We’ve made tremendous strides in improving pesticide stewardship and sustainability since the Integrated Pest Management (IPM) approach was formalized some 50 years ago. Global pesticide use has leveled off in the past 15 years. In the U.S., applications of the most broadly toxic pesticides declined by more than 50% between 1997 and 2007 as a result of regulations and more targeted alternatives developed by industry. The bald eagle, a poster child for pesticide impacts on wildlife, was removed from the endangered and threatened species lists by 2007. This success was due in part to regulatory action to eliminate uses of pesticides toxic to the birds and their young.

Many of the new pesticides registered in the U.S. in the past decade have been low-risk biopesticides, naturally occurring substances, or pesticides that have met USEPA’s criteria for reduced risk. These criteria include low use rates; low impact on human health; low potential for groundwater contamination; low toxicity to birds, fish, and other non-targets; and compatibility with IPM.

Biopesticides include microorganisms, plant extracts, and other biochemicals. *Bacillus thuringiensis*, or Bt, is a market-leading biopesticide with conventional applications as well as incorporation into plants through genetic modification. Although biopesticide sales have been less than 5% of the more than $36 billion annual pesticide market, their sales growth has exceeded conventional pesticides by 14% over the past decade due to reduced residues, shorter re-entry times after application, and improved efficacy in conventional and organic production.

Opportunities for improvement

Worldwide, we continue to suffer unsustainable losses from pest activity. Each year, the pest damage results in losses of crop value estimated at $5 billion a year from sucking insects, $40 billion a year due to weeds, $80 billion from plant-parasitic nematodes, and $300 billion in post-harvest losses due to insects, fungi, and other causes. We need more effective strategies and tools, especially as we look to feed two billion more mouths over the next 30 years.

Concerns about pollinators and pesticides have been well documented. The March 2013 *Report on the National Stakeholders Conference on Honey Bee Health*, published by USDA, indicated that based on laboratory analysis of bees and bee products, bee exposures to pesticides are common and that “Acute and sub-lethal effects of pesticides on honeybees have been increasingly
documented and are a primary concern.” One issue is pollinator exposure to potentially harmful concentrations of pesticides in dust generated when planting insecticide-treated seeds, documented in both U.S. and European studies. The report concluded additional field research is needed to accurately determine risks.

Weed resistance to herbicides has been well covered in recent issues of Crops & Soils magazine. Resistance is also a continuing concern for insects, diseases, and other pests. Corn rootworm, which has a long history of developing resistance to insecticides as well as overcoming crop rotation as a control strategy, has shown the ability to develop resistance to the Cry3Bb1 toxin contained in some genetically modified corn hybrids. Colorado potato beetle, diamondback moth, several cotton pests, and the fungal diseases late blight and apple scab are among the many pest organisms that have successfully overcome multiple chemical control options since the 1920s when insect resistance to insecticides was first documented. In that instance, lead arsenate insecticide was reported to be losing effectiveness against codling moth, a pest of tree fruit.

Lead and arsenic are very stable and can still be found in orchard and former-orchard soils, presenting a risk including the potential for uptake by crops grown in those soils. Environmental and human health impacts from pesticide use continue to be reported; fortunately in many instances, by the time the research is published, regulatory or market changes in pesticide use have mitigated the identified concerns.

There are additional important reasons why we should continue to pay attention to opportunities to improve stewardship and reduce pesticide risk. Although many countries have vigorous regulatory programs, they do not eliminate risk. Regulators recognize that pesticides vary in level of risk; hence, USEPA’s Reduced-Risk Pesticide Initiative and the “Danger,” “Warning,” and “Caution” signal words on pesticide labels. Pesticide application methods and application sites also engender varying levels of risk. Finally, history holds many examples where, despite best efforts by manufacturers and regulators, we learned about specific risks that required modification, withdrawal, or cancellation of registered pesticide uses only after the products had been on the market for a time.

CEAP and IPM

Since June of 2010, USDA-NRCS has been publishing a series of watershed-based conservation assessments on cultivated cropland, which report on adoption and effectiveness of conservation practices and IPM. These Conservation Effects Assessment Program (CEAP) reports are comprehensive, multi-agency efforts that have been completed for six watersheds to date.
In the most recent report, released in May for the Arkansas White-Red River Basin, only 5% of cropland acres benefited from a relatively high level of IPM during the 2003–2006 study period. This compares with 25% of cropland fully meeting nutrient management criteria for rate, timing, and method for both nitrogen and phosphorus and 18% receiving a high level of tillage management to reduce sediment, nutrient, and agrichemical losses from cropland.

In the Chesapeake Bay Region, 9.4% of cropland acres were reported to be under high-level IPM compared with 4.8% in the Ohio-Tennessee River Basin, 5.8% in the Great Lakes Region, and 7% in the Missouri River Basin. Ten percent of cropland acres in the Upper Mississippi Basin scored in the high-level IPM category.

Each report provides additional detail on practices. Pesticides were applied on 98% of cropland acres in the Upper Mississippi River Basin. Routine or preventative treatments were reported on 58% of acres. Biological pesticides were reported for 7%. Pesticides with different modes of action were rotated or tank-mixed to delay resistance on 37%. Dealer recommendations were reported as the primary factor in pesticide decisions on 17% of acres, followed by crop consultants at 3% and university extension at less than 1%.

Deliberate scouting, or systematic observing for pests or pest damage, was practiced on 50% of cropland acres in the Upper Mississippi River Basin. Informal scouting, making general observations while doing other tasks, was practiced on 40%. Weather data were used to guide pesticide applications on 66% of acres. Crops were rotated to manage pests on 77%. Crop varieties resistant to pests were used on 44% of acres. Planting locations were selected to avoid pests on 10%.

In each watershed, researchers used computer modeling to estimate the percentage of acres with low, moderate, and high need for additional practices to address concerns. In the Upper Mississippi River Basin, a 44% reduction in pesticide losses and a 21% reduction in risk to aquatic organisms and humans could be achieved by addressing the 9 million acres with high needs for additional practices. Options include IPM practices, tillage management, buffers, filter strips, windbreaks, and other strategies that reduce or eliminate the potential for pesticide losses from cropland due to runoff, leaching, erosion, or drift.

Adding value to our services

The most striking results from the CEAP reports for CCAs may be the opportunity to more actively engage with our clients on pesticide application decisions. On average, more than half of the acres surveyed receive routine treatments or preventative scheduling. Dealer or crop consultant recommendations are the primary decision factor on less than 20% of cropland acres. These data suggest enormous growth potential to apply our knowledge and skill to improve crop quality and yields, preserve effective pesticide products, and promote reduced-risk options.

What might you do to identify producers in your area or in your current client base who could improve their performance by taking greater advantage of your expertise? Are there strategies you or your colleagues have found effective in improving producer engagement and influence?

Another key lesson from the CEAP reports is that not all cropland acres are equally vulnerable to pesticide losses through runoff, leaching, or drift. Soil type, tillage system, proximity to ground and surface water, and the type and quality of vegetation between application sites and surface water all contribute to increasing or decreasing potential for losses. Pesticide losses equal reduced efficacy and lost value to your clients. What can you do to improve your skills in recognizing cropland most vulnerable to pesticide losses and recommending pesticides appropriate for those vulnerabilities? Is there potential for you to provide additional planning services, or to partner with an individual or firm to do so, perhaps in conjunction with NRCS Conservation Activity Plans for IPM described in the May–June 2013 issue of Crops & Soils magazine?

Where might you develop your business model to increase value-added services? Do you provide scouting services for a fee? Would your clients benefit from professional application equipment calibration? The pilot calibration project that we described in the January–February 2013 issue of Crops & Soils magazine, which delivered better coverage and cost savings to fruit tree growers in Minnesota and Wisconsin, has now become a standard service offering to our scouting clients.

Finally, how can you improve your skills in addressing “inappropriate behaviors”? Pete Nowak, professor emeritus at the University of Wisconsin, has taught many CCAs and others about the importance of disproportionality, i.e., many of the stewardship challenges we face result from the actions of a minority of producers. When you see something that’s not quite right, do you know how to effectively identify the reason and contribute to a balanced solution that makes sense for the producer and environmental stewardship?

Let’s take the opportunity to learn as much as possible from our public investment in the CEAP research. To view the CEAP reports and report summaries, visit www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/nra/ceap.