

Behavior Change Best Practices: Integrated Pest Management and Biodiversity Conservation in Horticultural Systems — A Guide for Extension Professionals #1: Introduction¹

Adeyinka T. Ayodele and Laura A. Warner²

This publication series provides science-based guidance for integrating integrated pest management (IPM), an approach that combines biological, cultural, physical, and chemical strategies to manage pests while minimizing risks to people and the environment, and biodiversity conservation, which involves protecting and enhancing the variety of living organisms and their habitats, in Florida's ornamental and landscape horticultural systems from a human dimensions standpoint. It is intended for Extension professionals, nursery and greenhouse producers, landscape and pest-management professionals, Master Gardener Volunteers, and others who encourage residents, landscape managers, nursery professionals, and other stakeholders to adopt integrated pest management and biodiversity conservation practices. As part 1 of a five-part manual, this introduction establishes why behavior change matters for IPM and biodiversity and lays the foundation for later sections that focus on behavior change techniques.

This manual aims to equip the reader with research-based, practical skills, enabling them to deliver comprehensive education in integrated pest management and biodiversity conservation for horticultural systems. By building capacity, this manual supports lasting improvements in sustainable pest management and ecosystem stewardship. The components of this guide are:

- Introduction (this publication)
- Defining and Selecting the Audience
- Choosing Behaviors and Developing a Strategy
- Understanding the Audience
- Evaluating Behavior Change

Linking to Long-Term Vision

Effective work in IPM and biodiversity conservation begins with a long-term vision. Reflecting on the importance of these practices helps guide Extension professionals in making intentional decisions about program priorities and resource use (Crowley et al., 2020). A defined sense of

purpose allows professionals to connect their daily activities with broader community and environmental outcomes such as healthier landscapes and increased biodiversity.

Intentionality is a core feature of established Extension planning frameworks. The Targeting Outcomes of Programs (TOP) Model (Boone et al., 2002) emphasizes starting with clear end goals and working backwards to identify the behaviors, learning needs, and activities necessary for the desired conditions (Harder, 2016). In the context of IPM and biodiversity conservation, desired conditions might include healthier landscapes, expanded habitat, or greater public acceptance for ecologically beneficial landscapes. Keeping these long-term outcomes in mind helps ensure programs are designed to produce meaningful ecological and social impacts (Barnes, 2024).

Long-term vision focused on these key outcomes will support more consistent behavior change efforts and position Extension professionals to select appropriate audiences, prioritize high-impact behaviors, and choose approaches that align with real decision-making contexts. Integrating reflection and purposeful planning into professional practice helps ensure that education and outreach efforts are grounded in evidence and responsive to stakeholder needs. For example, emphasizing increased public acceptance for pollinator gardens might guide Extension professionals to work to reduce barriers to engagement rather than focus solely on plant lists.

By integrating reflection and purposeful planning into their work, Extension professionals can strengthen the durability and impact of IPM and biodiversity conservation efforts. A clear long-term vision anchors programs in evidence, supports accountability, and helps ensure that education and outreach contribute to resilient horticultural systems across Florida's communities.

Background

Ornamental horticulture and landscape horticulture are economically and environmentally significant components of Florida agriculture. These systems include the production, installation, and maintenance of ornamental plants that enhance residential, commercial, and public spaces. Demand for ornamental plants continues to rise as urbanization expands and communities invest in green spaces, increasing pressure on professionals to produce and maintain healthy plants while protecting environmental quality (Janbandhu et al., 2024).

Balancing productivity with environmental stewardship remains a critical challenge. Traditional landscape management approaches can disrupt ecological balance and have prompted the search for more sustainable pest management strategies (Galli et al., 2024). This movement has advanced IPM, an ecological approach that combines cultural, biological, and chemical tactics to keep pests below damaging levels while safeguarding ecosystem services (Zhou et al., 2024).

Given the complex pressures in horticultural settings, behavior change is urgently needed in many contexts. While ecological and entomological sciences are needed to identify and advance horticultural practices that support biodiversity, people must be willing to engage in such practices to realize their full impact. Understanding what drives individuals to choose sustainable actions is a key part of fostering lasting change (McKenzie-Mohr, 2012), as people who make decisions about landscape management need to adopt best practices that conserve biodiversity within horticultural systems. This gap between awareness and action has been widely documented in environmental behavior research, where individuals may express concern but fail to adopt corresponding practices (Kollmuss & Agyeman, 2002).

While IPM and biodiversity conservation are grounded in ecological and technical sciences, their success ultimately depends on human decision-making. Practices such as scouting, threshold-based treatments, habitat diversification, and reduced-risk pesticide use deliver increased benefits when they are consistently adopted by residents, landscape professionals, nursery and greenhouse producers, and other landscape managers. As a result, understanding how and why individuals adopt, resist, or discontinue these practices is essential. Behavior

change is the mechanism through which technical IPM and biodiversity conservation recommendations translate into real-world outcomes.

Behavior Change

Historically, education has assumed that lack of knowledge is the central barrier to people taking action (Grant, 2023). While knowledge and awareness are precursors to action (Gusto et al., 2023; Rogers, 2003), they are rarely enough on their own. Individuals may value biodiversity and pollinator conservation but may feel constrained by social norms, lack of motivation, perceived costs, complexity, or other uncertainties that influence decision-making to a greater extent than knowledge alone (Gusto et al., 2023; McKenzie-Mohr, 2012).

Beyond these barriers, conservation efforts often miss some important opportunities. Even with conservation programs in place, individuals interested in conservation issues are often overlooked, despite their potential to broaden the impact of conservation organizations (Maynard et al., 2020). Furthermore, high levels of interest do not fully translate into action (Silvert et al., 2023), suggesting an inactive audience with strong potential for engagement. Lastly, conservation research and practice have yet to fully take advantage of behavioral sciences and innovative strategies for changing behavior, limiting their ability to generate sustained behavior change (Balmford et al., 2021).

Extension's value lies in intentionally designing for behavior change (Rogers, 2003). Extension professionals have an important role in promoting practices that maintain biodiversity, reduce negative environmental impacts, and ensure sustainable production for the future. Moving beyond basic awareness, this guide provides Extension professionals and others with evidence-based behavior change strategies that support adoption, maintenance, and long-term impact in horticultural pest management and biodiversity conservation.

The Nature of Behavior Change

Behavior change can be described as a multi-stage process rather than a discrete event. The Transtheoretical Model of Change (TTM) says that people go from not thinking about a potential change, to considering it, getting ready to act, taking action, and finally sustaining the change (Prochaska et al., 1992) (Figure 1).



Figure 1. Stages of change pertaining to requesting wildlife-friendly landscape maintenance from landscape professionals: precontemplation, contemplation, preparation, action, and maintenance.

Credit: Figure adapted from Prochaska et al. (1992) by UF/IFAS.

While TTM explains where individuals are in the behavior change process, Diffusion of Innovations helps explain why they may choose to adopt or reject specific practices, making the two frameworks complementary for Extension programming. Diffusion of Innovations theory (Rogers, 2003) describes an adoption-decision process where people must first gather adequate knowledge about a practice or technology before they can make a decision about potential adoption. At the point of decision-making, individuals' perceptions of five characteristics of the idea or technology influence whether they adopt it. Specifically, they are more likely to adopt an innovation if they perceive that it:

- has relative advantage,
- is compatible with existing routines and values,
- is available to try out before committing,
- has observable outcomes, and
- is not overly complex.

Extension professionals and others who promote IPM and biodiversity conservation can use these attributes to design interventions and educational strategies that increase the likelihood of adoption. By emphasizing an innovation's advantages, demonstrating its compatibility with existing practices and value, providing opportunities for trial, making benefits visible, and reducing perceived complexity, educators can address common barriers to adoption. For example, in a study on Florida residents' involvement in pollinator gardening, Silvert et al. (2023) reported that perceptions of all five attributes predicted engagement. Residents were more likely to engage in pollinator gardening when they perceived it as compatible with their lives and routines, saw the outcomes associated with pollinator gardening, saw the advantages of doing so, believed they could try pollinator gardening without making a long-term commitment, and did not find pollinator gardening to be too complicated. The models mentioned above guide later publications in this series by informing audience selection, behavior prioritization, strategy design, and evaluation.

Acknowledgments

This work is supported by the Crop Protection and Pest Management (CPPM, EIP) program, project award no. 2024-70006-43670, from the U.S. Department of Agriculture's National Institute of Food and Agriculture.

References

Balmford, A., Bradbury, R. B., Bauer, J. M., Broad, S., Burgess, G., Burgman, M., Byerly, H., Clayton, S., Espelousin, D., Ferraro, P. J., Fisher, B., Garnett, E. E., Jones, J. P. G., Marteau, T. M., Otieno, M., Polasky, S., Ricketts, T. H., Sandbrook, C., Sullivan-Wiley, K., Trevelyan, R., ... Nielsen, K. S. (2021). Making more effective use of human behavioural science in

conservation interventions. *Biological Conservation*, 261, 109256.
<https://doi.org/10.1016/j.biocon.2021.109256>

Barnes, A. (2024, December 9). Clarifying the core: Why every organization needs purpose, vision, and values. StartHuman's Substack.
<https://starthuman.substack.com/p/clarifying-the-core-why-every-organization>

Boone, E. J., Safrit, R. D., & Jones, J. (2002). *Developing programs in adult education: A conceptual programming model* (2nd ed.; ERIC Document No. ED475148). Waveland Press.
<https://eric.ed.gov/?id=ED475148>

Crowley, C., Flood, K., Caffrey, B., Dunford, B., FitzPatrick, Ú., Hamilton, J., & O'Gorman, M. (2020). Engaging and empowering people in biodiversity conservation: Lessons from practice. *Biology and Environment: Proceedings of the Royal Irish Academy*, 120B(1), 1–15.
<https://doi.org/10.3318/BIOE.2020.15>

Galli, M., Feldmann, F., Vogler, U. K., & Kogel, K.-H. (2024). Can biocontrol be the game-changer in integrated pest management? A review of definitions, methods and strategies. *Journal of Plant Diseases and Protection*, 131, 265–291.
<https://doi.org/10.1007/s41348-024-00878-1>

Grant, W. J. (2023). The knowledge deficit model and science communication. In *Oxford research encyclopedia of communication*.

Gusto, C., Silvert, C., Warner, L. A., Diaz, J., & Mallinger, R. (2023). Exploring Floridians' perceptions of pollinator-friendly gardening to identify critical adoption barriers and strategies. *Urban Forestry & Urban Greening*, 81, 127867.
<https://doi.org/10.1016/j.ufug.2023.127867>

Harder, A. (2016). Using the TOP Model to measure program performance: A pocket reference: WC092. *EDIS*.
<https://ask.ifas.ufl.edu/publication/WC092>

Janbandhu, M. S., Mehta, A., Beese, S., Pandey, S. K., Singh, B., Patel, A., & Singh, B. P. (2024). Advances and emerging trends in horticultural production and management. *Journal of Experimental Agriculture International*, 46(3), 47–69.
<https://doi.org/10.9734/JEAI/2024/v46i32325>

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior?

Environmental Education Research, 8(3), 239–260.
<https://doi.org/10.1080/13504620220145401>

Psychologist, 47(9), 1102–1114.
<https://doi.org/10.1037/0003-066X.47.9.1102>

Maynard, L., Monroe, M. C., Jacobson, S. K., & Savage, A. (2020). Maximizing biodiversity conservation through behavior change strategies. *Conservation Science and Practice*, 2, e193.
<https://doi.org/10.1111/csp2.193>

Prochaska, J. O., DiClemente, C. C., & Norcross, J. C. (1992). In search of how people change: Applications to addictive behaviors. *American*

Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). Free Press.

Zhou, W., Arcot, Y., Medina, R. F., Bernal, J., Cisneros-Zevallos, L., & Akbulut, M. E. S. (2024). Integrated pest management: An update on the sustainability approach to crop protection. *ACS Omega*, 9(40), 41130–41147.
<https://doi.org/10.1021/acsomega.4c06628>

¹ This document is AEC853, a publication of the Department of Agricultural Education and Communication, UF/IFAS Extension. Original publication date July 2026. Visit the Ask IFAS website at <https://ask.ifas.ufl.edu> for the currently supported version of this publication. © 2026 UF/IFAS. This publication is licensed under CC BY-NC-ND 4.0.

² Adeyinka Ayodele, graduate student, Extension education, UF/IFAS Department of Agricultural Education and Communication, Gainesville, FL; Laura A. Warner, professor and Extension specialist, program evaluation and social marketing, Department of Agricultural Education and Communication, and UF/IFAS Center for Land Use Efficiency; UF/IFAS Extension, Gainesville, FL 32611.

The Institute of Food and Agricultural Sciences (IFAS) is an Equal Opportunity Institution authorized to provide research, educational information, and other services only to individuals and institutions that operate in compliance with applicable federal and state non-discrimination laws and policies. For more information on obtaining other UF/IFAS Extension publications, contact your county's UF/IFAS Extension office. U.S. Department of Agriculture, UF/IFAS Extension Service, University of Florida, IFAS, Florida A&M University Cooperative Extension Program, and Boards of County Commissioners Cooperating. Andra Johnson, Dean for UF/IFAS Extension.