and new ideas don't fall through the cracks between agency grant programs
- g. Minimize barriers such as overly burdensome compliance paperwork
- h. Include funding specifically for connecting growers and Pest Control Advisors (PCAs) with the latest SPM research and technical assistance
- i. Investigate mechanisms to encourage and compensate engagement of growers and rural communities in funded projects
- j. Design to enable access for farms of all sizes and commodities, and provide SPM options to those employing the full spectrum of growing practices
- k. Clarify disqualification rules
- l. The BIFS Program should:
 - » Allow for 3 concurrent projects
 - » Work to have coverage of 'minor' specialty crops, i.e., ensure each funding year that 1 out of the 3 grants approved is from a 'minor' specialty crop (e.g., not on the list of the top 10 annual farmgate value specialty crops)
 - » Simplify applications and consider other ways to reduce barriers for applicants within sufficient resources to put together a grant application
 - » Include an outreach and education program for potential BIFS project applicants to ensure sufficient and qualified applicants for BIFS grants outside of the usual research applicants

DESIGN GUIDANCE 14: For new SPM licensing categories to be successful, it should:

- a. Add a new category (e.g., “Category H”) named SPM
- b. The SPM category should, like the Laws and Regulations category, be required as a precursor to other categories and to writing pest control recommendations for clients
- c. Require a minimum number of annual hours of training for license renewal, as does the Laws and Regulations category
- d. Require new PCAs to add the category as a requirement of obtaining their first license
- e. Require PCA license renewals to add this category to their license before being able to continue writing recommendations
- f. The requirements for the new category could be satisfied by coursework and/or an exam, allowing candidates to draw on their experience and information collected over the years
- g. Add a fourth category for “Integrated and Sustainable Pest Management” to the categories for Continuing Education. (Currently these include: "Pesticide Laws and Regulations," "Aerial Pest Control Equipment and Application Techniques," and "Other," Aerial (for pilots); Laws and Regulations; other)
- h. Create measures to address equity of access for PCAs to encourage diverse representation from socially disadvantaged and historically marginalized communities

DESIGN GUIDANCE 15: In order for this opportunities assessment to be successful, it should:

- a. Consider making unused working lands invested in by CA public entities available to farmers practicing SPM, with priority for small and socially disadvantaged farmers
- b. Explore mechanisms to engage State-owned agricultural easements to advance farmer implementation of SPM. Ensure any proposals are designed so as not to undermine farmer enrollment in easements
- c. There may be good opportunities to engage UCCE or other experts to share SPM best management practices with Bureau of Land Management and State land management agencies, including importance of, and procedures for, reporting pests.

DESIGN GUIDANCE 16: For SPM purchasing criteria to be successful:

- a. Have an SPM Purchasing Criteria task force that represents a diversity of stakeholders and interests and carries on the work of the SPM Work Group, ideally by including members from this group as well as the Criteria List they collaboratively developed. It is critical to have expertise in both agricultural production systems and certification auditing
- b. Build on the groundwork laid in discussions of the SPM Work Group on this subject
- c. Consider how to drive buyer initiatives to incorporate SPM, and align SPM purchasing criteria with buyer sustainability metrics, key buyer initiatives, and buyers supplier approval requirements. This also needs to mitigate the potentially negative impacts that buyer-led initiatives can have on farms.
- d. Engage the task force to create a clear process for validating producers who comply with SPM purchasing criteria, including consideration of a metric-based approach such as the Pesticide Risk Tool
- e. Enable participation by farms of all sizes, commodities, and production types (e.g., conventional, organic)

DESIGN GUIDANCE 17: For long-term support of the SPM purchasing program to be successful, it should:

- a. Consider at least a 25% bid preference, and then peg it to what DGS discovers (see above), to be adjusted over time
- b. Include all State LEA-affiliated programs
- c. Address grading standards as purchasing requirements for local agencies as a way to help potential budget impacts resulting from purchasing SPM products that may initially be more expensive than conventional.
- d. Keep in mind the diversity of school budgets (ensure that all students have access to this food, not just those in wealthier districts), financial inequities, access to local, regional, and state growers
- e. Address quality issues to mitigate food waste
- f. Consider Sweden's [Sustainable Procurement](#) System as a model

DESIGN GUIDANCE 18: A successful data system should:

- a. Include a framework outlining all the different categories of urban pesticide users
- b. Develop robust, targeted multi-lingual outreach and survey approaches for each user category
- c. Examine partnerships with user category organizations (e.g., building managers, restaurant owners, unions, swimming pool maintenance firms) and other entities with relevant data (e.g., waste management agencies) to facilitate cost-effective data collection and data validation
- d. Consider purchase of available relevant market data sets, such as sales of major categories of pesticide-treated products like paint and building materials
- e. Gather sales data on where products are sold, what categories of users are purchasing them, and what the specific pest needs and intended applications are in order to provide helpful information while avoiding imposition of stringent use reporting on consumers

DESIGN GUIDANCE 19: For urban pesticide use reporting to be successful, it should:

- a. Include the following use categories: indoor, outdoor, underground, and aquatic
- b. Enhance quality assurance for reporting and accountability for accuracy on the part of the manufacturers reporting sales
- c. Require urban PUR data to include locations of property treated by county and MTRS (section, township, range, base, and meridian), as well as target pest, and application site (indoor, outdoor, underground, aquatic), with safeguards to protect client confidentiality
- d. Include an enforcement mechanism to support quality of reporting
- e. Be designed to limit the burden on applicators
- f. Review and expand categories for reporting to correct inconsistencies and encourage greater specificity (e.g., from “landscape” to more specific categories such as “parks”)
- g. Include mechanisms to validate information provided in Pesticide Use Reports.

DESIGN GUIDANCE 20: For a pesticide sales database to be successful, it should:

- a. Break out sales data to separate different product types to allow evaluation of uses and their impacts (e.g., separate sales of gel products from those of foggers; separate pet flea control products from structural pest control products)
- b. Include accuracy-of-reporting mechanisms
- c. Provide quality assurance checks of the data submitted.
- d. Have retailers report on pesticide sales at the county level.
- e. Sales database should include ability to divide up products by types of uses (e.g., separate petproducts from ag products from structural pest control)
- f. Be included in an analysis, along with the pesticide use data

DESIGN GUIDANCE 21: For this funding to achieve its intended outcomes:

- a. A significant part of the funding should take into consideration science-based prioritizations conducted by a multi-stakeholder working group at DPR (see “Leadership” recommendations)
- b. Funding should cover an increased urban pest management focus for UC academic positions.
- c. Funding should support and incentivize UC IPM’s partnerships with other agencies and NGOs conducting urban-focused research and extension
- d. Use framework established in “data on pesticide use” (above) to inform funding streams to support research and innovation that achieves the highest impact for improving SPM.
- e. Account for the significant role of consumer products in structural pest control when considering funding amounts
- f. Enable more responsive, flexible, and integrated funding structures that encourage collaboration between industry and government funding
- g. Funds should enable these entities to develop more effective ways to communicate about SPM, including and especially public health significance.
- h. Ensure that urban SPM research feeds into DPR regulatory processes, particularly examination of alternatives, as well as priority setting for pest management initiatives at all levels

DESIGN GUIDANCE 22: For funding to achieve its intended outcomes:

- a. Include eligible projects that focus on advancing SPM knowledge, tools, research, practices, and implementation, including consideration of the relationship of SPM to healthy housing, environmental health in schools, effects of climate change on pest pressure and pest management systems, preventing pesticide impacts on water supplies, including reused water.
- b. Be targeted according to science-based prioritizations conducted by a multi-stakeholder working group at DPR as recommended in this Roadmap.

DESIGN GUIDANCE 23: In order for an outreach effort on urban SPM to be successful, it should:

- a. Identify priority areas according to science-based prioritizations conducted by a multi-stakeholder working group at DPR as recommended in the Roadmap, in combination with trend analyses. Strategically target influencers in these high-priority areas.
- b. Assemble an advisory team of relevant stakeholders and experts for each focus area (example, vets to focus on the area of pets or private and public landlords who own or subsidize a large number of units such as GHP Management, HUD to focus on rental housing pest management) that is identified.
- c. Collaborate with other state and regional agencies, as well as state associations of local agencies, working on interrelated issues (CalEPA, Natural Resource Agency, municipal wastewater treatment plants, stormwater programs, others).

DESIGN GUIDANCE 24: For a successful public awareness campaign:

- a. “Public awareness” should be interpreted broadly to encompass efforts pointing to consumers, industry, and subsets various groups (homeowners, renters)
- b. Work with stakeholders and/or a consultant to engage different messaging partners as appropriate to the campaign(s), and consider enlisting a marketing firm conversant in Community Based Social Marketing, which has a good track record for making progress in these kinds of topics.
- c. UC Cooperative Extension and UC IPM should play an integral role in public outreach design and implementation
- d. Specific priorities have to be further considered and discovered through market research
- e. Engage environmental outreach staff at DPR to perform targeted outreach to youth to provide age-appropriate education on SPM as it relates to gardening, healthy food, healthy homes, and environmental and human health benefits

DESIGN GUIDANCE 25: For general pest inspection requirements to be successfully formalized:

- a. Include requirements to assess conducive conditions
- b. Include enforcement requirements
- c. Include definition of spatial scope for inspections, which should be very wide and include adjacent landscapes
- d. Focus on identifying conditions, not fixing them
- e. Provide a specific list of items that must be included, e.g., map of house, construction materials, moisture sources, entry points, harborage etc., and specific recommendations to address pests and conditions. This could be modeled on existing wood-destroying organism language.
- f. Include a requirement that licensees offer the option of doing an inspection for each new account
- g. After a period of time, evaluate options for requiring general pest inspections in high priority situations such as multi-family housing and daycare. This could be based on building size and/or HUD designation (Section 8).

APPENDIX 2: GLOSSARY OF TERMS

Agricultural products. According to the Food and Agriculture Code (FAC § 47000.5), “agricultural product” means a fresh or processed product produced in California, including fruits, nuts, vegetables, herbs, mushrooms, dairy, shell eggs, honey, pollen, unprocessed bees wax, propolis, royal jelly, flowers, grains, nursery stock, raw sheared wool, livestock meats, poultry meats, rabbit meats, and fish, including shellfish that is produced under controlled conditions in waters located in California.

Pest. “Pest” means any of the following that is, or is liable to become, dangerous or detrimental to the agricultural or nonagricultural environment of the state: (a) Any insect, predatory animal, rodent, nematode, or weed. (b) Any form of terrestrial, aquatic, or aerial plant or animal, virus, fungus, bacteria, or other microorganism (except viruses, fungi, bacteria, or other microorganisms on or in living man or other living animals). (c) Anything that the director, by regulation, declares to be a pest. (FAC section 12754.5)

Pesticide. “Pesticide” includes any of the following: (a) Any spray adjuvant. (b) Any substance, or mixture of substances which is intended to be used for defoliating plants, regulating plant growth, or for preventing, destroying, repelling, or mitigating any pest, as defined in Section 12754.5, which may infest or be detrimental to vegetation, man, animals, or households, or be present in any agricultural or nonagricultural environment whatsoever. (FAC section 12753)

High risk pesticides. For the purposes of this Roadmap, the term “high risk” is used broadly to capture the full range of adverse environmental and human health impacts from pesticides when used in California. As described in the 2050 goals, California will evaluate its progress in reducing pesticide risks through a number of outcomes, including decreasing use, illness tracking, and environmental monitoring.

Agricultural pest applicators. Individuals who apply pesticides. Can include growers and professional applicators, sometimes working with the guidance of pest control advisors.

Integrated pest management (IPM). An effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment. The IPM approach can be applied to both agricultural and non-agricultural settings, such as the home, garden, and workplace. IPM takes advantage of all appropriate pest management options including, but not limited to, the judicious use of pesticides. In contrast, organic food production applies many of the same concepts as IPM but limits the use of pesticides to those that are produced from natural sources, as opposed to synthetic chemicals.

ACRONYMS

This list includes acronyms used more than once in the Roadmap.

APHIS	US Department of Agriculture Animal and Plant Health Inspection Service
BIFS	Biologically Integrated Farming Systems
CalEPA	California Environmental Protection Agency
CAPCA	California Association of Pest Control Advisors
CCC	California Community College
CDFA	California Department of Food and Agriculture
CE	Continuing Education
CEU	Continuing Education Units
CSU	California State University
DGS	Department of General Services
DPR	California Department of Pesticide Regulation
UC	University of California
UCCE	University of California Cooperative Extension, a division of UCANR
UCANR	University of California Agriculture and Natural Resources
PCA	Pest Control Advisors
PMAC	Pest Management Advisory Committee (an advisory committee to DPR)
PMSP	Pest Management Strategic Plan
SPCB	Structural Pest Control Board
US EPA	United States Environmental Protection Agency

APPENDIX 3: PESTICIDE USE CLASSIFICATION

The California Department of Pesticide Regulation classifies pesticide use as follows. “Agricultural use” has two definitional sub-divisions: “production agriculture use” (use in the production of an agricultural commodity) and “non-production agriculture use” (e.g. use in watersheds, rights of way, landscaped areas, parks, recreation areas, and cemeteries).

“Non-agricultural use” is defined as use in homes, industry, institutions, structural pest management, veterinary, and vector control districts—categories which have their own explicit regulatory definitions—that share a common theme of benefitting congregated populations and infrastructure that are most often associated with urban and suburban environments. See also [Guidelines for Interpreting Pesticide Labeling](#)

DPR USE RELATED DEFINITIONS/GUIDANCE²³

Term	Definitions	Comments
Agricultural Commodity	An unprocessed product of farms, ranches, nurseries and forests (except livestock, poultry and fish). Agricultural commodities include fruits and vegetables; grains, such as wheat, barley, oats, rye, triticale, rice, corn and sorghum; legumes, such as field beans and peas; animal feed and forage crops; rangeland and pasture; seed crops; fiber crops such as cotton; oil crops, such as safflower, sunflower, corn and cottonseed; trees grown for lumber and wood products; nursery stock grown commercially; Christmas trees; ornamentals and cut flowers; and turf grown commercially for sod.	Excludes use on livestock, poultry, and fish, thus removing applications on these specific commodities from DPR’s scope
Agricultural Use	<p>The use of any pesticide or method or device for the management of plant or animal pests, or any other pests, or the use of any pesticide for the regulation of plant growth or defoliation of plants.</p> <p><i>It excludes the sale or use of pesticides in properly labeled packages or containers that are intended for any of the following:</i></p> <ul style="list-style-type: none"> • Home use. • Structural pest management use. • Industrial or institutional use. • The management of an animal pest under the written prescription of a veterinarian. • Certain vector (mosquito abatement) control districts. <p><i>Sub-categories of agricultural use are:</i></p> <ol style="list-style-type: none"> 1. <i>Production agriculture:</i> pest management use conducted in the production for sale of an agricultural commodity or agricultural plant commodity. 2. <i>Non-production agriculture:</i> All other agricultural use is non-production agriculture use, including for watersheds, rights-of-way, landscaped areas (golf courses, parks, recreation areas, cemeteries, etc.). 	Defines Non-ag and non-production ag uses by exclusions

23 (SOURCE: California Food and Agriculture Code Section 11408. Further definitions for terms referred to in California Food and Agriculture Code 11408 are found in the California Code of Regulations Section 6000)

Term	Definitions	Comments
Non-agricultural use	<p>Includes:</p> <p>Home use: Use within, or in the immediate environment of, a household including single family homes, apartment units, dormitories, or any occupied dwelling.</p> <p>Structural: Use by a licensed Structural Pest Control Operator within the scope of their license.</p> <p>Industrial: Use within the confines of, or on property necessary for, the operation of factories, processing plants, packinghouses, or similar facilities, or use for or in a manufacturing, mining, or chemical process. In California, industrial use does not include use on rights-of-way. Post-harvest commodity fumigations at facilities or on trucks, vans, or rail cars are normally industrial use.</p> <p>Institutional: Use within the confines of, or on property necessary for the operation of, buildings such as schools (playgrounds are necessary for the operation of a school), hospitals, office buildings, libraries, or auditoriums. When a licensed Structural Pest Control Operator treats these buildings, it is structural use. Landscaping of walkways, parking lots, and other areas immediately adjacent to these buildings is institutional. Landscaping of larger, more independent areas is not considered institutional.</p> <p>Vector control: Use by certain vector control (mosquito abatement) districts.</p> <p>Veterinary prescribed: Use by or pursuant to the written prescription of a licensed veterinarian within the scope of their practice. There is no requirement for veterinarians to write prescriptions to themselves, so although not specifically mentioned in the law, by policy, veterinarians are covered by this use pattern.</p>	

Caution about classification complexities

The site or situation of use and the user will all affect how a particular use is classified. A particular use in one context may be classified differently in another. For example:

- A tree can be residential landscape (home), institutional landscape (institutional), or watershed (non-production agriculture) depending upon where it is growing. However, if that same tree is growing in an orchard, it would be production agriculture.
- An agricultural commodity fumigated in storage on a farm could be production agriculture while that same commodity fumigated in storage at a processing plant would be industrial.
- A swimming pool that is part of a residential property would be home use. A city, school, or other public pool would generally be institutional.

Use Category Examples (Note: common designations offered, but actual site/user specifics may result in different designations as mentioned above)

Use Category	Examples w/most common sub-designation
<p><i>Non-agricultural Use</i></p>	<ul style="list-style-type: none"> • Airports-Industrial • Amusement parks-Institutional • Apartments/townhouses-Home • Auditoriums-Institutional • Clubhouse landscape- Institutional • Condominiums-Home • Construction sites-Industrial • Food manufacturing plants- Industrial • Grain elevators (production agriculture if on farm)- Industrial • Home gardens (no distribution)- Home • Homeowner Association (HOA) Property (except golf courses)- -Various • Homes and residences-Home • Hospitals-Institutional • Libraries-Institutional • Lumber yards-Industrial • Mobile home parks-Home • Mosquito abatement districts- Vector control • Nurseries (retail non- production) Industrial • Office complex (around outside) Institutional • Office parking lots-Institutional • Oil wells-Industrial • Packing houses-Industrial • Paper mills-Industrial • Pet animals-Home • Ports-Industrial • Post-harvest commodity treatments- Industrial • Prescription from veterinarian- Veterinarian • Ranchette pasture (no distribution) Home • Restaurants-Industrial • Schools (buildings and grounds) Institutional • Seed treatment-Industrial • Sewage treatment plants-Industrial • Sewer lines-Industrial • Shipyards-Industrial • Shopping malls (inside or outside)- Institutional • Swimming pools-Various • Uncultivated non- agricultural ground-Various • Water treatment plants-Industrial • Wood treatment plants-Industrial • Zoos-Institutional

APPENDIX 4: URBAN PEST MANAGEMENT USES AND USERS

The Urban Subgroup developed the following framework to identify the landscape of pest management users and settings in order to inform their discussions. Urban Subgroup members acknowledge that their expertise covers many—but not all—of these areas of urban pest management, and identifies recommended actions to fill the gaps.

A. Non-licensed users and uses

- **At home.** These are individual users engaging in household-related pest management and/or pesticide use, such as: incidental in-home pest management treatments; use of sanitizers and disinfectants; pet treatments; home gardening; landscape and lawn care (including ‘weed and feed’ products); and swimming pool treatment. These activities are subject to labeling and sales reporting oversight and requirements. While users are required by law to follow label instructions and requirements, at-home users typically receive no formal training outside of any voluntary learning, and are not required to report their pesticide use, nor is there a mechanism to do so. As such, there is little data surrounding at-home pesticide uses.
- **On the job but not licensed to apply pesticides.** These are individuals for whom pest management is an incidental part of their job and their pesticide use has no licensing requirements. This class excludes those unlicensed users who work for a pest management business and perform pest management under the direction and training of a licensed applicator. This class includes individuals who perform pest management work for their employer at their employer’s property such as Homeowner Association employed landscapers, facility managers, school district staff, pool maintenance, health care facilities, and managers of cooling water system protection. In this class, pesticide use decisions may be driven by groups of individuals with widely varying goals, from personal tolerance to safety concerns. In some cases, users may be required to have training, such as school district staff who are required by the Healthy Schools Act to complete one hour of training annually if they apply pesticides. As with at-home use, unlicensed “on the job” users tend to have little training and low overall awareness about proper use, and while all users are required to follow labeling requirements, the label adherence of this group is unknown (likely highly variable depending on setting). All users in this category are required to follow label instructions and misuse is subject to enforcement. Additionally, some users in this category are subject to reporting requirements and/or enforcement action under pesticide and/ or workplace safety standards.

B. Licensed users and uses

- **Professional applicators**
 - » **Professional structural control.** This class includes professional, trained applicators registered and licensed under the [Structural Pest Control Board](#) at the California Department of Consumer Affairs. Pesticides are used by these individuals to manage pests associated with structures such as rodents and insects, including pests that destroy wood in structures such as buildings, docks, railroad cars, and airplanes, among [others](#). Reporting of these pesticide applications is required, however reporting requirements are not as detailed as for production agriculture.

- » **Professional landscape management.** These users are professional, trained “qualified applicators” who are or who work at the direction of individuals certified, registered and licensed under the California Department of Pesticide Regulation. Applicators include maintenance gardeners for hire who perform incidental weed management, as well as habitat managers, landscaping companies, and Qualified Applicators working for local governments applying pesticides to manage weeds in parks or vegetation along roadsides and rights-of-way, for example.
- » **Public health related pest management.** This class of users manage pests related to public health or medical reasons as part of official governmental pest management programs such as those conducted by local mosquito abatement districts. Public agencies that carry out vector control services are certified by the California Department of Public Health (CDPH) and are exempt from licensing by DPR under the terms of an [MOU](#). Public health related pest management is also provided by private companies under Category K and are licensed by DPR.

C. Users and bystanders of pesticide-treated products:

- Pesticide-treated articles contain pesticides that have been incorporated into the product with the intent to protect the product. Examples include certain mold-resistant paints, roofing materials, treated wood (including telephone poles), treated seeds, and fabrics treated to resist odor. Although the pesticides used to treat these items are regulated by DPR, the end product treated items fall under the “treated article” definition and are themselves currently exempted from regulation by DPR. Conversely, materials that are intended to protect the user, such as clothing impregnated with mosquito-repelling insecticides, are subject to regulation by DPR.

In this class of use and users, the application of the pesticide, for example by a building or consumer product manufacturer, occurs in a location that is remote from the ‘users’ and others who may be exposed to the pesticide. Human exposure to, and ecological impacts from, these pesticide-treated products at and around their actual use endpoint is not presently fully known.

APPENDIX 5: CHALLENGES IN URBAN PEST MANAGEMENT

There are several dynamics at play that distinguish urban pest management from production agricultural pest management that should be taken into account when considering approaches to SPM in urban settings. These include:

A. Heterogeneity of knowledge and use. Urban pest management includes a wide range of users with highly varying degrees of knowledge, from residents to professional pest management companies. Some uses require professional licensing (e.g., structural applications, such as termite treatment) and use reporting, while others do not (e.g., residents spraying for ants or administering flea medications to a pet).

B. Public perception, knowledge and attitudes

Visibility. The public visibility of urban pesticide use is low relative to production agricultural uses, particularly as it takes place in a more complex human environment with a wider and more diffuse range of potential causal agents, as described above. Many in the public are not aware of what constitutes a pesticide, nor the risks to human health from everyday items containing high-risk chemicals such as non-labeled antimicrobials in clothing or sanitizers. Additionally, many urban landscape applications occur in marginal areas such as roadsides, parks and private landscaping that are not always visible to the public.

Awareness. Agricultural producers are a more clearly defined user group that increasingly understands the short- and long-term economic incentives of ecologically based pest management, as pests are competitors that have direct economic impact. Urban pest management decisions are based on more subjective thresholds, for example, aimed at avoiding property damage, maintaining aesthetic landscapes and pest-free interiors, or reducing perceived health risks. Average pesticide users in an urban setting may not always know, ask or know where to ask how pesticide applications can affect their health or that of the environment, either in the short- or long-term.

Tolerance and attitudes. Awareness about SPM options in urban settings is generally low among unlicensed and untrained persons who perform pest control and the [wider public](#) alike. Some minimum risk pesticides that are exempt from EPA registration, such as essential oils, face additional barriers such as lack of residual control and complaints from consumers about their odor. Unlicensed urban users may be less conscious of pest prevention approaches in the absence of an immediate problem or need, which may make holistic approaches less successful. Habitat management in natural areas may be an exception as some urban residents and land managers question whether the risk of pesticide use exceeds the risk of the invasive species.

C. In addition, with the rare exception of a few external requirements (such as control of structure-damaging pests upon property transfer), thresholds are subject to the tolerance of the consumer.

For example, a majority of spiders are beneficial predators of pests, yet residents may be unwilling to tolerate them and seek quick fixes involving conventional pest control measures. A public mindset in which the presence of insects and other pests is perceived as a problem that requires active intervention contributes to a proliferation of conventional eradication controls. Common attitudes and beliefs are informed at least in part by awareness: for example, public perception about weed-free lawns might be different if communities understood the risks associated with some herbicide products.

- D. Insufficient support infrastructure.** Pest management in production agriculture is supported by a much more well-developed and funded set of organizations, infrastructure, and standards affecting its pest management activities, such as commodity associations, extension services, federal conservation programs, phytosanitary rules, USDA standards, and research centers. By contrast, structural and ornamental landscape SPM research and UC Urban Cooperative Extension programs receive comparatively little support. More broadly, urban pest management challenges beyond landscape and structural pest control receive little ongoing support.
- E. Data gaps.** Our collective ability to understand the scope of urban pesticide use and impacts is severely limited by the lack of data that can fully define the problem and even the influences, and the challenges inherent in quantifying non-agricultural pesticide use. Labels allow a plethora of uses but there is often limited use data available, and in regards to non-licensed use, no data are available to determine which uses actually occur. Most urban pesticide use is not subject to reporting requirements. With some exceptions, current requirements for pesticide use reporting generally do not require that locations of treatment or other details be included for urban applications. The only data on consumer uses of pesticides is only available as total statewide product sales volumes gathered by DPR for mill assessment purposes, and requires assumptions as to whether and how products that are sold are actually used by purchasers. In some cases, reported data do not provide sufficient detail to allow for useful analyses or to enable counties and DPR to easily identify use errors or potential data reporting errors that can skew our understanding of urban pesticide use.²⁴ Understanding use patterns is critical to informed product design, informed identification of SPM solutions, and science-based and complete regulatory evaluations of pesticide products.
- F. Complexity of classification, reporting and oversight, with gaps for unlicensed users:** The portion of regulated urban pesticide use in urban settings may have different oversight requirements than those for production agriculture. As an example of the oversight complexity related to licensing, the California Department of Pesticide Regulation regulates all of the following: qualified applicators of pesticides applied in residential, commercial, industrial, governmental, and institutional settings; landscape maintenance; right-of-way; plant agriculture; forest pest control; aquatic; regulatory; seed treatment; areas adjacent to animal agriculture; demonstration and research; public health related; wood preservation; sewer line root control; field fumigation; and microbial pest control. County Agricultural Commissioners oversee and issue certifications to private applicators who apply pesticides in some of the same settings when that property is owned or operated for producing an agricultural commodity, while those performing similar work in structural pest control obtain structural pest control licenses issued by the Structural Pest Control Board, and vector control technicians are certified by the California Department of Public Health.

In many cases, these licenses can overlap or two licenses can be required to perform the work. For example, a pest control business performing residential pest control may require a DPR license for pest control done outside the home for purposes other than protecting the structure, and a Structural Pest Control Board license for pest control performed to protect the structure.

²⁴ For example, structural, landscape maintenance, right of way, public health, vertebrate pest control, commodity fumigation, and regulatory pest control users do not have to report a value for the amount of area treated. Without an area treated value, it is not possible to calculate a use rate (product amount/area treated) that can be used to accurately identify reporting errors or potential illegal (conflicting with label) uses. As another example, while uses involving production agriculture require the user to report the use location to a specific 1 by 1 square mile section of land, non-agricultural and non-production agricultural users that are required to report need only identify the county in which the application occurred. The lack of specificity makes it impossible to identify proximity to residential addresses, schools, waterways and related possible unintended pesticide impacts.

Pesticide use reporting and oversight is particularly challenging for unlicensed pesticide users. Consumer, and some other, uses do not require licensing. Management systems are limited to pesticide sales reporting and registration related mechanisms. Labels convey safety and use information that users are required by law to follow. However, although the directions on home-use product labels provide safe-handling and use instructions, these safe-handling directions cannot be enforced and data show are rarely fully read and adhered to.²⁵ At the same time, [statistics](#) from the nationwide Poison Control System indicate that the top 10 most common adult poisoning calls relate to use of household cleaning products and pesticides.

As a result of both the regulatory complexity and the varied circumstances in which urban pest management is performed, it is especially challenging to distinctly categorize and assess urban pest management use and needs.

G. Externalized government costs. Legal structures, particularly the Federal Clean Water Act, create mutual responsibilities and costs associated with the pest control decisions made by individual actors. For example, cities and counties have been subject to costly National Pollutant Discharge Elimination System permit requirements around the occurrence of pesticides and pesticide-related toxicity in urban runoff and municipal wastewater effluent.

²⁵ See for example Edworthy J, Hellier E, Morley N, Grey C, Aldrich K, and Lee A, Linguistic and location effects in compliance with pesticide warning labels for amateur and professional users. In: *Human Factors* (2004, Spring): 11-31.

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Lockwood JA, Wangberg JK, Ferrell MA, Hollon JD, Pesticide labels: proven protection or superficial safety? *Journal of the American Optometric Association* (1994 Jan) 65(1):18-26.

APPENDIX 6: EXAMPLES OF ON-FARM SPM PRACTICES

SAMPLE LIST OF SPM PRACTICES

The following are *some* of the practices the SPM Work Group considers to be important to SPM. This list is not exhaustive, nor is it meant to be. Rather, it's meant to illustrate the kinds of practices, or combination of practices, that are inherent to SPM when implemented with the intent to create healthy, resilient farms and ecosystems.

It is important to note that simply implementing a couple of the practices or products below does not necessarily mean that SPM is being realized. As mentioned above, SPM is a systems approach, and the goal is to be ongoingly moving further down a continuum towards integrated, holistic, SPM.

Biological

- Classical and augmentative biological control
- Mating disruption (including pheromone and SIT disruption)
- Enhancing natural enemy populations through conservation plantings
- Resistant rootstocks and/or varieties
- Biological crop inputs (e.g. microbes, crop stimulants, seaweed)
- Plant Breeding
- Soil microbiome assessment

Cultural

- Cover crops
- No till farming, minimum or reduced tillage
- Irrigation regimes
- Trap crops
- Polyculture
- Weed barriers
- Selection of appropriate cropping systems for the location (Matching the soil, climate, water, pest pressures of a particular location with crops best suited for those conditions.)
- Pest Management Districts (area agreements)
- Pest prevention and surveillance activities
- Monitoring pest populations and weather conditions
- Taking management actions only when insect, mite, or weed pest populations exceed their economic threshold
- Predictive modeling for insects and disease populations

- Crop rotation
- Soil testing for nematodes and diseases along with crop selection
- Germination of weeds prior to planting
- Inclusion of perennials
- Rotation of crop protection products

Physical

- Manual weeding
- Crop free periods (staggered planting and harvest)
- Buffer zones
- Weed flaming
- Mulch
- Steaming
- Traps (manual and automated)
- Precision planting and cultivation
- Robotic weeders
- Technological
 - » Mechanical weeding
 - » Precision application technologies

SPM AND CHEMICAL PESTICIDES

There will no doubt be times when all other pest management options have been exhausted, and still a significant pest pressure remains. In these cases, chemical pesticides may still be employed, so long as the intention is to use these products in a targeted way, as needed in order to eradicate the pest(s) and continue on with a holistic, integrated pest management approach that aims to build overall system health. Chemical pesticides include but are not limited to:

- Fumigants
- Chemical repellents
- The use of seeds that have been treated with chemical pesticides
- Antibiotics
- Herbicides
- Fungicides

APPENDIX 7: A NOTE ON SCIENCE-BASED, EXPERIENTIAL, AND OTHER WAYS OF KNOWING

The SPM Work Group grappled with many complex questions, including several that look at the kinds of knowledge the field of pest management relies on and where and how this knowledge is generated. The group asked:

- *How do we generate the information we need?*
- *Who is generating the information and decides what information is valid in a given situation?*
- *How is the information that's there being used, and who decides?*

In reflecting on these important questions, the SPM Work Group acknowledges that there are **multiple ways of knowing, including Western science, farmer experience, and traditional, Indigenous knowledge sources, that yield important information for the field of pest management**. Instead of thinking of these as competing or even separate methodologies, this group considers science and experiential and observational knowledge as important pieces of the puzzle that **must inform each other in order to generate the full breadth and depth of knowledge needed** to move California towards safer and more SPM.

While this sentiment is becoming increasingly understood across the field, there still exists a large gap between the experiential knowledge being generated and it being influential and implemented. **It is important to consider how Indigenous and other forms of observational data can meaningfully inform research which then informs decision making, regulations, policies, and on-farm practices**. Additionally, it's important to acknowledge that while research can be a powerful tool used in making decisions, policies and regulations, these things are ultimately informed by societal values, government structures, and politics.

The SPM Work Group recommends that scientists, practitioners, and traditional and experiential knowledge sources work together early and often when conducting pest management research in order to bring in the breadth of experience needed. For example, this means bringing in practitioner, Indigenous and traditional knowledge to the research design process, as opposed to after the research has begun or once the results are gathered.

The SPM Work Group would like to see **transparency and equity of access** to how the information is generated, the information itself, and to the decision-making process for how that information is used. When considering how the information is then used, the SPM Work Group recommends that those who are impacted by the decisions be included in the decision-making process. A thorough understanding of impact should be gathered by multi-stakeholder teams, including scientists, practitioners, and community members.

The intention here is to enable a robust and thorough process of knowledge generation and dissemination, and to help balance the influence that entities with substantial access to power and financial resources have on this process. The ultimate goal here is to protect and enhance practitioner, public, and environmental wellbeing.

The following is a list of guiding principles the SPM Work Group believes is essential when evaluating the legitimacy of knowledge, regardless of whether it is developed through Western science or experiential and observational methodologies, or a combination of both:

- A. There is precision and attention to detail and accuracy in how the information is gathered
- B. The experiment is replicable
- C. There is a quality of generalizability. That is, the results can be applied broadly, as opposed to only on a single site or in a specific scenario
- D. Results are carefully tracked and compared with each other
- E. There are clear, transparent standards for what is being measured and how
- F. The methodology clearly identifies its limitations
- G. The experiments are impartial, insofar as they are designed to be, and are carried out, free from contextual values of the researchers and practitioners.
- H. Design, methodologies, and results are transparent
- I. The results are easily known and transferable to others

APPENDIX 8: SPM TRANSITION INITIATIVE - PRELIMINARY PROGRAM DESIGN

The following design is meant as a starting point to develop the SPM Transition Initiative recommended above.

- A. The State should commit to paying the negative difference between a previous three to five-year average yield and the yield a farmer produces while they are actively transitioning to SPM. We encourage the State to develop guidelines that account for cases when previous yields were exceptionally low, so as to not create a disincentive for farmers to join this Initiative. These guidelines should also account for crop loss due to non-pest related issues and how these will be factored into this program.
- B. This “transition funding” should be available to all growers in California during the terms of transition, to be determined based on crop type. Design to enable participation by farms of all sizes, commodities, growing practices.
- C. Provide all farmers participating in this Initiative with the knowledge needed to implement SPM. This could include free or low-cost SPM-trained Technical Assistance (from UC, CSU, or other independent technical assistance providers) to all participating growers. In carrying out implementation, the State needs to pay particular attention to removing barriers to participation by small farms and socially disadvantaged farmers. This could include providing language-relevant Technical Assistance to these farmers during the application process and throughout implementation.
- D. The Department should set a percentage reimbursed per parcel proposed for transition. The amount of eligible parcels should be significant enough to drive a large shift towards SPM, while also capping the State-led investment at a reasonable amount.
- E. Encourage synergy with CDFA’s OPCA and Healthy Soils program where possible. This may include harmonizing applications, and/or giving additional application points to those growers implementing Healthy Soils management practices.
- F. Collaborate with supply chain leaders to identify ways that buyers can help offset risk and support the goals of this initiative. This may include programs that preserve market share for a period of time as growers develop new production strategies based on SPM.
- G. Engage partners at the Federal level to support with funding and implementation of this initiative.
- H. Bring banking and insurance leaders to the table
- I. Engage PCAs to be champions of this Initiative and explore ways to incentivize their participation.
- J. An outcome of this Initiative will be a diversity of grower demonstration plots showing the viability of SPM practices.
- K. One of the key performance indicators of the program should be long-term implementation of SPM, so as to track the overall goal of transitioning parcels to being managed with SPM practices.
- L. Funding for this program should not inadvertently burden farmers.

APPENDIX 9: CRITERIA LISTS

The following lists were developed by the SPM Work Group and Urban Subgroup as a way to clearly articulate the diversity of needs and interests represented in the groups. These items acted as guiding principles for the groups as they developed the Roadmap's goals and recommendations, and served as a tracking mechanism for ensuring that everyone's interests were addressed. All members committed to developing a Roadmap that integrated everyone's interests, so while the relative importance of each item differs from member to member, each member agreed to steward their group's entire list.

Summary of Criteria List Developed by the SPM Work Group

SYSTEMS APPROACH (ECOSYSTEM LEVEL)

1. Create diverse, healthy, economically productive systems that prioritize prevention of pests (e.g. insects, noxious plants, plant diseases) and support ecosystem health and resilience.
 - *E.g. This may include understanding the ecology of the ecosystem to manage surrounding habitat, prioritizing cropping systems and natural enemies.*

SYSTEMS APPROACH TO PEST MANAGEMENT

1. Conduct pest management following a systems approach
 - *E.g. This may include efforts to exclude (eliminate invasion pathways), detect, survey for disease, identify disease pathogens, develop response (eradication, control, etc.) and incorporate integrating/stacking methods and technologies.*
2. Provide for a variety of tools and techniques to effectively manage pests while still being economical, practical, and accessible to the diversity of California producers
3. Make sure all decisions are based on science and/or empirical knowledge, supported by comprehensive, informed and transparent decision making
4. Prioritize the potential of natural systems and traditional ecological knowledge

PUBLIC AND ENVIRONMENTAL HEALTH

1. Protect public health and the environment with specific attention to sensitive populations and habitats
 - *E.g. Populations to be considered include, but are not limited to, farmworkers, farmers, pesticide applicators, and vulnerable, underserved, disadvantaged, or otherwise impacted communities.*
2. Where possible, encourage and pursue multi-benefit pest management solutions.

RESOURCES

1. Support the capacity-building and deployment of resources to all stakeholders to develop and implement SPM skills.
 - *E.g. These efforts may include education (on all levels), incentives, demonstrations, adaptive research and innovation focusing on that which supports ecological pest management (agroecology, ecological crop, soil, habitat management)*

STATE AND LOCAL ACTION

1. Ensure transparency in the regulatory process and seek continual improvement to further SPM
2. Strengthen and enhance the state's robust pest detection, prevention and exclusion programs, including those that are alternatives-based, that meet SPM standards
 - *Alternatives-based could be mating disruption, biocontrol, weed management.*

Full List of Criteria Developed by the SPM Work Group

The categories below are ONLY to help us see themes and find redundancy. There is no other hierarchy or implied meaning in the categories below.

We want the future of pest management in California to...

Systemic Approach

- Be holistic
- Be ecologically based, focusing on plant and animal health
- Be bio-intensive
- Be practical
- Be systems-based
- Create an environment where a systems approach, such as Integrated Pest Management (IPM), can be effectively implemented
- Realize the ecological health and economic potential of natural systems

Farms

- Attend to farms of all sizes
- Attend to farms of all commodities
- Be viable to the full spectrum of growing practices
- Provide the tools to ensure food and fiber production that meets consumer needs
- Support growers to make informed decisions that further the principles of SPM

People (Farm owners, Farmworkers, Impacted Communities, and Public Health)

- Attend to all farmers and ranchers in California, without exclusion due to cultural, ethnic, racial, or economic differences
- Consider the livelihood of farmers and ranchers, farmworkers, and community members
- Be economically viable for growers, farmworkers, communities, and consumers
- Minimize negative health impacts on all people
- Ensure the safety and wellbeing of farmers, farmworkers, pesticide applicators, and low-income, vulnerable, disadvantaged, or otherwise impacted communities
- Address the risk and vulnerability of Indigenous and other communities whose way of life and cultural practices depend on extensive use of natural resources

The Environment (Environmental Health and Climate Change)

- Actively consider and minimize impacts on all wildlife populations and ecosystems, including but not limited to pollinator populations, aquatic life, soil health, and others
- Support and encourage biodiversity
- Work to improve the health of natural resources, including but not limited to soil nutrients, water quality, and air quality
- Have appropriate mitigation strategies in place to avoid harm to natural resources
- Actively work to minimize climate change and its implications for pest management

Science, Research, and Innovation

- Be guided by science that is characterized by things like high standards, high quality, “soundness”, evidence-based, and peer-reviewed
- Promote publicly funded research and research capacity
- Be supported by robust public and privately funded research and education programs
- Embrace the most efficacious and safe technologies, new and old, that will appropriately increase effectiveness of pest management
- Encourage and provide support to growers to experiment with low toxicity alternatives
- Encourage an environment that supports innovation for pest management
- Support innovation among farmers to improve business operations through effective pest management
- Be characterized by a separation of advice from commission
- Be characterized by disclosure and transparency in the process of giving recommendations for use of materials

Implementation and Regulations

- Provide sufficient funding and access for adequate implementation of SPM options
- Be characterized by clear communication
- Be characterized by regulatory clarity
- Apply an alternatives analysis perspective in regulatory activities

Considering Impacts

- Actively consider and work to avoid unintended negative impacts of potential solutions, in the short and long term
- Support pest management choices that are based on a thorough understanding of different impacts and support informed choice about which risks and costs to incur
- Assist various audiences in interpreting and understanding risks and benefits related to pest management activities
- Include overall public health, environmental, and economic impacts in how we measure effective pest management

Education and Outreach

- Facilitate farmer-to-farmer sharing of information and best practices
- Support farmer collaboration to reduce pest pressure on a regional basis
- Support farm owners, farmworkers, and impacted communities to communicate effectively amongst each other about pest management strategies and their impacts
- Build community among growers, farmworkers, community members, government and others
- Support outreach efforts from SPM researchers to farmers, pesticide applicators, and communities and vice versa

Pest Management

- Achieve pesticide risk reduction
- Effectively manage pests
- Prevent pest problems before they happen
- Actively identify pest pathways and look for ways to exclude pests from entering California
- Maximize reliance on effective, low toxicity approaches to pest management
- Support greater understanding and adoption of biological control
- Include the understanding and increase the access of Black, Indigenous and other historically excluded methodologies of agriculture and pest management

Non-Ag Pest Management

- Address the special pest management needs of habitat management
- Address the special needs of urban pest management activities

Full List of Criteria Developed by the Urban Subgroup

The categories below are ONLY to help us see themes and find redundancy. There is no other hierarchy or implied meaning in the categories below.

We want the future of pest management in California to...

Systemic Approach

- Be holistic
- Be ecologically based, focusing on **people**, plant and animal health
- Be bio-intensive
- Be practical
- Be systems-based
- Create an environment where a systems approach, such as Integrated Pest Management (IPM), can be effectively implemented
- Realize the ecological health and economic potential of natural systems
- Support effective options that don't rely on specialized knowledge

Urban and Non-Production Ag Settings

- Attend to urban settings of various geographic and population sizes
- Attend to an array of socio-economic and ethnocultural groups in urban settings
- Encourage and support pesticide applicators and dwellers in urban structural settings to practice environmental-friendly pest management or IPM
- Address the special needs of urban and non-ag pest management activities, including those pertaining to:
 - » Households
 - » Pets
 - » Professions (e.g. veterinarians, swimming pool maintenance)
 - » Institutions (e.g. hospitals)
 - » Industries (e.g. hospitality, veterinary, manufacturing)
 - » Home gardens
 - » Nurseries
 - » Urban landscapes
 - » Retailers
 - » Impregnated products
 - » Golf courses
 - » Natural habitats
 - » Schools and childcare centers
 - » Rights of way
 - » Government agencies
 - » Other non-production ag locales

People (Urban Dwellers, Impacted Communities, and Public Health)

- Be economically viable for pesticide applicators and consumers in urban settings
- Minimize negative health impacts on all people
- Address the risk and vulnerability of urban dwellers experiencing health care inequalities in low and very low-income communities
- Be informed by the concerns and interests of those who are most affected by the impacts of pest management choices

The Environment (Environmental Health and Climate Change)

- Actively consider and minimize impacts on all wildlife populations and ecosystems, including but not limited to pollinator populations, aquatic life, soil health, and endangered species.
- Support and encourage biodiversity
- Work to improve the health of natural resources, including but not limited to soil nutrients, water quality, and air quality
- Have appropriate mitigation strategies in place to avoid harm to natural resources
- Protect future water supplies
- Actively work to minimize climate change and its implications for pest management
- Incorporate proactive climate change adaptation measures

Science, Research, and Innovation

- Be guided by science that is characterized by things like high standards, high quality, “soundness”, evidence-based, and peer-reviewed
- Promote publicly funded research and research capacity
- Be supported by robust public and privately funded research and education programs
- Embrace the most efficacious and safe technologies, new and old, that will appropriately increase effectiveness of integrated pest management
- Encourage an environment that supports innovation for pest management
- Be characterized by a separation of advice from commission
- Be characterized by disclosure and transparency in the process of a licensed professional suggesting or prescribing the use of products

Implementation and Regulations

- Provide sufficient funding and access for adequate implementation of SPM options
- Be characterized by clear communication
- Be characterized by regulatory clarity
- Encourage effective enforcement
- Apply an alternatives analysis perspective in regulatory activities

Considering Impacts

- Actively consider and work to avoid unintended negative impacts of potential solutions, in the short and long term
- Support pest management choices that are based on a thorough understanding of different impacts and support informed choice about which risks and costs to incur
- Assist various audiences in interpreting and understanding risks and benefits related to pest management activities
- Include overall public health, environmental, and economic impacts in how we measure effective pest management

Education and Outreach

- Facilitate peer-to-peer sharing of pest management information and best practices among those with cultural, economic and language commonalities
- Support collaboration amongst pest control applicators in order to share effective IPM practices and to reduce overuse and ineffective use of pesticides
- Support the education of those needing to make pest management decisions, including:
- Licensed pesticide applicators
 - » property managers
 - » pet owners
 - Urban and rural dwellers
 - government agencies members
 - political officials
 - Veterinarians and other medical professionals
 - Others who do incidental pest control, such as institutional and industry staff

Pest Management

- Achieve pesticide risk reduction
- Effectively manage pests
- Support the prevention of pest problems before they happen (*examples include building codes, landscaping practices, etc.*)
- Actively identify pest pathways and look for ways to exclude pests from entering California
- Maximize reliance on effective, low toxicity approaches to pest management
- Support greater understanding and adoption of biological control
- Include the understanding and increase the access of Black, Indigenous and other historically excluded methodologies of growing food and pest management

APPENDIX 10: METHODOLOGY

To develop this Roadmap, the SPM Work Group and Urban Subgroup underwent an in-depth, multi-stakeholder collaborative process, which took place over the course of 16 months. Throughout this time, the groups were committed to developing a Roadmap that would advance pest management in California in ways that meet the wide range of needs at the table. Making improvements to a field as complex and far-reaching as pest management is in and of itself an ambitious goal, but doing so in a way that considers all interests and leaves no one behind is an extraordinary undertaking. And yet, it is also essential because no one person or one stakeholder group holds the solutions to the challenges we collectively face. A high-level overview of the process approach is outlined below.²⁶

Pre-Launch: Hearing From the Field

The first step of the Roadmap development process was to hear from a diverse set of stakeholders about their perspectives on key challenges and opportunities in the field of pest management. The facilitation team interviewed 50 leaders from a wide array of organizations, interest groups, agencies, farms, and communities. The primary objectives were to understand the landscape of issues and to identify the groups and potential members for the SPM Work Group and the Urban Subgroup. A summary of the challenges, opportunities, and potential solution areas was then presented to the group as a launch point for their work. The representatives from the groups that were ultimately convened represented a wide spectrum of stakeholders who are invested in and impacted by pest management in California.

Phase 1: Criteria Gathering

An important design principle of this project was “working on behalf of the whole” From the very beginning, the members of both groups were asked to commit to not only advocate for their own perspectives and stakeholders they represent, but also to work to find creative solutions that integrate everyone’s needs and interests. In order to understand these needs and enable us to track our progress towards our goal, both groups created a list of interests that the group collectively agreed would need to be addressed in order for the Roadmap to truly work for everyone (see Appendix 8, Criteria List).

The SPM Work Group spent their first three meetings listening to each other’s perspectives and understanding the landscape of diverse concerns and interests represented in the group. Together, they reflected on what the future of pest management would look like if it were to attend to all these interests and needs. Each item on the Criteria List is important to at least one member of the group. Each of the criteria vary in importance to the various members, but all agreed to develop a Roadmap that tends to all of the interests listed.

The Urban Subgroup, initiated 6 months after the SPM Work Group, used the SPM Work Group’s list as a starting point and built on it to address the needs and interests of urban pest management and the unique uses and users in this context.

²⁶ The two primary frameworks used to support the work of the groups were Convergent Facilitation and Systems Practice.

Phase 2: Systems Assessment & Strategy Development

Another design principle that guided this project was “thinking like a system.” Once the group clearly identified and aligned on the Criteria List, the next task was to develop a shared understanding of the system of pest management in California. The SPM Work Group engaged in a robust system assessment that began by articulating what a healthy system would look like, and then explored the interconnected dynamics that were most powerful in shaping the behavior of the system. The group identified feedback loops that contribute to keeping problems in place, and those which are moving it toward a greater state of health. A simplified causal loop diagram from this process is included below. The group then identified key leverage points in the system—places where sustained and focused effort could lead to outsize effect in moving the system toward a greater state of health.

For the SPM Work Group, this initial set of leverage points included:

1. Enhancing knowledge, outreach, and technical assistance funding and infrastructure
2. Activating markets and supply chains
3. Supporting growers’ capacity to take risks inherent in transitioning to SPM
4. Updating California’s pest prevention and exclusion systems

The Urban Subgroup underwent a more modest systems assessment that identified and ranked key forces shaping the behavior of the system in the urban context, a process that then led to the identification of the following leverage points:

1. Strengthen and expand systems to provide, the data and science needed for sound regulatory decisions, product design, and effective pest management
2. Support and empower key influencers and magnifiers to build adequate and effective SPM communication and implementation
3. Better align regulatory frameworks with sustainable pest management

In discussions following the systems assessments, these leverage points evolved into the focus areas that form the main structure of the Roadmap, along with two additional themes that were identified as being essential to both groups:

1. Improving California’s pesticide registration and continuous evaluation process
2. Strengthening coordination within California’s leadership

For each of these focus areas, the groups developed goals, priority actions, additional actions, and design guidance for each of the areas. While both the SPM Work Group and Urban Subgroup offered input into the other group's recommendations, it is important to note that the agricultural and urban recommendations are the work product of those groups only. The groups worked collaboratively to develop goals and recommendations for the overarching areas. While there are differing opinions about the priorities of these goals and recommendations, the members all agreed that the ideas put forth in this Roadmap will greatly support California’s progress towards safer and more sustainable pest management.

Phase 3: Public Input

The Roadmap advances the best collective thinking of the SPM Work Group and Urban Subgroup. In order to contribute to this, the public was invited to offer their input on a draft of the Roadmap. This phase is meant to support the groups to understand what perspectives might still be missing, hear ideas that may not have surfaced yet, and harness the creativity and insight of stakeholders that may not otherwise be represented. Both groups committed to meaningfully consider the input received during this time.

Phase 4: Final Decision-Making

Once the groups have had a chance to consider the public's input, they will work to integrate these perspectives and ideas into their goals and recommendations. This phase will give the groups time to work through outstanding issues and fine tune the Roadmap so that it sufficiently addresses each of the interests identified in Phase 1.

SPM Work Group Learning Journeys

As a way to support the group's learning, the SPM Work Group went out into the field to visit farmers and farm workers, and brought in several panels of practitioners and experts to share their first hand experience and understanding of the challenges and opportunities. The first Learning Journey took the group to the Salinas Valley where the group visited:

- **Driscoll's Strawberry Test Plot** where the group heard from Miles Reiter, CEO; Henry Gonzales, Monterey County Ag Commissioner; Jenny Broome, Global Plan Health Department Manager, Senior Scientist; Phil Stewart, Global Plant Breeding Director; Joji Muramoto, UCSC Cooperative Extension Specialist
- **The home of agricultural workers and community members**, where we heard from and shared lunch with Olga Montes, Agricultural Worker and CHAMACOS Study 27 Participant; Rosa Lopez, Community Member & CHAMACOS Study Participant; Maria Ines Catalan, Catalan Family Farms & Graduate of Rural Development Center
- **Pinnacle Organic**, where the group went on a walking tour and heard from Phil Foster, owner/farmer; and Margaret Lloyd, Farm Advisor

The second Learning Journey was designed to bring insights into the group focused on the four leverage point areas identified in the systems assessment process. These panel discussions took place over two days on Zoom and included the following topics and guests:

- **Research Discussion: Understanding Influences Shaping Pest Management Research**
 - » *Dr. Akif Eskalen, Department of Plant Pathology, UC Davis*
 - » *Dr. Jim Adaskaveg, Department of Microbiology & Plant Pathology, UC Riverside*
 - » *Dr. Miguel Altieri, Department of Environmental Science, Policy, and Management (Entomology & Agroecology), UC Berkeley (retired)*
 - » *Mark Lipson, Consultant, Pacific Plate Organics*

²⁷ To learn about the CHAMACOS Study visit <https://cerch.berkeley.edu/research-programs/chamacos-study>

- **Outreach Discussion: Scanning the Landscape of Knowledge Communication to Growers**
 - » *David Haviland, Farm Advisor, Cooperative Extension Kern County*
 - » *Dr. Steven Fennimore, Professor of Extension, UC Davis Plant Sciences*
 - » *Chris Storm, PCA/Viticulturist, Starr and Storm Crop Solutions*
 - » *Charlie Hamilton, Pest Control Advisor, Grow West*
- **Grower Panel: Understand influences shaping agricultural pest management decisions**
 - » *Bruce Rominger, Rominger Brothers Farm*
 - » *Derek Azevedo, Bowles Family Farm*
 - » *Helen McGrath, Flying M Ranch*
 - » *Javier Zamora, JSM Organics*
 - » *Paul Wenger, Wenger Ranch*
- **Farm Risk Management: The role of banking & insurance**
 - » *Roland Fumasi, Rabobank*
 - » *Ryan Mortenson, USDA Risk Management Agency*
- **Human Health & Ecological Impacts of Pest Management**
 - » *Kim Harley, UC Berkeley*
 - » *Nan Singhasemanon, Department of Pesticide Regulation*
 - » *Susan Kegley, Pesticide Research Institute*
- **Supply Chain: What role do buyers have in shifting the paradigm of pest management?**
 - » *John McKeon, Taylor Farms*
 - » *Paula Daniels, Center for Good Food Purchasing*
 - » *Scott Dray, Walmart*

BEYOND THE ROADMAP

The group process outlined above led to the production of a strategic roadmap for the future of pest management in California, but it also led to additional outcomes. Over the course of the project, through micro-trainings and coaching, these leaders also gained skills in collaborative leadership and strategy for understanding and transforming complex systems. Through the process, trust and relationships were built across significant differences and this web of relationships in the field will serve to help carry the spirit and letter of the Roadmap forward for years to come. Finally, it is our hope that the farms, agencies, and organizations at the table gained significant perspective on the systems in which they operate to inform their own strategies to align with future sustainable pest management.

