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Title: Implementation of the IPM and Environmental Education Curriculum

PROJECT DESCRIPTION

Problem, Background and Justification

Ongoing or Completed Work Relevant to the IPM and Environmental Education Curriculum

The University of Connecticut Integrated Pest Management (IPM) Program is the cornerstone of efforts to protect ground and surface water and make farming a sustainable enterprise. IPM's objective is to reduce dependence on pesticides while maintaining crop productivity, crop quality, and the quality of life we enjoy. IPM activities are best visualized as a continuum starting with existing practices - usually spraying on a calendar-based schedule - and moving through a series of steps to production with little or no pesticides used. This is a difficult process. Separate strategies must be developed for managing each pest on each crop, along with ways to combine tactics so that multiple pests can be dealt with at the same time. It is a formidable challenge but one that is being met. In Connecticut, over 590 commercial producers and grounds keepers managing approximately 37,000 acres have been trained in IPM practices. This training has resulted in reducing the use of pesticides being applied to Connecticut crops and landscapes by more than 80 tons (Ashley et al., 2002).

In urban states like Connecticut and Massachusetts, where the majority of land is owned and managed by individuals other than farmers, the above impacts are not enough. To have maximum impact, IPM education must be extended to include the general population. In 2001, with the generous support of the Bingham Trust, development of the K-12 IPM and Environmental Education Curriculum began. To date, curricula for grades K-1, 2-3, and 7-8 have been published, and the curriculum for grades 4-5 is in press. Curricula for the remaining grades will be completed over the next two years. The topics that the IPM and Environmental Education Curriculum teaches address the Connecticut Science Framework as well as the National Science Education Standards. In addition, it is integrated with other curricular areas, such as language arts, social studies, mathematics, art, economics, and technology.

The IPM and Environmental Education Curriculum is relevant to current environmental concerns and events that affect citizens in Connecticut, in the Northeastern Region, and in the nation. The curriculum lessons teach students and other citizens about pests: insects, weeds and invasive plants, and diseases that may occur in homes, yards and gardens, schools, and communities. Using the steps of IPM, participants research pest situations and make decisions on the best way to manage pest populations and safeguard human health using nonpesticidal tactics. Alternate solutions to pesticide use are explored. Curriculum lessons invite participants to devise a mechanical trap, select the most host-specific biological control agent, or design a backyard or community garden to attract wildlife. In an IPM curriculum lesson for grades 7-8, students research the topic of genetically modified foods and participate in a debate to discuss the pros and cons of this controversial subject. In the curriculum for grades 2-3, participants learn about "nature's bug zappers" for mosquitoes. Children develop an understanding of the importance of bats, dragonflies, and other mosquito predators that provide natural, or biological control. Each

dual grade level curriculum includes lessons on chemical control. The focus of these activities is that pesticides should only be used as a last resort when nonpesticidal strategies are ineffective. Judicious selection of pesticides, careful application tactics, and proper disposal of unused pesticides are emphasized in the curriculum lessons.

The IPM and Environmental Education Curriculum is broad-based in terms of pests and crops that are addressed. It engages students, their families, and other citizens in learning about pests, including insects, rodents, weeds and invasive plants, and diseases that are potential threats to plants, humans, and other animals in and around homes, public buildings, agricultural lands, and natural areas. The curriculum also provides information on beneficial organisms, such as lady beetles. The importance of selecting nonpesticidal tactics to manage pests and protect the environment is stressed. A diversity of crops is addressed in the IPM curriculum, whether the crops are part of a backyard vegetable patch, a town butterfly garden, or other type of residential, community, or natural area.

Widespread implementation of the IPM and Environmental Education Curriculum will result in a citizenry that is better prepared to make decisions to safeguard the environment. Citizens will understand the role of IPM in protecting the environment and will appreciate the contribution that farmers make to protect the environment. It is likely that homeowners and gardeners will apply IPM principles when faced with pest management needs in their own homes or in their daily lives. Everyone in the Northeastern Region will benefit from a citizenry that understands IPM and the positive impact it has on the environment.

Development of the IPM and Environmental Education Curriculum by the University of Connecticut began in 2001 with a grant awarded to Dr. Richard Ashley, Professor Emeritus, by the Bingham Trust, a private foundation. The grant runs from 2001 through 2006 and provides resources for the curriculum development team and some of the publishing costs for each set of curricula. The curricula sets encompass two grade levels each: K-1, 2-3, 4-5, 5-6 (there is overlap between the grade 4-5 and the grade 5-6 curricula), 7-8, and 9-12. Presently, curricula for grades K-1, 2-3, and 7-8 have been developed and published. The curriculum for grades 7-8 was the first curriculum to be developed because the teachers who wrote the lessons had prior curriculum development expertise for the middle school grades. The grade 7-8 curriculum was piloted in 2003-2004 and has been extremely well received. Educators who filled out evaluation surveys following workshops and other training sessions ranked the curriculum as one that will be widely used, is teacher-friendly, maintains the interest of students, and addresses identified state and national science standards. The curricula for grades K-1 and 2-3 was published in 2005 and training for educators and other professionals is being provided. The curriculum for grades 4-5 is in press and the grade 5-6 curriculum is currently being written.

As each set of materials is developed and printed, the next step involves educational outreach to introduce the new curriculum to educators from public, private, parochial, American Montessori, and home schools. Additionally, outreach education occurs for 4-H leaders. The IPM curriculum has been introduced through workshops and educational exhibits in Connecticut.

The IPM and Environmental Education Curriculum was developed with three goals in mind:

1) To create interesting, engaging, and fun activities for students to learn about environmental issues and to adopt IPM as a life style
2) "Teacher Ease;" to design a curriculum that is user-friendly and contains all instructional components needed to teach the lesson content as well as all supplemental materials that enhance the teaching experience, such as videos, books, posters, and games
3) Scientific relevance; teaching IPM principals and methods on a practical level that can be embraced by students and other citizens. The IPM curriculum addresses relevant science standards on a state and national level so that they support existing science curricula at schools. The IPM curriculum not only satisfies state and national science standards but it is cross-curricular, addressing math and language arts standards for each dual grade level in a meaningful way.

Each dual grade level curriculum kit is comprised of 20 to 30 lessons, which may be completed as a single topic exploration or as a multi-lesson unit. This allows teachers the flexibility of introducing lessons from the IPM curriculum as they best fit in with the mandated curriculum, testing requirements, and other demands already in place in many school environments. The lessons include core curriculum components as well as related art and technology activities. The lessons are presented in an easy to follow format and involve students in hands-on activities to foster both critical and creative thinking.

The curriculum for grades 7-8 was published in October 2003, and a series of curriculum training workshops was held between October 2003 and September 2004. Four of the training sessions were held at Regional Education Service Centers throughout Connecticut. In March 2004, the Connecticut Science Teachers Association sponsored a training session and exhibit as part of their annual meeting, and in May 2004 the Connecticut Science Supervisors Association repeated the program. The curriculum was also showcased at two Connecticut Science Expositions in 2002 and 2003, attended by more than 10,000 students from public, private, parochial, and home schools. Finally, in September 2004 Eastern Connecticut State University sponsored a training session for their students who were about to graduate as science or social studies teachers. By September 2004, 126 teachers and other educators received training in the use of the IPM and Environmental Education Curriculum, and 61 curriculum kits were distributed free of charge to Connecticut school districts.

The grade 7-8 curriculum, including all 27 lessons, five enrichment activities, and supplemental materials in text form but without video tapes and posters was published in CD-ROM format for distribution to IPM programs in other states, to home school organizations, and to other citizens. The curriculum materials on the CD-ROM will soon be posted on the University of Connecticut IPM website (www.hort.uconn.edu/ipm).

Twenty-two assembly programs, created and presented by performing artist Chris Rowlands, were awarded to some of the schools that participated in the curriculum workshops and that intended to utilize the curriculum. The assemblies were enthusiastically received by the students and judged educationally valuable by their teachers. Mr. Rowlands introduced the IPM curriculum mascot, Izzy the Praying Mantis, presented the principles of IPM in song and demonstration, and involved a high level of student participation.

When the curriculum for grades K-1 was published in December 2004, a similar training program was implemented. In March 2005, the Connecticut Science Teachers Association sponsored a training session and exhibit as part of their annual meeting. Three curriculum workshops were held in April and May at Regional Education Service Centers throughout Connecticut. Additional curriculum kits were distributed to American Montessori Society schools and home school organizations.

State leaders in the Connecticut 4-H program were provided with IPM curricula for grades K-1 and 7-8 for use in their programs. The Putnam and Coventry, Connecticut Boy Scouts also received CD-ROMs of the IPM and Environmental Education Curriculum.

The introduction of the IPM curriculum for grades 2-3 began in the fall of 2005 with a teacher training workshop presented at the National Science Teachers Association Convention in Hartford, Connecticut. Curriculum workshops for grades K-1 and 7-8 will also continue concurrently with training sessions for the grade 2-3 curriculum during 2006.

To date, IPM curriculum kits, which include lesson plans, assessments, and supplemental materials, have been disseminated to 110 schools in Connecticut, with some schools receiving more than one curriculum for different grade levels. Approximately 150 educators and other professionals have received training, primarily in Connecticut and a small number in the Northeastern Region. Despite the overwhelmingly positive response received thus far, the project is just at the beginning of the essential outreach efforts to teach educators about this new and exciting curriculum. IPM has traditionally been a program where farmers and other producers were trained to learn about agricultural pests, identify harmful weeds, insects, and diseases that could lower crop values, and make informed decisions on pest management. Today, however, there is a critical need to transition IPM beyond the agricultural community and to provide educational outreach for all citizens. More and more non-agricultural property owners control much of the land in the Northeastern Region and apply high percentages of pesticides. Homeowners, community leaders, and civic groups have a stake in the health of the environment. They need IPM education. Reaching the targeted stakeholders in environmental protection through teaching the concepts and use of IPM by educating students in school systems is the best approach. If the youngest stakeholders are educated, adults in their lives can be influenced to provide a future citizenry of environmentally concerned and savvy individuals who will be better prepared to assess pest problems and make knowledgeable decisions for pest management. A primary goal of the proposed project is to reach every household in Connecticut and the region through the children. Extension outreach using the IPM and Environmental Education Curriculum is a very effective way to impact these landowners by teaching them how to manage pests and protect the environment. However, funds are needed to enhance initial efforts in Connecticut, and training needs to expand throughout the Northeastern Region.

Demand for teacher training and the IPM curriculum has been very strong in Connecticut. There is also considerable interest from other states in the Northeast and beyond, and this interest is growing. Requests for curriculum kits have been received from teachers, school districts, and curriculum specialists in Louisiana, Massachusetts, New York, Pennsylvania, Puerto Rico, Vermont, and West Virginia. Connecticut and Rhode Island water quality programs have been

supplied with sample kits as well, and colleagues in these programs are interested in working with us to train educators and obtain additional curriculum kits in the region.

The positive and enthusiastic feedback on the IPM curriculum received from participants at the March 2005 Northeast Regional Community and Urban IPM Conference in New Hampshire resulted in an increasing demand to not only develop and distribute IPM curriculum kits in the Northeastern Region but also to extend partnerships to other production regions, national organizations, and Federal agencies. IPM curriculum sample kits were given to state IPM Coordinators at the New Hampshire conference. Through discussions and other communications with Environmental Protection Agency (EPA) Office of Pesticide Programs staff, requests were made to provide information on the IPM curriculum to other EPA departments, including their Office of Environmental Education, IPM in Schools, the EPA-wide healthy schools groups, and regional pesticides outreach coordinators (K. Seikel, personal communication, 2005). IPM curriculum sample kits have also been shared with the National IPM Program, the National 4-H Program, and the Ag in the Classroom Program. The initial feedback was very positive, and follow up communications are in progress (M. Fitzner, personal communication, 2005). Requests have also been received to make the IPM curriculum materials available in a virtual library under development by the Entomological Foundation to provide, on a global level, resources on responsible pest management to students and educators (A. Gower, personal communication, 2005). These requests from intended partnerships with Federal agencies and national organizations will expand implementation of the IPM and Environmental Education Curriculum to other production regions in the U.S.

Philosophy of the IPM and Environmental Education Curriculum

"Over the course of human history, people have developed many interconnected and validated ideas about the physical, biological, and social worlds. Those ideas have enabled successive generations to achieve an increasingly comprehensive and reliable understanding of the human species and its environment. The means used to develop these ideas are particular ways of observing, thinking, experimenting, and validating. These ways represent a fundamental aspect of the nature of science and reflect how science tends to differ from other modes of knowing" (American Association for the Advancement of Science, 1993).

Most teachers know that science instruction is much more than just a presentation of topics that includes "the ability to inquire, the capacity to use scientific principles to make decisions, and the ability to communicate effectively about science" (National Research Council, 1994). The IPM and Environmental Education Curriculum supports science literacy by asking students to apply their knowledge of science content and scientific principles to understand the issues surrounding pest management at home, in the community, and all over the world.

In a world that is changing rapidly, individuals will live in a society that is more complex to imagine, and prepare for a future that is more difficult to predict. Students need to be exposed to curriculum issues that engage them in a model of learning that demands more than the mere recitation of facts. They must have the ability to apply information, solve new and complex problems, and use this knowledge in new situations (Connecticut State Board of Education,

1991). The IPM and Environmental Education Curriculum is designed to engage students in authentic learning activities such as debates and advertising campaigns.

The underlying philosophy of the IPM curriculum is that science is not only a body of knowledge; it is also a way of thinking about the world around us. Environmental science, the focus of this K-12 curriculum effort, requires application of students' understanding in realistic problem-based everyday conflicts. These learning activities require students to access and evaluate information in order to solve problems and make decisions that are critical to protecting the environment for future generations.

In addition, the IPM curriculum that has been developed is integrated with mathematics, reading, language arts, and social studies at all levels. To successfully analyze, synthesize, evaluate, and apply information, students need a strong foundation of knowledge and skills in all of the content areas. Students who understand the connections among knowledge skills from different disciplines will be prepared to make sense of, and act on, the range of information they will encounter in tomorrow's workplace and in their own lives.

Align Curriculum, Instruction and Assessment. Sound instruction is based on clear learning objectives and incorporates provisions for feedback on student understanding and progress. Assessment of student learning involves authentic tasks (tasks that model real-world problems or decisions), which are designed to measure understandings and skills that have been identified in the curriculum. Assessment tasks have been embedded within instructional units so that teachers use the assessments as learning strategies, as well as to gauge student learning.

The IPM and Environmental Education Curriculum reflects the kind of learning that takes place in the real world. Inquiry-based instruction is much more than merely presenting a hands-on lesson. The learning activities promote critical thinking about environmental issues that affect us locally and globally. The lessons give students opportunities to think for themselves. Problems are presented without specific steps to find a solution. Students create their own tables, graphs, and charts in order to explain the resolution of a question or problem based upon their own experimental data. The learning activities promote positive interdependence, individual accountability, and group processing (BSCS Innovative Science Education, 1993).

Integrating the Arts. There are many organizations external to public schools that desire to have the schools teach about certain topics – drugs, nutrition, safety issues, etc. Twenty years ago, recycling was a top priority in the state of Connecticut. To address the IPM and Environmental Education Curriculum and make it come to life, an award-winning professional artist and performer was hired to create an entertaining, yet informative program. For over nineteen years, Chris Rowlands was "Ray Cycle," delivering the message of caring for the planet through recycling materials. College students working on the IPM curriculum project, when informed that Chris would be creating a program, remembered his songs, and more importantly, his message from years ago when they were in primary school. Mr. Rowlands has performed 22 assemblies in Connecticut to date on the IPM curriculum at public and parochial primary and middle schools complete with original songs, artwork, and interactive participation by the students.

The Need for Informed Citizenry

In polls conducted over the past 40 years, Americans have responded that they care about a healthy environment (The Gallup Organization, 2003). Most citizens, however, do not have a basic understanding of environmental issues, nor do they have the necessary skills and expertise to resolve these issues. In a recently published report on the status of environmental education in the United States, a challenge was put forth to increase the level of environmental literacy among citizens now and in the future. To accomplish this challenge, the National Environmental Education Advisory Council recommended broadening environmental education leadership and its targeted audiences; improving the quality, accessibility, and distribution of materials on environmental education and the programs that provide them; developing professional development training programs to prepare educators to teach environmental concepts such as IPM; and building public understanding of the value of this education (National Environmental Education Advisory Council, 2005). The proposed IPM and Environmental Education Curriculum project will implement these recommendations to enhance environmental education for citizens of all ages.

Although the number of farms is declining, an increasing number of students in cities and suburbs are taking agriculture classes and thinking about careers in the industry. These classes teach skills students can apply to science or other fields that they pursue. Much of the increase is in urban areas. Many companies want graduates who are strong in science (Seewer, 2005). A recent study at Washington State University found that children who interacted with plants early in life, took environmental classes, or engaged in gardening with their families became adults who now participate in and appreciate active gardening (Lohr and Pearson-Mims, 2005). The IPM and Environmental Education Curriculum teaches children at a young age about Integrated Pest Management and how these principles apply not only to agriculture but also to residential and community living.

Gardening is now the second most popular leisure activity in the United States (Francese, 2002). Homeowners and other citizens make pest management decisions every day so they can grow healthy plants. In a 2003 market research study by the National Gardening Association, 84 million households in the United States, representing 78% of all households, were involved in lawn and garden activities. These households spent $38.4 billion on lawns and gardens, and this figure continues to increase annually (Butterfield, 2004). Proper care and maintenance of residential landscapes requires knowledge and decision-making about pest management, selection of nonpesticidal tactics, and protection of environmental quality to reduce human health risks. This knowledge begins with IPM.

In a news conference on environmental education in the state of Washington, a recent survey indicated widespread citizen support for environmental education and its inclusion as part of a well-rounded education. Preliminary research showed that students gained better scholastic achievement levels when they attended schools that offered environmental education in comparison to students from schools where environmental science was not taught. Teaching environmental education to students and all citizens gives them the solid science background they need to prepare them for real-world situations. Students should learn about nature and the environment by experiencing it first hand (Koenings, 2004).

As Connecticut and other states in the Northeastern Region lose valuable forests and farmland to development, the growing urban and suburban populations need to acquire the skills necessary to make informed decisions on pest management to minimize pesticide use, maintain a healthy food supply, and provide safe drinking water. Children are our future, and they must be prepared to be good environmental stewards.

Stakeholder Involvement

The Community IPM Working Group in the Northeast surveyed and prioritized the pest management needs requested by stakeholders in the region. The stakeholder-identified needs addressed a wide array of surroundings, including homes, lawns, and gardens, and school buildings and landscapes. The Working Group also identified a need for teaching IPM in schools. Priorities set forth by the Community IPM Working Group in 2003 include:

a) "Develop outreach to homeowners, retailers of homeowner pest management products, and 'multipliers' (e.g., libraries, teachers)" and
b) "Identify and address research and outreach needs for structural pest management in community settings (residences, public buildings, schools)"

The principal focus of the Community IPM Working Group for 2005 is IPM in residential settings, including suburban outdoor IPM and indoor urban IPM (Northeastern IPM Center, 2005).

Approximately 200 participants gathered in New Hampshire in March 2005 for the Northeast Regional Community and Urban IPM Conference. During the conference, participants were asked to prioritize topics and related issues that involve community and urban IPM (Please see Appendix A, "Northeastern IPM Center: Priorities for Community and Urban IPM."). The IPM priority receiving the highest number of votes was Education and Outreach. Developing outreach IPM for homeowners and 'multipliers' (e.g., teachers, media, libraries) was included as the issue most critical to address in the immediate future. The second highest priority was to determine IPM impacts and successes by developing criteria to measure successes of IPM implementation in community settings. A third priority, developing IPM curricula for schools, also received a significant number of votes from conference participants (Northeastern IPM Center, 2005).

The Public Health IPM Working Group established stakeholder priorities in 2003 to address public health concerns regarding ticks, mosquitoes, and the diseases associated with these organisms. The second highest priority determined by the Working Group is development and dissemination of IPM educational programs and guidelines for management of ticks and mosquitoes. The educational programs and materials should be suitable for homeowners, schools, municipalities, and environmental groups, with an emphasis on selecting and using the least toxic pesticides or nonpesticidal methods (Northeastern IPM Center, 2005).

On a national level, stakeholders across the nation were surveyed to determine national priorities for IPM. A National Road Map for Integrated Pest Management was developed in 2004 to

increase information exchange among all IPM practitioners on a national level. The National IPM Program identified three focus areas: 1) production agriculture, 2) natural resources and recreational environments, and 3) residential and public areas. Strong components of research, education, and extension are required to address priorities of these focus areas. Protection of the environment is essential to reduce potential human health risks and maintain a healthy food supply, and pesticide use must be lowered to minimize adverse impacts from non-point source pollution in water bodies that are not only used for recreation but for drinking water as well. The National Road Map for Integrated Pest Management lists the areas where citizens live, work, and play as the locations where they are most likely to be exposed to pests and pest control methods. IPM programs need to include information on pest control, and effective delivery methods such as training programs to convey this needed information to citizens, to ensure that the use of IPM practices will have minimal impacts on the environment. A key educational need for IPM development and adoption requested in the National Road Map is to create public awareness and understanding of IPM, including health, environmental, and economic impacts, through education programs in schools (Northeastern IPM Center, 2005).

The objectives of the proposed project, 1) to continue to develop and provide educational outreach by training science teachers and IPM leaders on the new IPM and Environmental Education Curriculum; and 2) to implement the K-12 IPM and Environmental Education Curriculum in order to produce environmentally-aware citizenry address these priorities in the Northeastern Region and the nation.

The unanticipated interest in the IPM curriculum throughout the region has created demand for additional numbers of curriculum kits and for additional training programs and workshops. Funds are required to cover the increased costs associated with training sessions and production of curriculum kits and to accommodate requests wherever possible. With the potential applicability of the IPM and Environmental Education Curriculum in the Northeastern Region as well as other regions in the United States, it is anticipated that requests for IPM curriculum kits and the accompanying training programs will continue to increase over the next five to ten years.

The implementation of the IPM and Environmental Education Curriculum into Connecticut schools will result in a more environmentally-aware citizenry who will be better prepared to make knowledgeable decisions to protect the environment. In addition, the public will be more appreciative of the efforts made by farmers to protect the environment. Considerable interest has developed for the use of the Connecticut IPM curriculum as the basis for developing IPM curricula for other Northeastern Region states. It is anticipated that similar results will be realized throughout the nation.

Objectives and Anticipated Impacts

The following **objectives** are proposed for the project:

1) To continue to develop and provide educational outreach by training science teachers and IPM leaders on the new IPM and Environmental Education Curriculum. Training will include the following areas:

a. Environmental concerns in the Northeastern Region
b. Principles of IPM as presented in the curriculum
c. Impacts of IPM on solving environmental problems
d. Implementation of IPM methods that can be used to contribute to the restoration and preservation of the home and agricultural environment

A copy of the curriculum will be provided during training.

2) To implement the K-12 IPM and Environmental Education Curriculum in order to produce environmentally-aware citizenry

The following **impacts** are anticipated based on the fulfillment of project objectives:

1. The IPM and Environmental Education Curriculum will provide knowledge and practice in the principles of sound, science-based pest management for insect, weed, and disease organisms. The curriculum promotes reduction of pesticide use by teaching students and other citizens about alternative, nonpesticidal tactics that can be adopted to control pests in their homes, schools, municipal buildings, communities, yards, gardens, and natural areas. In situations where pesticides must be used, the curriculum stresses that careful selection of pesticides must occur to safeguard human health and the environment. Following educational instruction, IPM practices could be adopted and implemented in a measurable number of homes, schools, and communities. The number of participants in the training sessions, the extent that their training would reach others, and how these stakeholders will adopt IPM practices in their homes, schools, and communities would be quantified. Numbers of curriculum kits delivered to training session participants would also be determined.

2. In the same manner, as training for science teachers is developed and provided, training to other IPM and environmental leaders in Connecticut and the Northeastern Region will also expand. Stakeholders representing environmental, conservation, and civic organizations, which may include 4-H, Boy Scouts and Girl Scouts of America, the Connecticut Department of Environmental Protection, The Nature Conservancy, and the Audubon Society, will be contacted and steps taken to develop and provide training on the IPM and Environmental Education Curriculum.

3. A great potential exists for enhanced collaboration among stakeholders in the Northeast who will be able to implement IPM strategies and systems as a result of receiving training on the curriculum. Teachers who participate in a training session at one school, for example, will then be able to share the information with colleagues in an entire school district or region. With time, IPM practices that are presented in the curriculum could be disseminated or otherwise made available to a growing list of stakeholders in the Northeastern Region and beyond.

4. Types of IPM systems and strategies will be validated in follow up communications with teachers and environmental leaders in the Northeastern Region. Training session participants will be surveyed regarding the extent to which the curriculum was used.

The number and type of IPM curriculum kits and other educational materials disseminated will be quantified as well as the number of participants in the training programs. Information on the IPM and Environmental Education Curriculum, including training sessions and workshops, will be made available on the University of Connecticut IPM website. It is hoped that some of the IPM curriculum materials will be made available online and in CD-ROM format during the two years that the proposed project is conducted. IPM website hits will be tracked and summarized over the two-year period. These impacts will improve and increase implementation of IPM strategies and systems in the Northeast.

5. IPM will transition from being a strategy used in the traditional agricultural arena of farms and orchards to include homes, schools, communities, and the natural landscape. As teachers and other educators receive training on the IPM curriculum, they will be able to teach IPM methods to their students or other citizens, who will further share this information with their families and communities. IPM will then be delivered to a growing pool of stakeholders. The stakeholders who receive training will be enabled to make knowledgeable decisions to reduce adverse environmental effects from pest management practices, such as overuse of chemical solutions to pest problems.

Approach and Procedures

The proposed project will be conducted over a two-year period. To accomplish the stated objectives, the following approach and procedures will be undertaken:

1. For Objective 1 (To continue to develop and provide educational outreach by training science teachers and IPM leaders on the new IPM and Environmental Education Curriculum), IPM curriculum training for teachers, other educators, and environmental leaders will be developed. The training will include environmental concerns in the Northeastern Region; principles and practices of IPM; impacts of IPM on environmental problems; pests and pest life cycles encountered in homes, schools, communities, yards, gardens, and natural areas in the region; and IPM methods that can be used for pest management, with emphasis on nonpesticidal tactics and reduction of pesticide usage in the environment.

   Information on the new IPM and Environmental Education Curriculum will be presented through training sessions or workshops to science teachers, curriculum specialists, curriculum consultants, and other educators at public, private, and parochial schools, as well as home school organizations. An IPM curriculum workshop will be presented at a Connecticut state university and as a Special Topic Session will be offered at Confratute, a professional development program and summer institute for teachers and educational leaders. The training sessions will also be offered to environmental leaders in Connecticut and the Northeastern Region.

   During Year 1, the project will continue to build as new components are added to the workshops, exhibits, and other programs that were developed and conducted from

2003 through 2005 for the grades K-1 and 7-8 curricula. New IPM training sessions will be created during Year 1 for the grade 2-3 curriculum, which was recently published in the fall of 2005. In Year 2, the plan is to continue to enhance training by developing and presenting training sessions and conducting other extension outreach activities for the grade 4-5 curriculum, which is anticipated to be published in the spring of 2006.

A copy of the curriculum and other necessary materials will be provided to attendees during training sessions.

2. For Objective 2 (To implement the K-12 IPM and Environmental Education Curriculum in order to produce environmentally-aware citizenry), training sessions and workshops will be conducted locally in Connecticut. A minimum of four training sessions or workshops will be presented in Connecticut each year during Years 1 and 2 of the proposed project. The training sessions will include distribution of curriculum kits and supplemental materials to trainees. The IPM curriculum will be introduced during the training sessions. Lesson content will be described, including:

    - Focus areas and skills
    - Curriculum objectives
    - Essential questions and understandings
    - Background information
    - Vocabulary introduced in each lesson
    - Materials provided (handouts, overhead transparencies, supplements, videos, books, games, posters, etc.)
    - Preparations required
    - Involvement activities
    - Assessments
    - Follow up activities
    - Follow through projects for more in-depth coverage of the curriculum lessons
    - Resources to enhance the learning experience

    Participants in the training sessions will also participate in hands-on demonstrations of several activities included in the curriculum lessons to gain valuable participatory experience that will assist them in the classroom or area where the lesson is to be taught to the students. The hands-on demonstrations may occur as an outdoor activity, such as field identification of insects or weeds, learning about nonpesticidal tactics, or making and recording observations from small plots. Indoor hands-on activities may include learning about biological control through an interactive predator-prey game, using microscopes to observe small organisms, devising mechanical methods to monitor or control pests, or reading and evaluating current material on environmental problems to derive solutions for those problems. The training session attendees will learn how these activities help teach the principles of IPM to students and other citizens.

3. Curriculum training sessions or workshops will be adapted from the Connecticut training programs for the grade 2-3 and 4-5 curricula and implemented in Massachusetts or other state in the Northeastern Region. A training session will be developed and implemented for the grade 2-3 curriculum during Year 1. A separate training session will be developed and implemented for the grade 4-5 curriculum in Year 2. The training sessions will be developed according to the protocol described in **Approach and Procedures**, Section 2.

4. A separate workshop will be developed on the IPM and Environmental Education Curriculum for a presentation to be delivered at a regional meeting in the Northeastern Region, such as the Northeast IPM Coordinators meeting, the New England Vegetable and Fruit Conference, or the New England Greenhouse Conference. The workshop will be developed during Year 1 and presented during Year 2.

Project Timetable

Year 1 (May 1, 2006 through April 30, 2007)

- Training sessions and workshops will be developed for the IPM and Environmental Education Curriculum during Year 1. A new IPM training program for the grade 2-3 curriculum will be created and presented to teachers and other educators in Connecticut.
- A curriculum training session or workshop will be adapted from the Connecticut training program for the grade 2-3 curriculum and implemented in Massachusetts or other state in the Northeastern Region.
- Contacts with IPM and other environmental leaders from conservation or civic organizations will be initiated to expand the IPM curriculum training sessions to include stakeholders from these groups.
- A separate workshop will be developed on the IPM curriculum in Year 1 for a presentation to be delivered at a regional meeting in the Northeast during Year 2.

Year 2 (May 1, 2007 through April 30, 2008)

- Training sessions and workshops will continue. A new IPM training program for the grade 4-5 curriculum will be developed and presented to teachers and other educators in Connecticut.
- A curriculum training session or workshop will be adapted from the Connecticut training program for the grade 4-5 curriculum and implemented in Massachusetts or other state in the Northeastern Region.
- Curriculum training sessions will be conducted for IPM and other environmental leaders in conservation or civic organizations in Connecticut and the Northeastern Region.
- A separate workshop on the IPM curriculum will be presented at a regional meeting in the Northeast.

Evaluation Plans

Anticipated impacts and outcomes resulting from the proposed project will be measured by the following objectives:

1. Teachers, educators, and other IPM or environmental leaders who attend training sessions or workshops for the IPM and Environmental Education Curriculum will be asked to complete evaluation forms. The forms will provide feedback on the following areas:

    - the effectiveness of the training
    - how relevant the materials are for current or future environmental science classes or programs
    - the number of students or other participants that the educators will in turn teach about the IPM and Environmental Education Curriculum

2. The responses from the forms will be tallied and summarized to determine the outcome of the training sessions and workshops and how the IPM curriculum will be used by each participant. The forms will also be used to maintain a database of contacts in the region as curricula and new training sessions are developed and implemented.

3. A follow up evaluative form and cover letter will be sent to teachers and other educators who have received the IPM and Environmental Education Curriculum and/or who have attended training sessions or workshops. Comments from educators who are using the curriculum will be gathered once they have had sufficient time in their classrooms to become familiar with the materials and have taught some of the IPM lessons to their students. Teachers and other educators will be asked for their feedback on: 1) the relevancy of the curriculum materials, 2) the extent of their use of the materials, and 3) the number of citizens, including children and their families, who will be impacted by the curriculum. Knowledge gained by students who learn about IPM methods and then participate in IPM-related activities, such as designing a poster on IPM or investigating a pest control method as a research project, will be compiled from students' assessments of these activities that are included in each curriculum kit. Results from the returned data will be compiled and tabulated to determine short-term impacts and adoption rate of the IPM curriculum materials in Connecticut, Massachusetts, and the Northeastern Region. Teachers will be asked for their opinions on particular curriculum lessons or units that they used in class to assist with planning for future IPM curriculum development and educational outreach. The responses from educators who have used the curriculum will be summarized and reported.

4. It is anticipated that a growing network will form of trained educators and other environmental leaders who will in turn further the educational outreach impacts of the project by conducting workshops or other training sessions for additional teachers, students, and other citizens in their school, school district, or community. Through the training sessions, information will be delivered on the principles of IPM and the impacts of IPM on solving environmental problems. Students and other citizens who receive

training will be better prepared to address environmental concerns in the Northeast and implement IPM methods to make informed decisions and respond to those concerns.

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