Comprehensive Pesticide Environmental Assessment Tool for U.S. Agriculture

Final Report

December 1, 2011

Grantee Name: IPM Institute of North America, Inc.
Project Title: Comprehensive Pesticide Environmental Assessment Tool for U.S. Agriculture
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Period Covered by Report: September 1, 2007 – August 31, 2011
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Deliverables:

1. An on-line pesticide product ranking tool.
2. An outreach program including website, electronic and print communications.
3. An external peer review (including NRCS staff) at three stages and an ongoing internal review by our diverse, broad stakeholder advisory group.
4. A comprehensive evaluation of use over two seasons in key cropping systems and production regions; 12 quarterly and one final progress reports; three annual advisory meetings by conference call and three in person.
5. Reduction in impacts of the highest hazard pesticides by 10% by tool users by the end of the 2010 season.

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Executive Summary

When a pesticide application is needed, choosing least-hazardous options is a key component of Integrated Pest Management (IPM). Data and tools needed to fully evaluate potential impacts and tradeoffs across chemical and non-chemical management options are not readily available to the pesticide user. The lack of a credible, comprehensive and easy-to-use pesticide evaluation tool has limited IPM promotion and performance benchmarking by grower groups, USDA, eco-certifiers and commercial food buyers.

This project developed the Pesticide Risk Mitigation Engine (PRiME), an efficient, user-friendly option for farmers, advisors, program managers, policy makers and others to evaluate pesticide options for impacts on health and the environment, improving the quality and quantity of IPM. PRiME addresses NRCS priority concerns by seeking to protect and improve water quality and help pesticide users minimize impacts on non-targets including humans, wildlife and aquatic ecosystems.

Our primary goal was to develop an online, user-friendly tool to evaluate pesticide risks in agriculture. Our deliverables, as stated in the original grant proposal, were:

1. Develop a web application that would:
    a. estimate risks to resources including: ground and surface water, soil and air quality, worker safety, consumer safety (residues on food), wildlife habitat, pollinators, beneficial insects, and birds**;**
    b. evaluate hazards to each resource of concern separately or in combination;
    c. assess individual or combined pesticide products;
    d. weigh impacts of application methods, quantity and frequency of application;
    e. account for site-specific conditions;
    f. provide access to information on mitigation options for specific product/application selections; and
    g. provide an index “score” and ranking for each application and for all applications over a single season, as well as sub-scores for each resource concern.

2. An outreach program including website, electronic and print communications targeting key user groups.

3. An external peer review at three stages and an ongoing internal review.

4. A comprehensive evaluation of use over two seasons in key cropping systems and production regions.

5. Reduction in impacts of the highest hazard pesticides by 10% by tool users by the end of the 2010 season.

We have succeeded in launching PRiME, www.ipmprime.org. This user-friendly web application includes eight risk indices (Aquatic Invertebrates, Algae, Fish, Earthworms, Small Mammal, Avian Acute Risk, Avian Reproductive Risk, and Inhalation Risk for Workers/Bystanders) and weighs impacts of application methods, quantity and frequency of application.

Additionally, we developed outreach materials including website, electronic and print communications targeting key user groups (Appendix A). We completed an external peer review of all risk indices included in PRiME, as well as pilot testing over two growing seasons and six crops (apples, pears, cherries, green beans, potatoes and grapes; see Appendix D for a summary of pilot testing).

We fell short of our proposed deliverables in the following areas:

- PRiME does not include risk indices for: ground water, consumer safety, pollinators or beneficial insects. A dietary risk index has been developed and peer-reviewed, but we were unable to operationalize this index within the grant period. A pollinator index is nearly complete, and will be added to PRiME as time and resources allow.
- PRiME does not yet account for site-specific conditions. We are currently upgrading PRiME's pesticide fate and transfer modeling to account for site-specific soil, weather and crop type, as well as edge-of-field filter strips, all of which will affect pesticide movement off site.
- Although PRiME accounts for some differences in exposure potential associated with application methods, it does not suggest mitigation measures based on risk outputs. This component is being developed in conjunction with site-specific pesticide fate and transfer modeling described above.
- Although PRiME can aggregate risk scores from multiple pesticide applications within each risk index, it does not aggregate scores across risk indices to produce a single risk score. After much effort developing and evaluating various methods for such aggregation, the project team could not reach a consensus that there is a scientifically justifiable way to aggregate scores across disparate risk indices without obscuring important risk trade-offs (see our Policy on Indicator Structure, Appendix H). As we continue to refine and add risk indices to PRiME, we will continue to seek more concise ways of reporting risk and summarizing large datasets.
- We cannot report a reduction in highest risk pesticide applications among PRiME users. PRiME was not developed fully enough to suggest that 2011 pilot testers make pest management decisions based on PRiME output.

Project timeframe

Due to programming delays that limited our opportunity to interact with growers prior to the 2010 growing season, our project required a one-year, no-cost extension through September 2011. The extension allowed us to conduct post-season testing of the PRiME tool in fall of 2010 and continue testing and development through the 2011 growing season. It also allowed us to more fully develop and test the pesticide fate and transfer modeling and additional risk indices to ensure that our end product met the needs of its potential users including NRCS.

Project beneficiaries
Potential beneficiaries of the PRiME tool include (1) conventional and organic producers and crop advisors, (2) NRCS staff working with producers to develop and implement pest management plans, (3) Extension specialists advising producers, (4) food and fiber processors evaluating performance of supplier IPM programs, (5) certification organizations, (6) pesticide developers and manufacturers, and (7) regulators evaluating relative hazards of alternatives to products facing restrictions or loss of registration.

Project funds
Project funds were predominantly spent as anticipated. Although minor changes were made to budget lines, we did not incur additional cost beyond what was included in our initial 2007 proposal to NRCS. In 2009, we requested the addition of new subcontractors to the project. In our initial proposal, we included $100,000 in our budget for the 'purchase of existing databases and/or database development.' This amount was budgeted for additional needs that we anticipated identifying as our project developed. The expenditures of the additional subcontractors, totaling $60,000, were drawn from the database budget line. Additionally, after receiving a one-year, no-cost extension, funds for another year of personnel time were needed. A portion of the grant funds originally budgeted for travel expenditures were shifted to cover personnel salary for the additional year of project development.

Demonstrating alternative technology
PRiME project team members engaged in a variety of outreach opportunities to present and demonstrate the PRiME tool to potential users. Before an accessible web application and user interface was developed, team members presented the PRiME indices and risk calculations. Throughout the development of the tool and user interface, team members presented both the PRiME risk indices and web application to a variety of audiences including professional associations, regulatory agencies, grower groups, distributors, processers, certification agencies and NRCS. Through presentations at meetings, conference calls, workshops and trainings, the project team was able to demonstrate the usefulness of PRiME and collect valuable feedback for incorporation into the tool. For a detailed list and description of PRiME outreach, see Appendix G.

Physical and economic results
Because PRiME was not developed fully enough to suggest that 2011 pilot testers make pest management decisions based on PRiME output, we cannot report quantifiable results achieved through the use of PRiME.

As we continue to develop and refine PRiME, we do expect the tool to help users realize both economic and physical results in the coming years. We expect quantifiable physical results from the use of PRiME to include (1) users evaluating applications and changing the types of pesticides used and (2) users implementing suggested mitigation strategies, resulting in reduced pesticide risk. We anticipate that growers using PRiME will realize cost savings associated with reduced pesticide applications as well an increased ability to demonstrate risk reduction, allowing them to access and compete in new markets including eco-certifications.

Programs that could potentially use PRiME
NRCS staff working with producers to develop and implement pest management plans could use PRiME to improve a producer's ability to reduce impacts on key environmental resources. PRiME could also be used to evaluate a producer's eligibility for cost share and incentive payments. See also Appendix C, Technology Review Criteria for Alternative Technologies.

Recommendations
We have identified the following recommendations that would facilitate further implementation of the PRiME tool.

- **Remaining key indices**. We will complete and implement the dietary risk and pollinator indices so that users are not making decisions based on incomplete data.
- **Site-specificity**. We will complete next year's planned beta test of estimating pesticide concentrations in water based on site-specific scenarios, evaluate results and revise water modeling based on results.
- **Continued and expanded outreach**. Our outreach approach will continue to include presentations at scientific and industry meetings, a peer-reviewed publication in progress led by Pierre Mineau, and close collaborations with key industry pilot testers including organizations with potential to impact many users including food processors, distributors and retailers, and eco-certification programs.
- **Formal launch of PRiME**. Once next year's beta test is complete, we will announce a formal launch including press releases and an inaugural newsletter focused on PRiME for users and potential users.
- **Collaboration with NRCS**. We will continue to work closely with the NRCS WIN-PST group and with NRCS state and county staff to explore opportunities to use PRiME to support NRCS's mission.
- **Internationalization.** We will continue to develop and implement our plan for internationalization to facilitate use in any country worldwide.

Introduction

Over the last four years, the IPM Institute of North America, with project partners Oregon State University, Carleton University, BCS Ecologic, The Pesticide Research Institute, the Natural Resources Defense Council and Waterborne Environmental, has developed the Pesticide Risk Mitigation Engine (PRiME), a web application that estimates agricultural pesticide risks to key resource concerns, including, birds, earthworms, small mammals, aquatic ecosystems and worker/bystander health and safety.

Key personnel:

Dr. Thomas Green (PI), president, IPM Institute of North America, Inc. Green has more than 25 years experience in environmental protection and four successful ventures including an IPM supply business he grew to more than $1.6 million in annual sales. He holds a Ph.D. in

entomology from the University of Massachusetts and is a Certified Crop Advisor and Technical Service Provider and chief scientist for the Eco Apple eco-label program.

Dr. Charles Benbrook, chief scientist, The Organic Center. Benbrook provides expertise on pesticide impacts on human dietary risk. Benbrook worked in Washington, D.C. on agricultural policy, science and regulatory issues from 1979 through 1997. He served for 1.5 years as the agricultural staff expert on the Council for Environmental Quality; from 1981-1983, he was the Executive Director of the Subcommittee on Department Operations, Research, and Foreign Agriculture, U.S. House of Representatives; from 1984-1990, served as the Executive Director, Board on Agriculture, National Academy of Sciences; he ran Benbrook Consulting Services from 1991 through 2006.

Karen Benbrook, principal of BCS-Ecologic, Inc., is a primary developer of the existing toxicity unit system used by Protected Harvest. Karen's responsibilities related to the PRiME project include the development of pesticide hazard databases which include pesticide products, environmental fate and toxicological properties of pesticide active ingredients, and pesticide residues found in food.

Mark Cheplick, agricultural engineer, Waterborne Environmental, assists in the implementation of the EXAMS - PRZM Exposure Simulation Shell (EXPRESS) within the PRiME user interface. Mark has extensive experience developing EXPRESS and provides the PRiME project with code and consultation.

Dr. Michael Guzy, assistant professor senior research, Biological and Ecological Engineering, Oregon State University, is responsible for overall system design, including database structure, pesticide fate and transfer modeling, and user interface. Michael has 15 years experience programming in industry and academia on mission-critical, distributed, GIS, and web-based systems.

Dr. Paul Jepson, director, Integrated Plant Protection Center, Oregon State University provides expertise on pesticide impacts on beneficials and other non-target organisms and supervises the information technology experts who design and maintain the online interface. Paul's research interests in IPM include the study of pest and natural enemy population dynamics in agricultural systems and have focused particularly on pesticide management and side effects, biological pest control and the development of ecological risk assessment for beneficial invertebrates.

Jonathan Kaplan, senior policy specialist, Natural Resources Defense Council, will assist with outreach to users, recruitment of user testers and development of the sustainable funding plan. Jonathan is a project specialist in the health program and coordinates NRDC's efforts to promote alternatives to pesticide use.

Dr. Susan Kegley, principal and CEO, Pesticide Research Institute, provides expertise on dermal and inhalation risk to workers and bystanders. Susan is an organic chemist with expertise in

pesticide toxicology, pollutant fate and transport; environmental monitoring and analytical chemistry; and experience with pesticide regulation, pesticide data sources and the pesticide toxicology and epidemiology literature.

Dr. Pierre Mineau, senior research scientist, Pesticides Section, National Wildlife Research Centre, Science and Technology Branch, Environment Canada and Department of Biology, Carleton University will provide expertise on pesticide impacts on birds and other non-target organisms, and serve as liaison to a complimentary effort underway within the Canadian government.

Wade Pronschinske, technical services manager, IPM Institute of North America, provides overall management of technical design and implementation, as well as design of new user interface components, quality assurance of the web application and databases, user interface aesthetics, pilot testing and user training. Wade studied environmental ethics at Florida State University and has experience developing web-based training and evaluation materials for the United States Air Force.

Joe Bagdon, NRCS Technical Advisor

Project Goals

Our primary goal was to develop an online, user-friendly tool to evaluate pesticide risks in agriculture. This tool would apply best available science, in an easy-to-use platform, to give all U.S. producers, advisors and regulatory professionals the ability to make more informed pest management decisions by comparing options for any commodity and selecting those with the least risk and/or effective mitigation options. Unlike current tools, our goal was to develop a tool that would be easy to use, regularly updated and readily accessible nationwide.

Our deliverables, as stated in the original grant proposal, were:

1. Develop a web application that would:
    a. estimate risks to resources including: ground and surface water, soil and air quality, worker safety, consumer safety (residues on food), wildlife habitat, pollinators, beneficial insects, and birds**;**
    b. evaluate hazards to each resource of concern separately or in combination;
    c. assess individual or combined pesticide products;
    d. weigh impacts of application methods, quantity and frequency of application;
    e. account for site-specific conditions;
    f. provide access to information on mitigation options for specific product/application selections; and
    g. provide an index “score” and ranking for each application and for all applications over a single season, as well as sub-scores for each resource concern.

2. An outreach program including website, electronic and print communications targeting key user groups.

3. An external peer review at three stages and an ongoing internal review.

4. A comprehensive evaluation of use over two seasons in key cropping systems and production regions.

5. Reduction in impacts of the highest hazard pesticides by 10% by tool users by the end of the 2010 season.

Scope of Project Tasks

To create our assessment tool, we began with a review of existing approaches and models to develop a list of potential attributes. We created mock up web pages to illustrate our planned approach and began development of a prototype using apples as our pilot crop. We began developing a prototype tool including a database of pesticides (active ingredients and formulated products) used in U.S. apple production.

Our project team scientists developed white papers describing PRiME's risk calculations. These white papers were peer reviewed by independent experts and revised based on feedback.

We released a prototype of the PRiME web application online including the following features: a Google Earth mapping tool and subsequent retrieval of NRCS soils data; product and use pattern selection; manual entry of application data; bulk upload of spray records; and risk evaluation for seven indices, including evaluation of individual applications as well as cumulative risk for multiple applications. After the release of the prototype tool, we began development of an informational website to complement the web application housed on servers at Oregon State University. We developed supporting documents for the website including help files, frequently asked questions, terms of use and a privacy statement. We sought input from users including crop advisors, growers and the PRiME advisory committee and refined the user interface accordingly.

A beta version of the PRiME website was launched and we began expanding our products database to include products registered for additional specialty crops. PRiME-beta included a shopping cart for accounts and free guest access. We also implemented first tier water modeling in PRiME-beta, allowing us to operationalize the aquatic risk indices and develop the infrastructure necessary to implement more sophisticated water modeling in the future.

Throughout the development process, we continually sought user feedback and refined the web application to streamline processes, in terms of data entry from the user as well as background processes to make PRiME run more quickly and efficiently over the internet. We continue to develop and refine the databases that are the foundation of PRiME risk calculations.

Project Support

Primary support came from the NRCS CIG grant. Additionally, the project was facilitated by several key collaborations. The following collaborators provided in-kind and direct support in development of the PRiME project:

Canadian Department of Agriculture
General Mills – matching funds contribution of $15,000 over three years
Great Lakes Protection Fund – $10,000 grant for work on user interface and risk indices
Oregon State University – $70,000 subcontract as part of USDA NIFA – IPM PIPE grant to develop PRiME for six specialty crops, $124,684 cash match for Paul Jepson and project assistant time for PRiME development
Unilever – in-kind contribution of intellectual property of PRoMPT tool, valued at $325,000
University of Illinois – in kind contribution of graphic design work on elements of PRiME website and user interface by Scott Martin, University of Illinois graduate student
University of Wisconsin – Center for Integrated Agricultural Systems – contribution of meeting space, time, food for PRiME presentation and training, valued at $187.00
US EPA Region V - $26,308 for the Inhalation Risk Index and pesticide fate and transfer modeling
US EPA Region X –$6,120 to develop PRiME for use with potatoes in Washington and Oregon
Wescott Agri Products – contribution of meeting space, time, food for PRiME grower testing, valued at $529.56
Chuck Benbrook, Organic Center – in-kind contribution of time for participation on project team, $181,700 cash match for Chuck and Karen Benbrook for PRiME development
Karen Benbrook, BSC Ecologic – in kind contribution of time for participation on project team
Paul Jepson, Oregon State University – in kind contribution of time for participation on project team
Jonathan Kaplan, Natural Resources Defense Council – in kind contribution of time for participation on project team, $17,000 cash match for evaluating PRiME for compatibility with Stewardship Index and development of pesticide impact metric for sustainability index
Susan Kegley, Pesticide Research Institute – in kind contribution of time for participation on project team
Pierre Mineau, Environment Canada– in kind contribution of time for participation on project team, $93,654.85 cash match for PRiME development
PRiME advisory committee members – meeting time, participation in conference calls

Background

Currently, agricultural pesticide users face a variety of options when a pesticide application is required. To select the optimum product and mitigation options considering efficacy, cost and relevant hazards, users must evaluate a wide variety of criteria including the target pest, product price, persistence, transport and fate in the environment, potential for residue at harvest and post-harvest, as well as acute and chronic toxicity to applicators, consumers and other non-target organisms including beneficials, aquatic and terrestrial organisms. Data

needed to fully evaluate products are not readily available and must be compiled from product labels, MSDS, and research and Extension publications and websites. No producer is presently equipped to perform this evaluation efficiently and effectively.

PRiME was developed to provide a readily available, easy to use tool that would permit producers, advisors and regulatory professionals to compare different pest management scenarios for any specialty or commodity crop and select options with the fewest potential environmental and health hazards, and to identify mitigation options for products/uses selected.

Several pesticide hazard assessment tools are currently in limited use but none are ideal, i.e., easy to use, regularly updated, readily accessible nationwide, customizable to specific cropping systems and environments, and addressing the full range of primary resource concerns. State-of-the-art examples include the Pesticide Environmental Assessment System (PEAS), currently in use in a very limited number of crops and locales by Protected Harvest, an eco-label program developed in collaboration with growers, university-based and independent scientists and environmental advocates.

NRCS-developed the Windows Pesticide Screening Tool (WIN-PST) is widely used by NRCS professionals to assess impacts of pesticide options in conjunction with technical assistance and incentive programs for producers. Unilever has also developed a proprietary system called the Pesticide Risk Management Profiling Tool (PRoMPT) which includes an innovative user interface and strengths in water resource impact mitigation. Joe Kovach, IPM Coordinator, Ohio State University, developed the Environmental Impact Quotient (EIQ), a pesticide hazard indexing system used in several crops in the US and Canada. The IPM Institute, in conjunction with growers, crop advisors and scientists from Cornell and the University of Massachusetts, has developed a three-tier ranking system for pesticides used in apple production for the Northeast Eco Apple project, including: “use with justification” for products with few impacts; “use with restrictions” for products where specific mitigation of impacts is advisable and available; and “do not use” where effective alternatives are available.

Rather than reinvent the wheel or lose the knowledge base in this arena that has been developed to date, we enlisted these programs and scientists behind the development of these systems to best complement or incorporate the capabilities of existing tools, where appropriate as judged by our advisory group, external review panel and project team.

Project beneficiaries

Potential beneficiaries and uses of the PRiME tool include: (1) conventional and organic producers and crop advisors will maximize incentives and minimize hazards, liabilities and costs; (2) NRCS staff working with producers to develop and implement pest management plans will improve ability to identify and mitigate resources impacts and evaluate eligibility for cost share and incentive payments; (3) Extension specialists advising producers will improve product selection and evaluation of their program impacts; (4) food and fiber processors will improve ability to evaluate performance of supplier IPM programs; (5) certification organizations will be

able to optimize sustainable performance standards to protect resource concerns and improve evaluation of program impacts; (6) pesticide developers and manufacturers will gain ability to identify high-hazard pest-crop combinations in need of new technology and evaluate cost and risk trade-offs; and (7) regulators will be able to evaluate relative hazards of alternatives to products facing restrictions or loss of registration.

Natural resource issues addressed
The PRiME tool seeks to protect and improve water quality and help users identify and mitigate pesticide impacts on birds, earthworms, small mammals, aquatic ecosystems, and worker/bystander health and safety.

Limited access to comprehensive information about potential impacts of pesticide products on resource concerns limits a user's ability to make an informed decision when choosing between multiple products and application methods. Without having the tools available to efficiently and effectively compare between options, a user may apply a high risk product, potentially causing an unintentional negative impact on the environment or worker health, when an alternative, lesser risk and equally effective product is available.

Review of Methods

There have been many environmental indicators developed in the past, with some still in use today. Rather than reinvent the wheel or lose the knowledge base that has been developed to date, we enlisted some of these programs and scientists behind the development of these systems to best complement or incorporate the existing capabilities of existing tools.

We began with a thorough review of the programming and rationale behind Unilever's PRoMPT tool. Much of the initial user interface design was based on this model. From the Pesticide Environmental Assessment System (PEAS), we borrowed databases and the concept of Use Pattern Adjustment Factor (UPAFs) which adjust risk scores, up or down, based on likely exposure potential. We made use of databases from WIN-PST. For our initial pesticide fate and transfer modeling, we use a modified version of the GENeric Estimated Exposure Concentration (GEENEC2).

While these tools represented the state of the art of pesticide risk indicators, none was user-friendly, online and up-to-date. Our task was to develop a new tool that would be easy to use, regularly updated and readily accessible nationwide.

Innovation
PRiME includes a greater number of risk indices than have been previously addressed in a single tool. We have accessed a broad array of data sources to calculate risk rather than a narrow selection of indicator species, e.g., data for many species of birds rather than just one or two.

We have attempted as much as possible, to anchor PRiME's risk indices to field-level data and reduce reliance on theoretical extrapolations which are less precise. Field-level calculations will also provide a more empirical basis for estimating the impacts of management practices which can mitigate or exacerbate risk.

PRiME also includes a Geographic Information Systems (GIS) interface for users to identify their location, including outlining their field on a map to access spatially referenced data such as area and soils. Soils data are imported from NRCS Web Soil Survey. Users are also able to import pesticide data from electronic spray records and save scenarios they generate to save time and effort.

User Requirements

In order to utilize the PRiME tool, there is no need for a producer to alter their operations. PRiME calculates risk assessments using basic pesticide application information entered by the users, including product applied, amount applied, application method and area to which the product was applied. All pilot participants were already keeping the necessary pesticide application records. In many cases, only the format of the recorded data needed to be altered in order to effectively communicate with PRiME.

Timeline of Development

Fall 2007-Spring 2008

- Held first annual advisory meeting with project team and 20 advisors. Reviewed existing approaches and models developed a list of potential attributes for our tool with input from advisors.
- Developed and refined a set of user scenarios using real-world potential applications to help drive design and development.
- Mocked up an initial series of web pages to illustrate our planned approach.

Spring 2008-Fall 2008

- Began development of prototype for apple pilot.
- Developed database for pesticides (active ingredients and formulated products) used in U.S. apple production.

Fall 2008-Spring 2009

- Developed white papers describing risk calculations for the following indices: Avian Acute, Avian Reproduction, Aquatic Invertebrates, Fish, Algae, Earthworms, Small Mammals, Inhalation and Human Dietary Risk.
- Developed GIS mapping capabilities of field boundaries, sensitive sites and mitigation features using high-resolution Google Earth imagery and automatic retrieval of NRCS soils data.
- Operationalized four risk indices.
- Unexpected setbacks delayed full integration of all desired components of the beta version. Collected user feedback to prepare for a fully integrated prototype by summer

2009.

Spring 2009-Fall 2009

- Chose a name for the risk evaluation tool: Pesticide Risk Mitigation Engine (PRiME).
- Prototype of PRiME web application released online, features included Google Earth mapping and subsequent retrieval of NRCS soils data, product and use pattern selection, manual entry of application data, bulk upload of spray records, and risk evaluation for seven indices, including evaluation of individual applications as well as cumulative risk for multiple applications.
- Tested PRiME tool with actual apple and pear orchard spray records.
- Initiated the peer review process for six risk indices (VOC Emission Potential, Inhalation, Avian Acute, Avian Reproductive, Small Mammals and Earthworm Risk Indices).
- Purchased domain name www.ipmprime.org and began developing informational website to complement the web application housed on the OSU server.
- Due to the complexity of the task, development of the pilot tool fell behind schedule during this period.

Fall 2009-Spring 2010

- Developed new website and PRiME web application with input from graphic designer.
- Streamlined user interface with input from users including, crop advisors, growers and PRiME advisory committee.
- Launched a beta version of the PRiME web application for limited release featuring nine risk indices and three options for risk output: (1) grouped by index, (2) grouped by product, and (3) cumulative.
- Greatly expanded products database to include nearly two thousand products registered for use in almonds, apples, green beans, cherries, grapes, pears, peas, potatoes, strawberries and tomatoes.
- Operationalized GENEEC2 within the PRiME web application for first tier water modeling, allowing us to operationalize the aquatic risk indices and develop the infrastructure necessary to implement more sophisticated water modeling in the coming months.
- Developed supporting documents including help files, frequently asked questions, terms of use and privacy statement.
- Lack of programming resources and the complexity of the programming task delayed the release of the tool's beta version during this period. To remedy this shortcoming, we hired a second full-time programmer in May 2010.

Spring 2010 – Fall 2010

- Released PRiME-beta including shopping cart and free guest access.
- Began implementation of EXPRESS to replace GEENEC2 for our pesticide fate and transfer modeling.

Fall 2010 – Spring 2011

- We refined the PRiME user interface with the goal of streamlining the process from data entry to risk calculation.
- Improved PRiME's underlying databases of pesticide products, physical and chemical properties and chemical toxicity, allowing users to run calculations on a greater number of products with fewer missing scores.
- The loss of our programmer and inability to finalize an IPM Institute web development environment caused a significant delay in user interface updates and the implementation of EXPRESS.

Fall 2011

- Released PRiME-CIG with user-friendly interface (www.ipmprime.org).

What Worked and What Did Not

We succeeded in creating a readily available tool to assess the impact of most available agricultural products on a series of environmental indices. However, we faced our biggest challenge in assembling a programming team and programming environment appropriate for the scope of this project. Most of the programming was done by Michael Guzy at Oregon State University, assisted by our manager of technical services. We hired a programmer to assist Dr. Guzy remotely from the IPM Institute, but the geographical separation and complexity of establishing a remote development environment proved too difficult for the new programmer, who left for better pay after six months.

An element we were not able to incorporate into the CIG version of PRiME was aggregation. In an effort to satisfy user needs and fulfill goals outlined in the grant proposal, we developed and tested several methods for aggregating risk scores to provide one output summarizing the combined risk of multiple scenarios. Ultimately, the project team could not reach a consensus that there is a scientifically justifiable way to aggregate scores across disparate risk indices without obscuring important risk trade-offs (see our Policy on Indicator Structure, Appendix H). As we continue to refine and add risk indices to PRiME, we will continue seek more concise ways of reporting risk and summarizing large datasets.

The primary setbacks in the development of PRiME stemmed from a lack of available programming resources. If the project began today, we would allocate more of the grant dollars toward programming and development of the user interface.

Discussion of Quality Assurance

PRiME has been designed as a probabilistic risk ranking tool, as opposed to an absolute measure of environmental harm. It is strongest in its ability to compare pesticide options relative to each other. PRiME risk indicators are one of three types, depending on the availability of information: empirically-based indicators that rely on actual field impact data;

indicators based on a reasonable theoretical construct but 'benchmarked' against specific incidents (e.g. the fish kill record) or against well studied pesticides; or indicators that rely entirely on risk quotients (typically expressions that relate projected exposure to predicted, single endpoint toxicity) without the possibility of validating the results or considering other endpoints (e.g. the bulk of human safety assessments, most assessments of reproductive and chronic toxicity etc).

Accuracy and completeness of the underlying databases for pesticide product information, physical and chemical data, and calculated toxicity values for each endpoint of concern are critical in calculating risk index scores. These databases are quality assured using various methods.

The pesticide products database was developed primarily from US EPA's Pesticide Product Information System (PPIS). Inconsistencies discovered after combining these data with data from California Department of Pesticide Regulation (CDPR) helped identify numerous errors. Additionally many data points were verified or corrected based on information obtained directly from pesticide labels.

Physical and chemical data were pulled from various quality-assured databases such as The Pesticide Manual and FOOTPRINT Pesticide Products Database. There are inconsistencies between data sources and within data sources, where experimental conditions varied. Where multiple values were found, data are summarized.

Much of our toxicity database came from previous work by Environment Canada, continued by our project team over the course of the grant period. Although our methodology for calculating toxicity values has been peer reviewed, our final data values do lack transparency. We have developed a work plan for a computer application that will record data points used for the calculations, thereby increasing transparency and giving us the ability to verify and update older data.

The PRiME web application has been quality-checked at numerous stages of development, assuring that output data are consistent with the original algorithms for risk index calculations, that UPAFs are correctly applied, and that data to and from pesticide fate and transfer modeling are correct.

For detailed descriptions of quality assurance for each risk index, see Appendix H, PRiME Project Materials.

Findings

We have accomplished our primary objective of creating a readily available tool to assess the impact of most available agricultural products on a series of environmental indices. This tool

has potential to be used by producers, advisors and regulatory professionals to compare different pest management scenarios for any commodity and select options with the least potential environmental and health risks.

Two examples of potential uses of PRiME reveal that there is a need for a tool that can identify high risk pesticide applications, allowing users to make informed pest management decisions that will help reduce their impact on environmental resources.

Need for further risk reduction

Comparing PRiME cumulative risk summaries of applications on a peach block in California in 1999 and 2009 reflects efforts over the past years to reduce high risk pesticide applications. Although the comparison illustrates that risk reduction was achieved over the ten year span, the 2009 cumulative risk output still shows a number of applications in the high risk category. Despite the availability of new reduced risk products on the market, there remains a need for further reduction of high risk applications. PRiME presents a method for pinpointing those high risk applications, allowing the user to target them for reduction.

1999

Product	EPA Reg. No.	Product App Rate	Active Ingredient(s) App Rate
BASICOP	19713-72	20.000 lb/ac	[Copper sulfate (basic) 10.600 lb/acre]
GOWAN DIAZINON 4E10163-163	5905-248	0.500 gal/ac	[Diazinon 1.992 lb/acre]
OMNI SUPREME SPRAY	5905-368	4.000 gal/ac	[Mineral oil, petroleum distillates, solvent refined light 27.871 lb/acre]
BREAK EC	100-702	4.000 floz/ac	[Propiconazole 0.112 lb/acre]
ROVRAL	264-453	1.500 lb/ac	[Iprodione 0.750 lb/acre]
ZIRAM 76 FUNGICIDE	4581-140	8.000 lb/ac	[Ziram 6.080 lb/acre]
PENNCAP-M MICROENCAPSULATED INSECTICIDE	70506-193	0.750 gal/ac	[Methyl parathion 1.501 lb/acre]
RED-TOP SPRAY SULFUR	2935-92	20.000 lb/ac	[Sulfur 19.400 lb/acre]
DU PONT VENDEX 50WP MITICIDE	70506-211	1.000 lb/ac	[Fenbutatin-oxide 0.500 lb/acre]
ELITE 45 DF	264-749	8.000 oz/ac	[Tebuconazole 0.225 lb/acre]
DU PONT LANNATE INSECTICIDE	352-342	2.000 lb/ac	[Methomyl 1.800 lb/acre]
ELITE 45 DF	264-749	6.000 oz/ac	[Tebuconazole 0.169 lb/acre]
DU PONT LANNATE INSECTICIDE	352-342	2.000 lb/ac	[Methomyl 1.800 lb/acre]
METHYL BROMIDE 89.5%	11220-17	30.000 gal/ac	[Methyl bromide 387.472 lb/acre]
ZIRAM 76DF FUNGICIDE	4581-140	8.000 lb/ac	[Ziram 6.080 lb/acre]

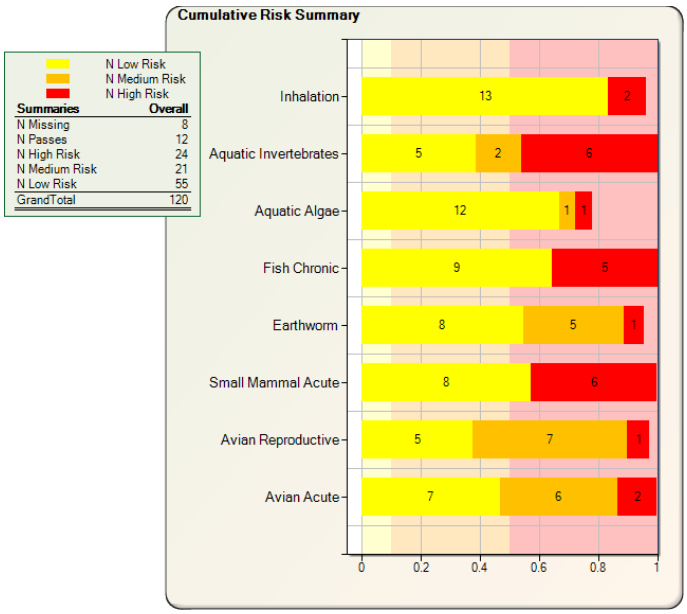


Figure 1. PRiME cumulative risk summary of applications on peach block in 1999 shows 24 applications in the high risk category. Data source: California DPR Pesticide Use Reporting.

2009

Product	EPA Reg. No.	Product App Rate	Active Ingredient(s) App Rate
BUMPER 41.8EC (PROPICONAZOLE) FUNGICIDE	66222-42	3.250E-002 gal/ac	[Propiconazole 0.122 lb/acre]
DUPONT ALTACOR INSECT CONTROL	352-730	0.200 lb/ac	[Chlorantraniliprole 7.000E-002 lb/acre]
SULFUR 6L	66330-211	1.000 gal/ac	[Sulfur 6.032 lb/acre]
ZIRAM 76DF FUNGICIDE	4581-140	8.000 lb/ac	[Ziram 6.080 lb/acre]
CHATEAU HERBICIDE SW	59639-99	0.750 lb/ac	[Flumioxazin 0.383 lb/acre]
GLYFOS X-TRA HERBICIDE	4787-23	0.600 gal/ac	[Glyphosate, isopropylamine salt 2.391 lb/acre]
SURFLAN A.S. AGRICULTURAL HERBICIDE	70506-43	1.000 gal/ac	[Oryzalin 4.000 lb/acre]

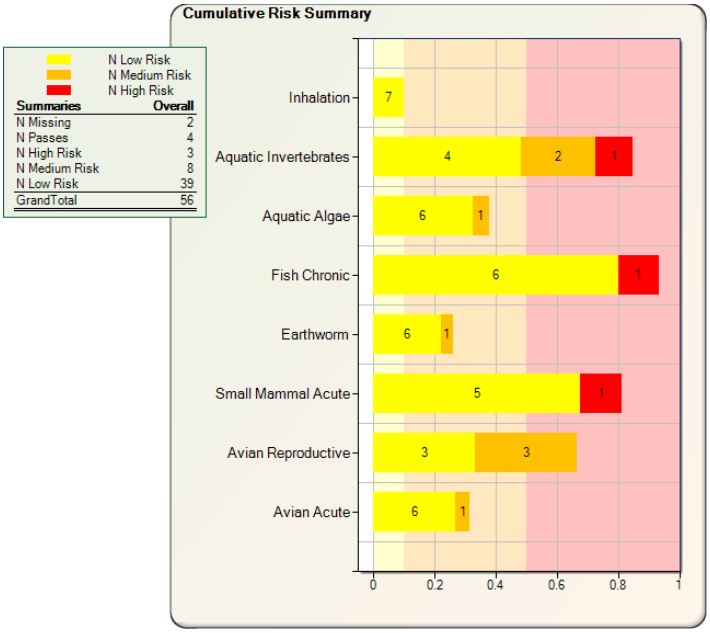


Figure 2. PRiME cumulative risk summary of applications on peach block in 2009 shows three applications in the high risk category. Data source: California DPR Pesticide Use Reporting.

Evaluating potential impacts of infestation

PRiME can be valuable in assessing the potential environmental impacts of a serious pest issue. Figure 3 (below) shows a PRiME cumulative risk summary for a typical season of applications on a block of apples enrolled in the Eco-Apple program. Figure 4 (below) shows a risk summary for the same block of apples but with a potential response to high brown marmorated stink bug (BMSB) pressure.

No BMSB

Product	EPA Reg. No.	Product App Rate	Active Ingredient(s) App Rate
Altacor	352-730	4.000 oz/ac	[Chlorantraniliprole 8.750E-002 lb/acre]
Avaunt	352-597	4.000 oz/ac	[Indoxacarb, S-isomer 7.500E-002 lb/acre]
Altacor	352-730	4.000 oz/ac	[Chlorantraniliprole 8.750E-002 lb/acre]
Assail	8033-26	5.330 oz/ac	[Acetamiprid 9.994E-002 lb/acre]
Assail	8033-26	8.000 oz/ac	[Acetamiprid 0.150 lb/acre]
Delegate	62719-541	6.000 oz/ac	[Spinetoram (XDE-175-J) 9.375E-002 lb/acre]

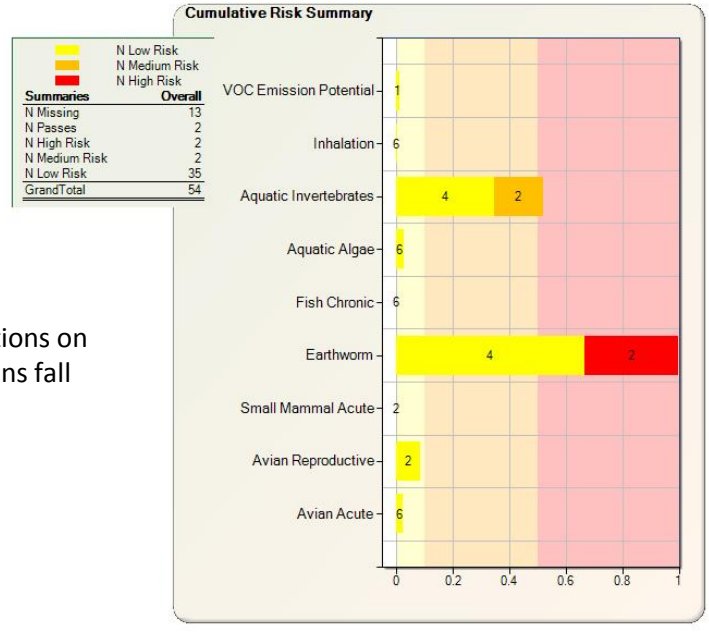


Figure 3. Cumulative risk summary of applications on block of apples without BMSB. Two applications fall in the high risk category.

Worst Case Scenario with BMSB

Product	EPA Reg. No.	Product App Rate	Active Ingredient(s) App Rate
Altacor	352-730	4.000 oz/ac	[Chlorantraniliprole 8.750E-002 lb/acre]
Actara	100-1250	5.500 oz/ac	[Thiamethoxam 7.425E-002 lb/acre]
Surround	61842-18	40.000 lb/ac	[Kaolin 38.000 lb/acre]
Actara	100-1250	5.500 oz/ac	[Thiamethoxam 7.425E-002 lb/acre]
Surround	61842-18	40.000 lb/ac	[Kaolin 38.000 lb/acre]
Altacor	352-730	4.000 oz/ac	[Chlorantraniliprole 8.750E-002 lb/acre]
Actara	100-1250	5.500 oz/ac	[Thiamethoxam 7.425E-002 lb/acre]
Surround	61842-18	30.000 lb/ac	[Kaolin 28.500 lb/acre]
Thionex 50W	66222-62	2.000 lb/ac	[Endosulfan 1.000 lb/acre]
Lannate LV	352-384	3.000 pint/ac	[Methomyl 0.927 lb/acre]
Danitol	59639-35	21.333 floz/ac	[Fenpropathrin 0.422 lb/acre]
Lannate LV	352-384	3.000 pint/ac	[Methomyl 0.927 lb/acre]
Danitol	59639-35	21.333 floz/ac	[Fenpropathrin 0.422 lb/acre]
Belay	59639-150	12.000 floz/ac	[Clothianidin 0.205 lb/acre]
Baythroid	264-840	2.400 floz/ac	[Cyfluthrin, beta 2.006E-002 lb/acre]

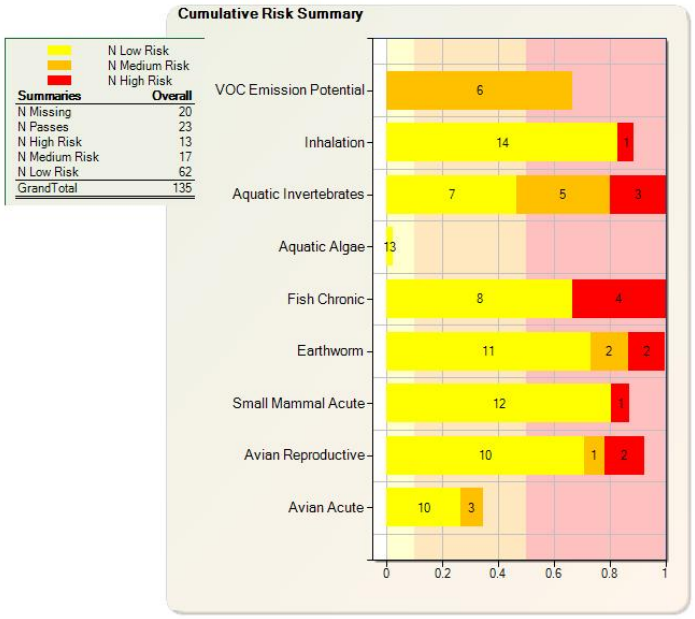


Figure 4. Worst case scenario: potential risk summary of applications on a block of apples with BMSB. 13 applications fall in the high risk category.

Conclusions and Recommendations

As we develop PRiME beyond the CIG grant period, we seek to maintain PRiME's financial sustainability while refining the tool to meet user and potential user needs. We have identified the following recommendations that would facilitate further development and implementation of the tool.

- **Remaining key indices**. We will complete and implement the dietary risk and pollinator indices so that users are not making decisions based on incomplete data. A dietary risk index has been developed and peer-reviewed, and we plan to operationalize this index within the coming months. A pollinator index is nearly complete, and will be added to PRiME as time and resources allow.
- **Site-specificity**. We will complete next year's planned beta test of estimating pesticide concentrations in water based on site-specific scenarios, evaluate results and revise water modeling based on results.
- **Continued and expanded outreach**. Our outreach approach will continue including presentations at scientific and industry meetings. Pierre Mineau is leading the compilation of a peer-reviewed publication explaining the PRiME tool in detail and the science behind PRiME risk indices. We will continue collaborating with key industry pilot testers including organizations with potential to impact many users including food processors, distributors and retailers, and eco-certification programs.

- **Formal launch of PRiME**. Once next year's beta test is complete, we will announce a formal launch including with press releases and an inaugural newsletter focused on PRiME for users and potential users.
- **Collaboration with NRCS**. We will continue to work closely with the NRCS WIN-PST group and with NRCS state and county staff to explore opportunities to use PRiME to support NRCS's mission.
- **Internationalization.** We will continue to develop and implement our plan for internationalization to facilitate use in any country worldwide, including the addition of legacy chemicals no longer in use in the US.

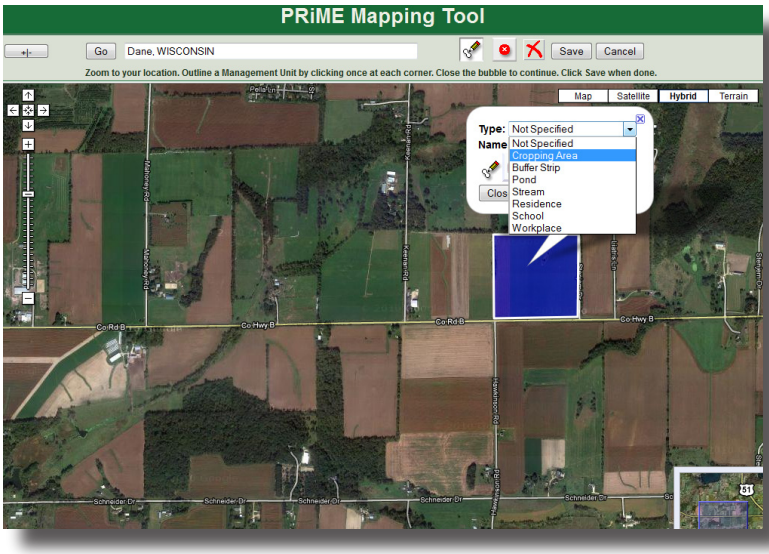
PRiME beta

Pesticide Risk Mitigation Engine

Improving health and environment by identifying and reducing pesticide risks in agriculture.

www.ipmprime.org

PRiME is an innovative online tool to help you assess and reduce potential risks to workers, birds, earthworms, small mammals and aquatic environments. PRiME helps you make more informed choices on practices and products.



PRiME Features

- User-friendly interface.
- GIS-based mapping tool to locate and map cropping areas, sensitive areas, mitigation zones and/or areas at high risk for runoff.
- Product database containing nearly 3,000 products.
- Upload feature to import spray records.

How Does PRiME Calculate Risk?

- Using a novel approach to risk calculation based on site-specific conditions, pesticide properties and empirical field impact data where available, the tool calculates risk to a comprehensive set of indices and can display a risk summary in various formats including risk ratings grouped by risk indices or products and a cumulative risk rating.

Get Started With a PRiME Charter Membership Today!

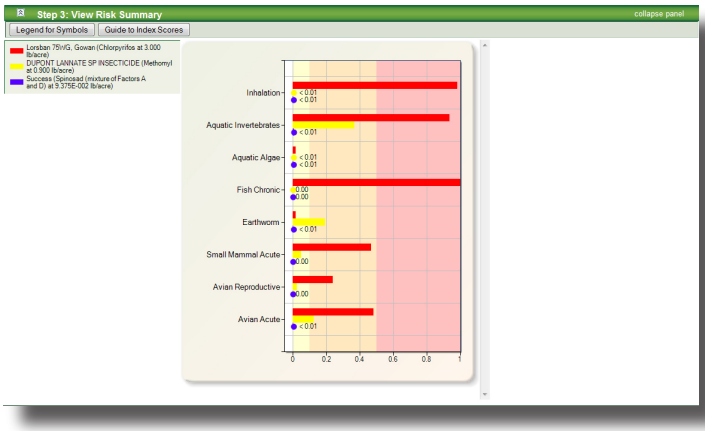
Access PRiME-beta as a Guest or Charter Member. Guest resources are available at no charge. Charter memberships provide full access for one year starting at a low introductory investment of $24.95. Your Charter account will allow you to save and retrieve previously recorded farm and pesticide use data, avoiding redundant data entry and a PRiME experience that is easy and efficient!

Why Use PRiME?

- Pesticide products vary in level of risk.
- Pesticide use sites vary in degrees of vulnerability based on soil characteristics and proximity to surface water, groundwater, wells, residences and other sensitive sites.
- Pesticide application methods entail varying degrees of risk.

What Does PRiME Offer?

- Estimate risk based on your site and application methods.
- Easily identify and prioritize opportunities to reduce risk.
- Identify lesser risk alternative products and mitigation practices to protect natural resources.
- Document your performance in reducing risk over time.



PRiME-beta is a pre-release version, most fully developed for specialty crops. In the coming year, PRiME will be developed for field crops and incorporate more site-specific features, taking into account soil, weather, crop and risk mitigation measures.

Project partners include BCS Ecologic, Oregon State University, Natural Resources Defense Council, Environment Canada, Pesticide Research Institute, Waterborne Environmental, University of Illinois and IPM Institute of North America.

Thanks to our major funders to date, including USDA NRCS, USDA NIFA, Unilever, General Mills, Great Lakes Protection Fund and US EPA Region V and X. To make a contribution, visit www.ipmprime.org/cigipm/donate.aspx.

PRiME beta
Pesticide Risk Mitigation Engine
www.ipmprime.org

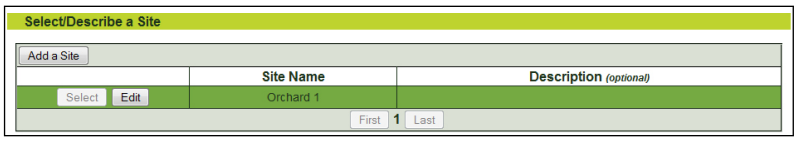
WALKTHROUGH

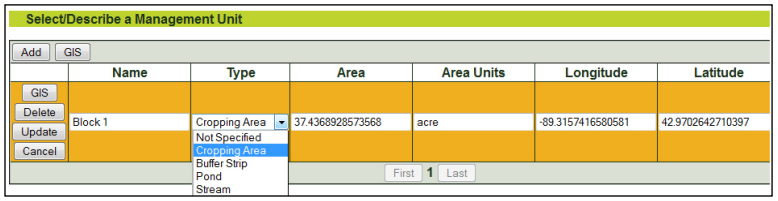
GET STARTED

- Login and set up a workspace. If you are a first-time user, the PRiME Account Setup Wizard will guide you through creation of a site (farm, orchard, etc.) and management unit (field, block, etc.).

STEP 1: SELECT AND DESCRIBE SITES AND MANAGEMENT UNITS

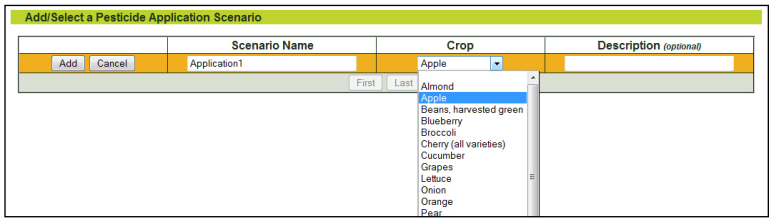
- Select a Site and Management Unit.
- Optionally, you may enter management unit area and geographic coordinates, or map your management units using the PRiME Mapping Tool. PRiME automatically retrieves site-specific soils data from NRCS.



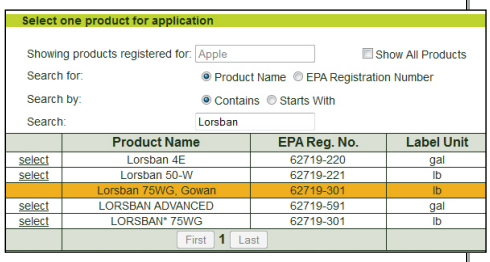


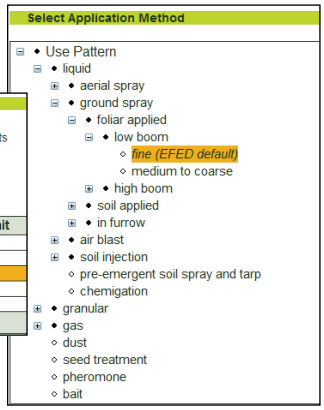
STEP 2: CREATE AND SELECT PESTICIDE APPLICATION SCENARIO

- Add a new Pesticide Application Scenario. A Pesticide Application Scenario consists of one or more pesticide applications on a management unit. A scenario can be historical, e.g. 2009 Spray Records, or it can be hypothetical, such as the products and use patterns you are considering.

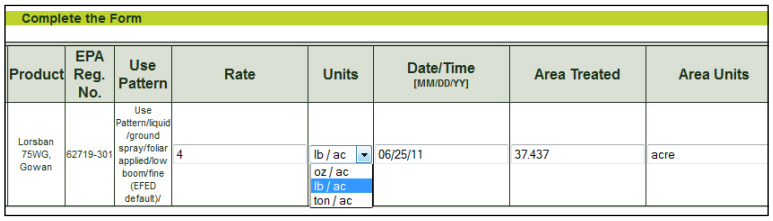


- Select a product and application method.





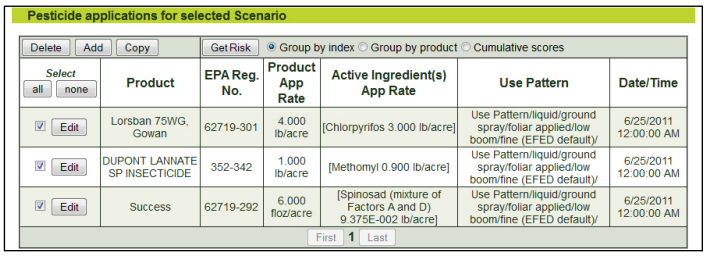
- Select application rate, date and area treated.

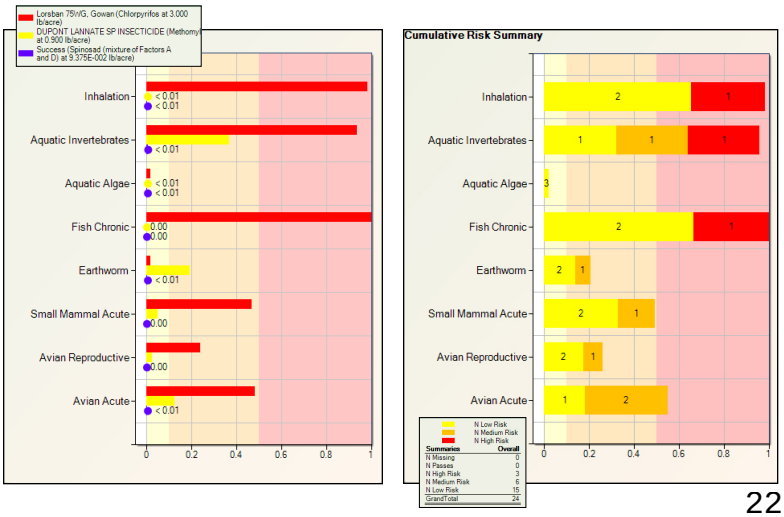


- You may also upload existing spray records using the PRiME Pesticide Application Import tool.

STEP 3: VIEW RISK SUMMARY

- Select applications for risk summary. Select your risk summary display preference: group by index, group by product or cumulative scores. Click the "Get Risk" button to run risk calculation.





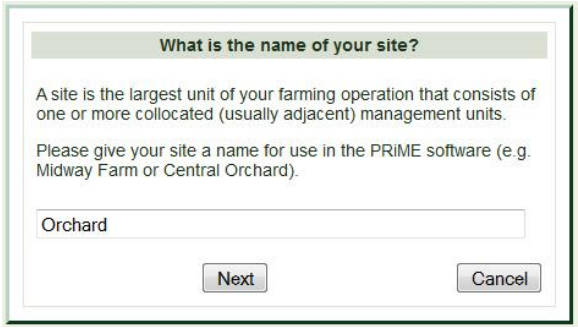
- PRiME estimates risk to nine resource concerns based on your site-specific conditions and pesticide application information.

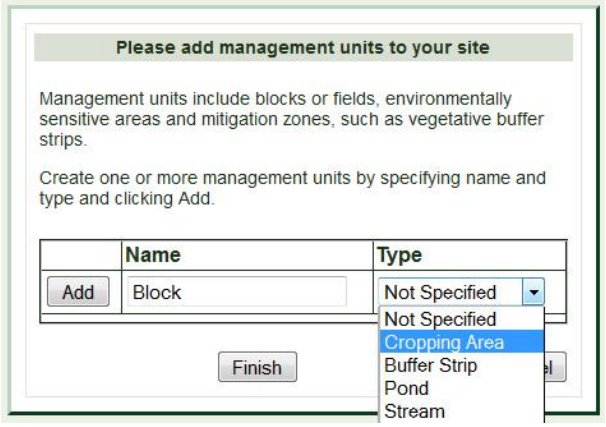
Appendix B

PRiME User Interface Features

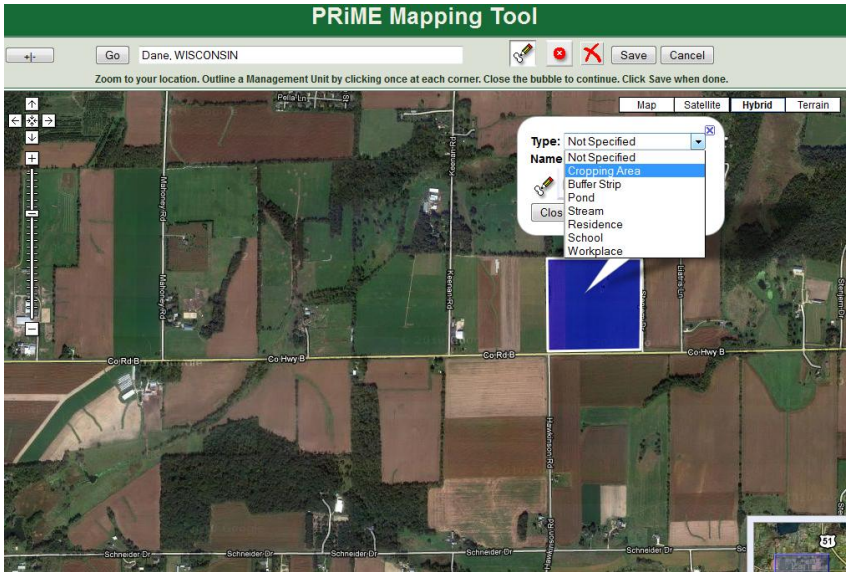
PRiME Home Page

Account Setup Wizard. If you are a first-time user, the Setup Wizard will guide you through creation of a site (farm, orchard, etc.) and management unit (field, block, etc.).

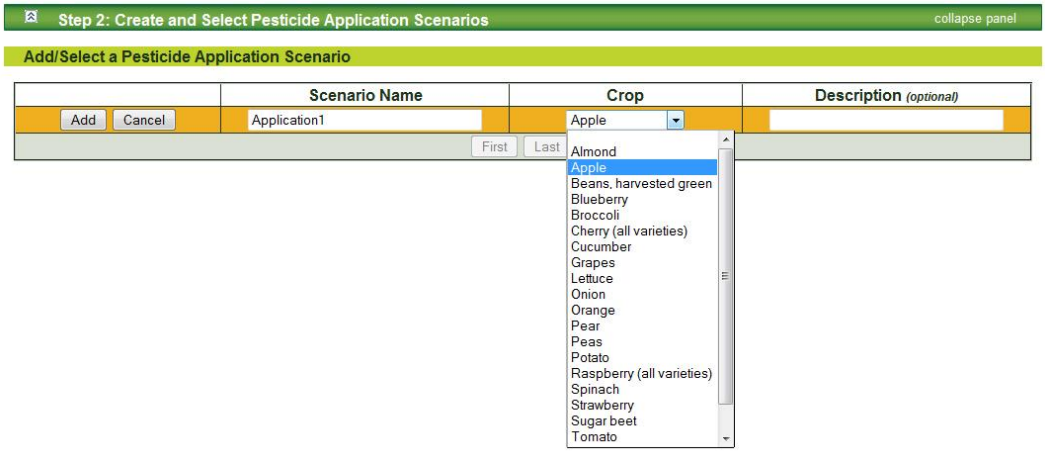




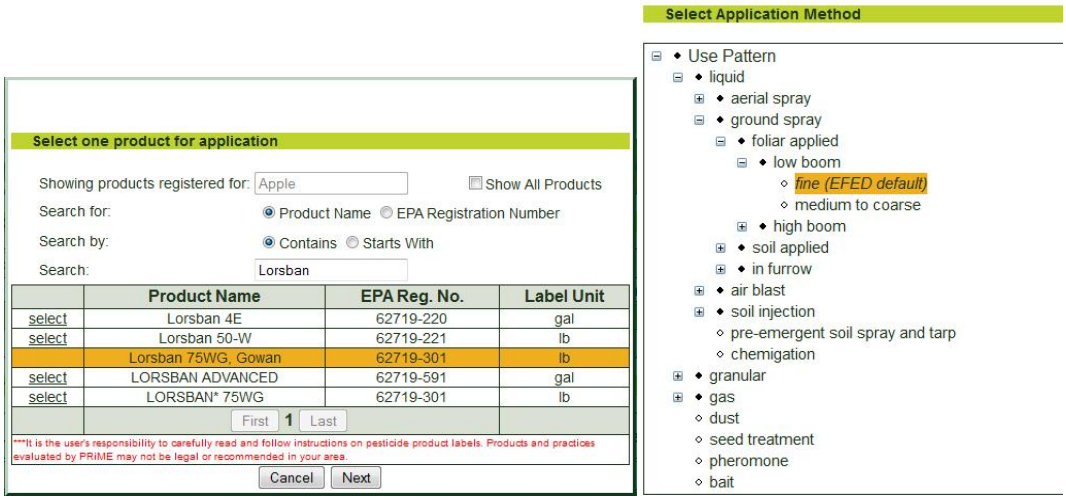
PRiME Mapping Tool. User may map and name management units using Google Earth. In addition to mapping cropping areas, user can map sensitive areas, mitigation zones and/or areas at high risk for runoff.



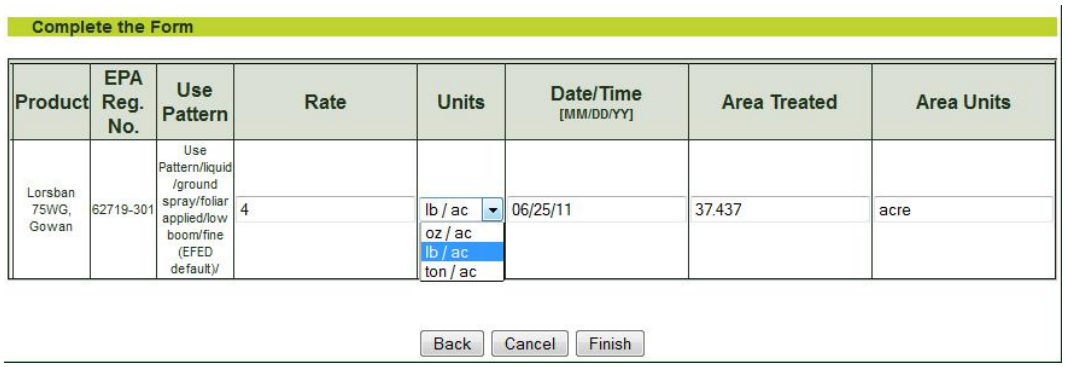
Pesticide Application Scenario. A Pesticide Application Scenario consists of one or more pesticide applications on a management unit. A scenario can be historical, e.g. 2009 Spray Records, or it can be hypothetical, such as the products and use patterns you are considering.



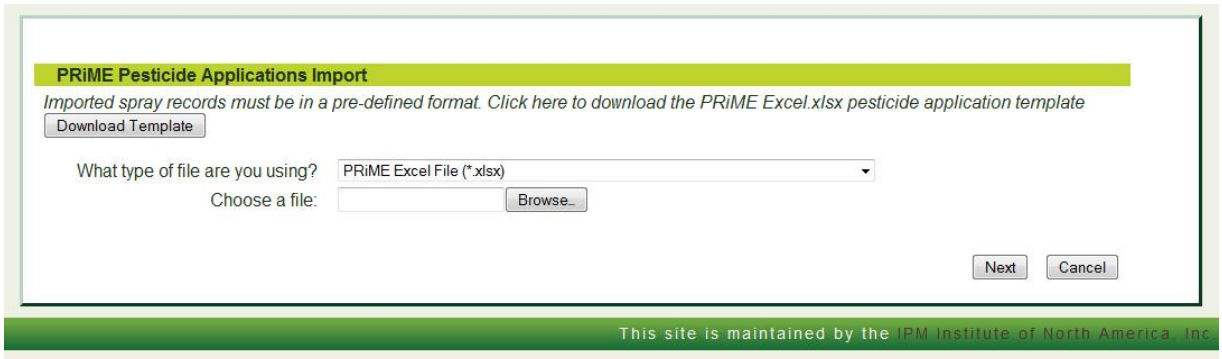
Products and Use Patterns. User selects a product from the product database and an application method from the use pattern tree. PRiME's current database contains nearly all products registered for agricultural use in the U.S.



Application Details. User enters the application rate, date and area treated.



Pesticide Application Import. Optionally, a user may upload existing spray records using the PRiME Pesticide Application Import tool.



Get Risk. User selects risk summary display preference: group by index, group by product or cumulative scores, and then clicks the "Get Risk" button to run risk calculation.

Pesticide applications for selected Scenario

Delete | Add | Copy | Get Risk | ◉ Group by index ○ Group by product ○ Cumulative scores

Select (all / none)	Product	EPA Reg. No.	Product App Rate	Active Ingredient(s) App Rate	Use Pattern	Date/Time
☑ Edit	Lorsban 75WG, Gowan	62719-301	4.000 lb/acre	[Chlorpyrifos 3.000 lb/acre]	Use Pattern/liquid/ground spray/foliar applied/low boom/fine (EFED default)/	6/25/2011 12:00:00 AM
☑ Edit	DUPONT LANNATE SP INSECTICIDE	352-342	1.000 lb/acre	[Methomyl 0.900 lb/acre]	Use Pattern/liquid/ground spray/foliar applied/low boom/fine (EFED default)/	6/25/2011 12:00:00 AM
☑ Edit	Success	62719-292	6.000 floz/acre	[Spinosad (mixture of Factors A and D) 9.375E-002 lb/acre]	Use Pattern/liquid/ground spray/foliar applied/low boom/fine (EFED default)/	6/25/2011 12:00:00 AM

First 1 Last

PRiME Risk Summary. PRiME estimates risk to eight resource concerns based on site-specific conditions and pesticide application information entered.

Appendix C

Technology Review Criteria for Alternative Technologies

The alternative technology developed in this project is the Pesticide Risk Mitigation Engine (PRiME), an efficient, user-friendly option for farmers, advisors, program managers, policy makers and others to fully evaluate pesticide options for impacts on health and the environment, improving the quality and quantity of IPM.

We believe PRiME could be used to assist NRCS staff working with producers in development of IPM plans as part of the NRCS 595 pest management conservation practice standard. PRiME could be used in combination with WIN-PST to improve a producer's ability to reduce impacts on key environmental resources. PRiME could also be used to evaluate a producer's eligibility for cost share and incentive payments.

The IPM Institute and PRiME project members at OSU actively monitor the performance of PRiME and will continue to do so on an ongoing basis. Additionally, OSU has committed budget and staff to maintain hardware and software requirements for PRiME servers ongoing.

To use PRiME, one needs only a computer with internet access. A PRiME user account, with an annual membership fee of $24.95, would allow a user to store information about sites and pesticide applications and upload electronic spray records. Free guest access is also available, but users of this feature are not able to upload electronic spray records or store data for future use.

Due to privacy agreements with our current pilot testers, we are unable to disclose the contact information for individuals that have implemented this technology. See Appendix D for a discussion of pilot testing activities.

As noted in the executive summary of our final report, we cannot yet report quantifiable results achieved through the use of PRiME because PRiME was not developed fully enough to suggest that 2011 pilot testers make pest management decisions based on PRiME output.

However, we have demonstrated that PRiME has applications as a method of identifying high risk pesticide applications in a pest management program, quantifying reduction in pesticide impacts over time, and estimating changes in pesticide risk in response to changes in regulation or pest pressures.

PRiME is developed and operated by the IPM Institute of North America, Inc., an independent non-profit organization formed in 1998 to foster recognition and rewards in the marketplace for goods and service providers who practice Integrated Pest Management, or IPM.

The IPM Institute of North America collects financial/credit card and payment information to accept payments of license or contract fees. The IPM Institute may need to share some of this information with delivery services, credit card clearing houses or other third parties necessary

to complete the transaction. The IPM Institute may use personal information such as name, postal address, email address, and company to engage in outreach activities, including contract renewal and PRiME updates.

Users own the data they enter into PRiME. PRiME uses pest management information only for purposes of providing risk assessments based on that information. PRiME does not share personal or pest management information with any third party unless we have asked for and obtained consent.

Contact Information for technology provider:

Wade Pronschinske
Technical Services Manager
Phone: 608 232-1410
Fax: 608 232-1440
Email: wade@ipminstitute.org

Appendix D
Summary of Pilot Testing

Types of pilots:
Our pilots so far have taken one of two forms. Either we receive a set of spray records, run them through PRiME and report the results back to the data provider. Or, we receive a set of spray records, or a sample set, advise the data provider on how to proceed, then follow up for feedback.

Participants:
We have worked with eight groups ranging from individual growers to large food processors. We have processed and analyzed spray records from approximately 85 growers, although the number of growers with whom we have had direct contact is significantly lower.

Crops/acres:
We have worked with spray records from approximately 14,500 acres and five crops. Details follow:

- Apples: 333 acres
- Pears: 1000 acres
- Cherries: 135 acres
- Green beans: 1700 acres
- Potatoes: 11,300 acres

General comments:
The first issue we usually have to overcome when testing with a new crop is missing products. We do our best to ensure our products database is complete for a given crop, but when we receive a large dataset, there are often a few missing products. In many cases, there are errors with EPA registration numbers (either they are cancelled, transferred, or there is simply a typo). In these cases we advise the data provider on how to proceed or correct the errors ourselves. In other cases, the products are simply missing from our database, and we correct the problem. For this reason, pilot testing has proven to be an invaluable tool for helping us fill in gaps in our product database.

The other common theme among those who use the interface themselves is that it is not very user friendly. We have gained much insight on this issue from face-to-face sessions with users, where we are able to observe their hang-ups and hear from them what does not make sense. We continue to work on these issues.

PRiME's bulk spray record upload has been an essential tool for processing large datasets efficiently. The uploader has been operational on our website for some time, and we are currently revising the interface to make it more user-friendly and to accept various formats for spray records exported from popular farm data management software (e.g. SureHarvest and John Deere ExtendAg).

Future testing:
We have plans this winter to work with tomatoes, grapes and more potatoes. We are also seeking opportunities to work with almonds, peas and strawberries.

Appendix E

PRiME Privacy Statement

Pesticide Risk Mitigation Engine
Privacy Statement

Scope

This Privacy Statement applies to the applications, databases, and websites operated the Pesticide Risk Mitigation Engine (PRiME). PRiME is developed and operated by the IPM Institute of North America, Inc., an independent non-profit organization formed in 1998 to foster recognition and rewards in the marketplace for goods and service providers who practice Integrated Pest Management, or IPM. This Privacy Statement describes the information that may be collected by PRiME and how we use and protect that information.

Assurances

- You own the data that you enter into PRiME.
- PRiME uses your pest management information only for purposes of providing you with risk assessments based on that information.
- PRiME does not share your personal or pest management information with any third party unless we have asked for and obtained your consent.

Information We Collect and How We Use It

Personal and financial information:

- Name
- Postal address
- Email address
- Company
- Financial/credit card and payment information

The IPM Institute of North America uses financial/credit card and payment information to accept payments of license or contract fees. IPM Institute may need to share some of this information with delivery services, credit card clearing houses or other third parties necessary to complete the transaction.

IPM Institute may use personal information such as name, postal address, email address, and company to engage in outreach activities, including contract renewal and PRiME updates.

Farming and pest management information:

- GIS data and/or latitude and longitude of cropping areas, mitigation zones and sensitive sites (optional)
- Products applied and method, rate and timing of applications.

PRiME may use your general location (state and county of farming operations) to provide links to location specific information such as crop profiles, pest management strategic plans and contact information for local NRCS and Extension offices.

PRiME uses GIS data and/or latitude and longitude of cropping areas, mitigation zones and sensitive sites to gather NRCS soils data, calculate sizes of mapped parcels and distances to sensitive sites, all of which improves the accuracy of risk calculations.

PRiME uses product application information to calculate the risk of each application or a combination of applications to various resource concerns, including workers, bystanders, consumers, birds, bees, small mammals, earthworms and aquatic ecosystems. PRiME uses the amount of time between spray application and workers entering the field to estimate risk to workers from pesticides absorbed through the skin.

Farming and pest management information can be factual or fictional. Exact location is optional and can be based on actual farming operations or fictional, where similarities to real situations are unintentional. Pesticide application information can be historical or hypothetical; in other words, you can evaluate spray records from past years or compare applications that you are considering making in the future.

PRiME will not share any user information with third parties unless necessary for processing financial transaction or unless otherwise specified by the user.

Website usage
In order to improve quality and facilitate use of the applications, PRiME may use information gathered as a result of using the website to help personalize website content, facilitate your use of the website (for example, to facilitate navigation and the login process), improve website quality, and monitor website use rates.

Contact Us
If you have questions or concerns regarding your privacy, please contact the IPM Institute of North America. E-mail us at wade@ipminstitute.org, or use the postal address below.
IPM Institute of North America 4510 Regent Street Madison, WI 53705

Updating this statement
IPM Institute may update this privacy policy by posting a new version on this website

Appendix F
PRiME Terms of Use

Pesticide Risk Mitigation Engine
Terms of Use

Welcome to the Pesticide Risk Mitigation Engine (PRiME). PRiME is maintained by the IPM Institute of North America, Inc., an independent non-profit organization formed in 1998 to foster recognition and rewards in the marketplace for goods and service providers who practice Integrated Pest Management, or IPM. Primary funding for the development of PRiME is through a Conservation Innovation Grant from the United States Department of Agriculture, Natural Resources Conservation Service. PRiME is made available to you subject to the following terms and conditions. By using PRiME, you signify that you have read and agree to the Terms of Use.

Section 1 – Intended use of PRiME

The currently released version of PRiME is for **test purposes only**. In the future, the development team will add more risk indices and refine data sources, pesticide fate and transfer models and risk calculations. Consequently, risk rankings are subject to change. The user should not make changes in pest management practices based on the current (beta) version of PRiME.

PRiME has been designed as a relative risk ranking tool, as opposed to an absolute measure of environmental harm. PRiME is intended to be used for resource protection and not as a pesticide selection tool, per se. Our goal is make available to our users the science of site-specific pesticide risk evaluation in an easy to use online tool.

It is the user's responsibility to evaluate products and practices in terms of cost, efficacy, resistance management and other factors involved in pest management decisions. Products and practices evaluated by PRiME may not be legal or recommended in your area. It is the user's responsibility to careful read and follow instructions on pesticide product labels. Use of any pesticide product contrary to instructions on the printed label is neither legal nor recommended.

Due to constantly changing laws, regulations and environmental conditions, the developers assume no liability for the use of products or practices evaluated by PRiME.
PRiME does not intend to discriminate against nor endorse any product or practice evaluated by its risk indices. Product names of commercial pesticides are included to help identify pesticide common names. The developers have assembled a list of EPA-registered products based on information available to them at the time of release. Criticism of products or practices not evaluated in PRiME is neither implied nor intended.

PRiME may NOT be used to:

- Advertise pest management products or practices as evaluated by PRiME;
- Settle disputes with pesticide manufacturers or other third parties.

Section 2 – Website disclaimer

2.1 Availability of PRiME

PRiME is an online application and, as such, is subject to interruptions of service, delays and other problems inherent to providing services over the internet. In order to accommodate ongoing development, the PRiME user interface is subject to change without notice. The developers are not responsible for any delays or temporary interruptions of service.

2.2 Third party sites

PRiME makes use of third party web services including NRCS web soil survey and Google maps. For informational purposes, PRiME may also provide links to third-party sites and documents, including USDA Crop Profiles or Extension recommendations. The developers of PRiME are not responsible for the accuracy or completeness of any third-party information. The developers of PRiME assume no liability for use of products or practices recommended by third party sites.

2.3 Accuracy of data

Available information relating to PRiME risk calculations is constantly changing. The developers have assembled the most reliable data available to them and continue to update databases as new information becomes available. The developers are not responsible for the accuracy or completeness of the data used for risk calculations.

PRiME risk calculations depend, in part, upon the accuracy and completeness of data entered by the user, including GIS representations of application site and sensitive areas, products applied and application rate, method and timing. The user is solely responsible for the accuracy and completeness of all data entered by the user.

2.4 Data storage

PRiME will store user data as long as the user maintains an active, paid subscription to PRiME. All user information will be kept private as per the terms of our Privacy Statement. The developers shall not be responsible or liable for any deletion or loss of any user data. PRiME reserves the right to withhold, remove and/or discard user data for non-payment of fees or failure to comply with the Terms of Use.

Appendix G

PRiME meetings, presentations and workshops

2008

Date	Meeting/Conference	Location	Presenter	Notes
May 2008	SETAC Europe		Paul Jepson	Brief presentation, follow up discussions with developers of FOOTPRINT
July 2008	Harbans Lal, NRCS		Tom Green	Discussed N Trading Tool & APEX
July 26-30	Soil and Water Conservation Society Annual Conference	Tuscon, AZ	Tom Green	Platform presentation
August 3-7	5th SETAC World Congress	Sydney, Australia	Pierre Mineau	Platform presentation
October 24	Agriculture and Agri-Foods Canada and Pest Management Regulatory Agency	Ottawa, Canada	Pierre Mineau	Technical presentation on the PRiME indices
November 10, 2008	WI Eco Apple		Tom Green	Presentation, 40 participants,
November 16-19	56th Annual meeting of the Entomological Society of America	Reno, NV	Chuck Benbrook	Poster presentation
December 5, 2008	North Central NRCS-IPM Working Group		Tom Green, Wade Pronschinske	Conference call presentation

2009

Date	Meeting/Conference	Location	Presenter	Notes
January 2009	California EPA	Sacramento, CA	Tom Green, Pierre Mineau, Michael Guzy, Susan Kegley, Chuck Benbrook	Presentations on the science behind the terrestrial and aquatic indices used in PRiME
January 2009	Meeting with SureHarvest	California	Tom Green, Wade Pronschinske, Pierre Mineau, Chuck Benbrook, Susan Kegley	
March 2009	Stewardship Index for Specialty Crops		Tom Green	Webinar presentation to the Stewardship Index Metrics Review Committee
March 24-26, 2009	6th International IPM Symposium	Portland, OR	Pierre Mineau, Michael Guzy	Invited platform presentations
April 2009	US EPA		Tom Green, Susan Kegley, Pierre Mineau	Discuss PRiME risk indices
April 21, 2009	Procacci Brothers Sales	Philadelphia,	Tom Green	Meeting with Kevin

	Corporation	PA		Delaney, Special Project Manager
July 14, 2009	CIG Showcase	Deaborne, MI	Wade Pronschinske	
September 23, 2009	North Central IPM Center Stakeholders Meeting	Champaign, IL	Tom Green	Presentation, 20-25 participants
October 1, 2009	Stemilt Growers- Pilot Testing	Wenatchee, WA	Tom Green	
October 2, 2009	Oregon NRCS Meeting	Portland, OR	Tom Green, Paul Jepson, Michael Guzy	
October 6,7, 2009	National IPM Coordinating Meeting	Washington, DC	Tom Green	
October 15, 2009	US EPA		Tom Green, Susan Kegley, Pierre Mineau	
October 26, 2009	California Sustainable Winegrowing Alliance Board of Directors Meeting	San Fransisco, CA	Tom Green	
October 27, 2009	Del Monte Pilot Testing	Lathrop, CA	Tom Green	
November 2, 2009	Farm Credit Canada – Field Manager Pro	Webinar	Wade Pronschinske, Amrita Batra, Michael Guzy, Pierre Mineau	
November 2, 2009	Agrian	Webinar	Wade Pronschinske, Amrita Batra, Michael Guzy	
November 4, 2009	Healthy Grown Program Annual Stakeholders Meeting	Madison, WI	Wade Pronschinske, Amrita Batra	
November 3, 4, 2009	Oregon State University Extension Grower Workshop	McMinnville, Mt. Angel, OR	Tom Green, Paul Jepson	
November 5-6, 2009	California Association of Winegrape Growers Board of Directors meeting	Paso Robles, CA	Tom Green	
November 6, 2009	NRCS & IPM working group	Webinar	Tom Green	
November 9, 10, 2009	South IPM Center meeting via conference call		Tom Green	
November 10, 2009	Earth Analytics Group	Webinar	Tom Green	
November 12, 2009	Center for Integrated Ag Systems: All Networks Eco Apple Meeting	Madison, WI	Tom Green	
November 23, 2009	Sure Harvest	Webinar	Tom Green, Amrita Batra	
November 24, 2009	Stewardship Index	Webinar	Tom Green, Amrita Batra	

December 2,3, 2009	Integrated Crop Management Conference (Grower Workshop)	Ames, IA		
December 4, 2009	Benziger Winery	Sonoma, CA	Joe Browde	
December 8, 2009	Washington State Horticultural Association	Wenatchee, WA	Tom Green	
December 13 -16, 2009	Entomological Society of America	Indianapolis, IN	Tom Green	
December 15, 2009	New England Fruit and Vegetable Conference	Manchester, NH	Joe Bagdon	

2010

January 4, 2010	Wisconsin Fresh Fruit and Vegetable Conference	Wisconsin Dells, WI	Tom Green	
January 20-22, 2010	National Alliance of Independent Crop Consultants	Orlando, FL	Tom Green	
January 26-28, 2010	Unified Wine and Grape Symposium	Sacramento, CA	Joe Browde	
Jan 31-Feb 3, 2010	Association of Applied Ecologists	Napa, CA	Paul Jepson	
February 2-4, 2010	Mid-Atlantic Fruit and Vegetable Convention	Hershey, PA	Tom Green	
February 4-6, 2010	Farming for the Future Conference- Pennsylvania Association for Sustainable Agriculture (Grower Workshop)	State College, PA	Tom Green	
February 10, 2010	NORPAC, Food Alliance		Amrita Batra	Webinar
March 2, 2010	Hector Duran, Sue Ratcliffe	Madison, WI	Amrita Batra	Demo, testing
March 8, 2010	Shepherd's Grain		Amrita Batra	Webinar
March 8, 2010	SureHarvest		Wade Pronschinske	Webinar, SISC Training
March 11, 2010	Red Tomato Eco Apple Grower's Meeting	Walpole, NH	Tom Green	
April, 2009	NRCS Net Meeting	Conference Call	Amrita Batra, Michael Guzy	
May 12, 2010	NRCS Regional Agronomists Conference call		Tom Green, Joe Bagdon	Webinar
May 15, 2010	OR Ag Commission		Paul Jepson, Michael Guzy	
May 23, 2010	UW apple growers workshop	LaCrosse, WI	Amrita Batra, Cliff Ohmart	
May 24, 2010	Wisconsin Healthy Grown Potato Growers Meeting	Plover, WI	Wade Pronschinske, Cliff Ohmart	
June 2010	McCain Foods		Amrita Batra	Pilot test
June 3, 2010	UC IPM Advisory Meeting	Davis, CA		

June 24, 2010	Potato Field Day	Othello, WA		
July 2010	General Mills	Pilot Test		
July 10, 2010	WI Healthy Grown Potato Grower Workshop			
July 4-8, 2010	2010 Melbourne IUPAC Pesticide Congress	Melbourne, Australia	Pierre Mineau	Invited platform presentation
July 19, 2010	CIG Poster Showcase	St. Louis, MO		
August 10, 2010	Fred Westcott apple growers			Pilot Test
November 16, 2010	Mid-Atlantic Crop School	Ocean City, MD	Tom Green	

2011

Date	**Meeting/Conference**	**Location**	**Presenter**	**Notes**
February 25, 2011	Apple IPM and PRiME Training	LaCrosse, WI	Wade Pronschinske	
July 15, 2011	PRiME Training	Sturgeon Bay, WI	Wade Pronschinske	

Appendix H
PRiME Project Materials

Project materials relevant to the PRiME tool can be found at PRiME's project materials webpage: www.ipmprime.org/cigipm/materials.aspx.

This webpage includes digital copies of the following documents which explain the background of the PRiME tool and risk indices.

- Mission Statement
- Guide to Interpreting Risk Index Scores
- White Papers:
    - Avian Acute Risk Index (PDF, 10pp, 856KB)
    - Avian Reproductive Risk Index (PDF, 12pp, 934KB)
    - Earthworm Risk Index (PDF, 9pp, 850KB)
    - Small Mammal Population Risk Index (PDF, 10pp, 911KB)
    - Aquatic Risk Indices (PDF, 21pp, 1.2MB)
    - Inhalation Risk Index (PDF, 34pp, 1MB)
    - Human Dietary Risk Index (PDF, 29pp, 316KB)
    - Worker Dermal Risk Index (in preliminary peer review)
    - Pollinator Risk Index (in progress)
- Policies:
    - Indicator Structure
    - Website Look & Feel
    - Transparency/Confidentiality of Project Materials
    - Funding
    - Units of Measure
    - Accuracy of Data
    - Multiple Data Points
    - Missing Data Points
    - Uncertainty
    - IPM
    - Efficacy
    - Resistance Risk
    - Internationalization