

# **WEED BIOLOGY & MANAGEMENT**

## **PLSCS 3150 -FALL 2017**

### **Soil & Crop Sciences Section**

### **School of Integrative Plant Science**



---

## **Course Description**

This course provides an examination and discussion of the various components related to the biology/ecology and management of weeds in both crop and non-crop ecosystems, particularly in the Northeastern United States. Formal lectures as well as slides, video, web-based resources, field trips, and hands-on laboratory sessions are used to present and facilitate the learning of course material. The first part of the course focuses on those biological/ecological factors that govern seed dormancy, plant growth, population dynamics, competitiveness, reproduction, and survival. Close attention is given to the accurate identification of plants and to characteristics that make weeds particularly competitive and/or undesirable in a given environment. The second part of the course examines the various strategies that are currently being employed to control weeds in different habitats including their benefits and drawbacks. Important aspects of chemical control including classification, mode of action, selectivity, symptomology, and resistance will also be presented. The use of integrated approaches to weed management in different ecosystems is explored. Controversial issues related to the adoption of herbicide tolerant crops (i.e. GMO's) as well as to the health and environmental concerns over herbicide use will be presented and discussed.

---

---

## **Course Objectives**

By the end of this course, you will:

- ★ Be able to identify the different life stages of at least 90 weed species commonly found in the Northeastern United States and southern Canada.

- \* Be able to identify and understand the major biological factors and ecological principles that influence weed growth, population dynamics, invasiveness, and survival.
  - \* Become familiar with the various strategies currently being used to control and/or suppress weeds in different crop and non-crop systems.
  - \* Become familiar with the classification, mode of action, selectivity, and symptomology of commonly used herbicides.
  - \* Be able to calculate and apply the appropriate amount of a given herbicide that is required to treat a specific area using a backpack sprayer.
  - \* Be able to appreciate the diversity and impact that weeds have in different ecosystems.
- 

## Instructor

### Antonio (Toni) DiTommaso

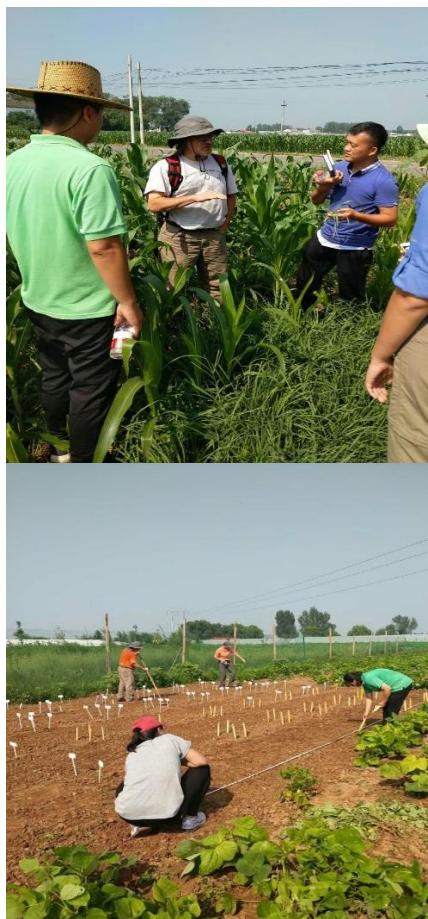


Professor  
Soil & Crop Sciences Section  
School of Integrative Plant Science  
903 Bradfield Hall, Ithaca, NY 14853

**Tel:** (607) 254-4702

**Fax:** (607) 255-2644

**E-mail:** [ad97@cornell.edu](mailto:ad97@cornell.edu)



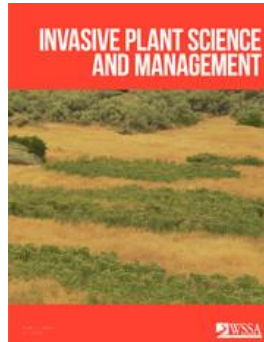
**Office hours:** Call or e-mail me for an appointment.

For more than 22 years, Professor DiTommaso has taught courses and performed research in the area of weed biology/ecology, biological weed control,

and integrated weed management. He is co-author of a weed identification guide for the Northeastern U.S. and eastern Canada that is available on CD. He was President of the Northeastern Weed Science Society (NEWSS) in 2012-13 <http://www.newss.org/index.php> and has been a member of the Weed Science Society of America (WSSA) <http://www.wssa.net/> for over 26 years.

Professor DiTommaso is currently Editor of the scientific journal ***Invasive Plant Science and Management***

<https://www.cambridge.org/core/journals/invasive-plant-science-and-management>



**Cornell Weed Ecology & Management Lab Web site:**



Weed Ecology and Management Laboratory at Cornell University

The image is a screenshot of the Cornell Weed Ecology and Management Laboratory website. At the top left is the Cornell University logo and name. At the top right is a search bar labeled 'Search Cornell'. The main heading is 'Weed Ecology and Management Laboratory' in blue text, with a small image of a yellow flower. Below the heading is a 'News &amp; Announcements' section with three articles: 'Pest control: Wicked weeds may be agricultural angels', 'Taste test? Deer preferences seem to help non-native invasive plants spread', and 'Garden offers living library of weeds, poisonous plants'. To the right of the news section is a collage of images showing various weeds and plants. At the bottom of the page is a navigation menu with six categories: 'About Us', 'Major Weeds', 'Organic Weed Management', 'Weed Ecology', 'Herbicide Reference', and 'Opportunities Contact Us'. Each category has a small icon and a brief description of the content.

<http://weedecology.css.cornell.edu/>



## Teaching Support Specialist

Kathy Howard  
G-019 Bradfield Hall  
Email: kch3@cornell.edu  
Phone: (607) 227-0421

## Teaching Assistant

Eugene Law  
905 Bradfield Hall  
E-mail: epl49@cornell.edu  
Phone: (315) 256-7466

---

### Course Expectations

Students are expected to have taken an introductory course in biology or botany prior to enrolling in this course. Additional introductory courses in crop science, soil science, and/or statistics will be an asset.

**Lecture hours: 10:10-11:25, Tuesdays & Thursdays (BF-105)**

**Laboratory hours: 1:25-4:25, Tuesday or Wednesday (Guterman Facility)**

A copy of the weed identification book by Uva, R.H., J.C. Neal & J.M. DiTomaso. 1997. ***Weeds of the Northeast***. Cornell University Press, Ithaca, NY. 397 pp. **is required and available for purchase at The Cornell Bookstore (\$30).**

Students are encouraged to purchase and read the text by **Ross, M.A. and Lembi, C.A. 2008. *Applied Weed Science: Including the Ecology and Management of Invasive Plants. Third Edition***, copies of this textbook are available for purchase on the Internet.

Material for lecture notes will also come from other textbooks and references that are listed below. Students are encouraged to supplement the lecture material with background readings and other reference readings that will be provided in advance. Copies of lecture notes will be provided throughout the term on the **Blackboard course website**, however not all material covered in class lectures/discussions will be found in the lecture notes. **I fully expect that you attend all lectures and laboratories.** Use a three-ring binder to collate all your course notes.

---

### Assessment

Grades [**Letter only**] for the course will be determined as follows:

	<i>Percentage of Final Grade</i>
Lecture Exam 1	10%
Lecture Exam 2	10%
Lecture Exam 3	15%
Seedbank Manuscript	20%
Weed Identification Notebook	12%
Weed & herbicide ID Lab Quizzes	3%
Weed Identification Practical Exam	15%
Herbicide Practical Exam	<u>15%</u>
	100%

**Lecture Exam 1** will test your understanding of material covered during the first 10 lectures of the course (Weed Biology/Ecology section).

Date/Time/Location: **September 26, 2017 /10:10-11:25 AM/ 105 Bradfield Hall**

**Lecture Exam 2** will test your understanding of material covered during the next 6 lectures of the course (Non-Chemical Weed Management section).

Date/Time/Location: **October 26, 2017 /10:10-11:25 AM/105 Bradfield Hall**

**Lecture Exam 3** will test your understanding of material covered during the last 9 lectures of the course (Chemical Weed Management section).

Date/Time/Location: **TBD/105 Bradfield Hall**

**Seedbank Manuscript.** A scientific journal article based on the seedbank/cropping system experiment will be required. A first submission of the report will be worth **15%** of your final grade. A revised report that incorporates my corrections and comments will be worth an additional **5%** of your final grade. The written reports are to be prepared following the format and style of the scientific journal *Weed Science*. However, **separate ‘Results’ and ‘Discussion’ sections are required.**

Due dates: Initial Submission: **November 7/8, 2017**

Revised Submission: **December 11, 2017**

**Weed Identification Notebook.** Specific instructions about the weed ID notebook will be provided during the first laboratory session.

Due date for Weed Notebook: **October 24/25, 2017**

**Weed Identification Practical Exam.** This exam tests your ability to accurately identify seeds, seedlings, and mature plants of various weed species examined during laboratory sessions. The use of WSSA accepted binomial Latin names for species identification is required.

Date/Time/Location: **October 17/18, 2017 2:00-3:00 PM/102 Bradfield**

**Herbicide Practical Exam.** This exam tests your ability to accurately recognize symptoms induced by various herbicides studied on both crop plants and weeds. Herbicide common names and not trade names will be required. Herbicide calculation and calibration problems may also comprise part of the exam.

Date/Time/Location: **November 28/29, 2017 2:00-3:30 PM/Muenschner**

---

## Cornell University Code of Academic Integrity

**“Each student in this course is expected to abide by the Cornell University Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student’s own work.”**

---

### General Weed Science Textbooks and Weed Identification Guides

- Anderson, W.P. 1996. Weed Science: Principles and Applications. Third Edition. West Publishing, Minneapolis/St.Paul. 388 p.
- Aldrich, R.J. & R.J. Kremer. 1997. Principles in Weed Management. Second Edition. Iowa State University Press, Ames, Iowa. 455 p.
- Bouchard, C.J. & R. Néron. 1999. Identification Guide to the Weeds of Quebec. CPVQ, Québec, Canada. 253 pp. **[available for purchase from instructor].**
- DiTommaso, A. & A.K. Watson. 2003. Weed Identification, Biology and Management. Software program. McGill University. Montréal, Québec, Canada.
- Liebman, M., C.L. Mohler & C.P. Staver. 2001. Ecological Management of Agricultural Weeds. Cambridge University Press, Cambridge, U.K. 532 p.
- Radosevich, S.R., J.S. Holt & C. Ghersa. 2007. Ecology of Weeds and Invasive Plants: Relationship to Agriculture and Natural Resource Management. Third Edition. John Wiley & Sons, New York. 454 p.
- Ross, M.A. & C.A. Lembi. 2008. Applied Weed Science: Including the Ecology and Management of Invasive Plants. Third Ed. Pearson Education, 576 p.
- Uva, R.H., J.C. Neal & J.M. DiTommaso. 1997. Weeds of the Northeast. Cornell University Press, Ithaca, NY. 397 pp. **[available for purchase in Cornell bookstore or on the internet].**
- 

### GENERAL INTRODUCTION

Weeds are plants out of place; plants that interfere with the activities of human beings. Amongst other things, plants may be toxic to humans or livestock, cause allergies, block waterways, suppress forest regeneration, create fire hazard, harbor crop diseases, or (most importantly) compete with crops causing yield reduction. Under any such situation, they are considered to be weeds.

Numerous plant families contain species that are considered 'weedy', and different weed species may have very different survival strategies and morphology. They may be woody or herbaceous, annual, biennial or perennial, out-crossing or interbreeding, large and erect or small and prostrate, grassy or broad-leaved.

In agricultural systems, undesirable plants are generally considered weeds because they compete with crops for light, nutrients, water, and space amongst other factors. In agro-ecosystems, a smaller number of survival strategies are

observed, and weeds can be viewed as pioneers of secondary succession that are adapted to survive in highly disturbed environments. Many annual plants, which can survive from generation to generation as seed in the soil, and many perennial herbs, which can reproduce vegetatively (clonally) from underground stems or roots are highly successful weeds. By studying the survival strategies of weeds, we can more easily design strategies to control them.

Globally, weeds are considered to be the most important biotic restriction to crop production. Weeds, unlike insect pests and diseases that are often only transient (although potentially highly damaging) components of crop production systems, are always present. No matter how much effort is used to kill weeds, they will never be eradicated. Management or control strategies can only hope to influence the composition and density of weed communities. We must aim to determine the influence of different weed community structures upon crop production, and be familiar with the techniques at our disposal to modify these communities, in the most economical and environmental ways, to our benefit. The discipline of 'weed science' effectively began in the 1940's with the advent of chemical herbicides. The Weed Science Society of America (WSSA) was formed around this time in order (for the most part) to collect and distribute information about chemical herbicides, a rapidly evolving field of research. For three decades, as agriculture in the 'developed world' underwent a revolution towards larger scale and greater mechanization, chemical herbicides were considered to be the only significant method of weed control.

Problems have now been recognized with chemical herbicides, and although they remain the most potent weed control tools available in many situations, weed scientists have begun to re-evaluate the role of old techniques, and search for new techniques to effectively manage weeds.

### ***2017 Cornell Weed Science Team***

