

# EDUCATIONAL CHALLENGES FACING PLANT PATHOLOGY

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and  
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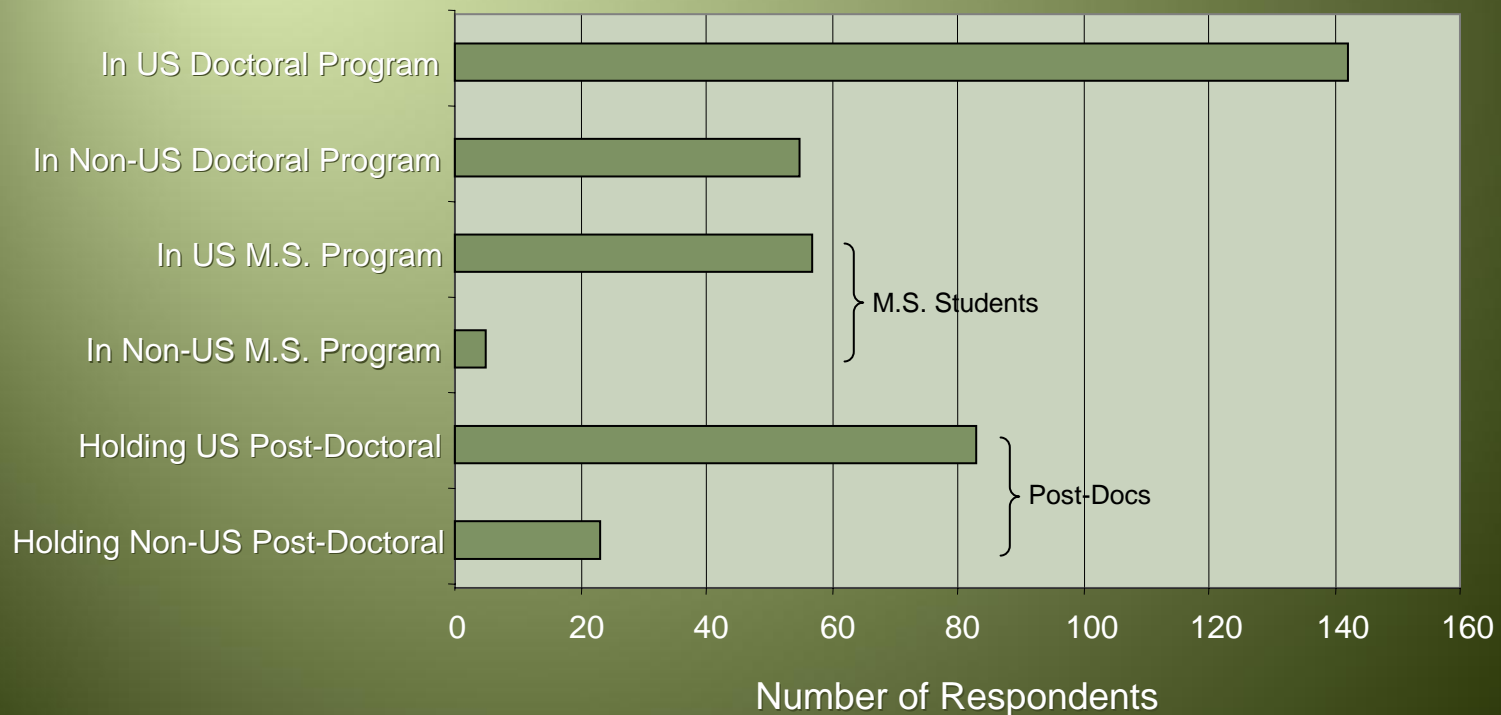
# The Concerns

- **“Declining student numbers and interest in plant pathology.”**
- **“Graduates are too specialized. Working in industry/consulting requires more generalized knowledge.”**
- **“We continue to have people knowing more and more about less and less.”**
- **“[There is a] lack of classically trained plant pathologists in diagnostics and management.”**
- **“[There is a] Lack of applied training of graduate students in ALL core areas of plant pathology.”**
- **“[There is a] Lack of skilled and broadly trained plant problem diagnosticians.”**
- **“[There is a need to] train applied plant pathologists so industry and extension have future candidates.”**

# Ad Hoc Committee Surveys

## Survey of Plant Pathology Graduate Students and Post-Docs

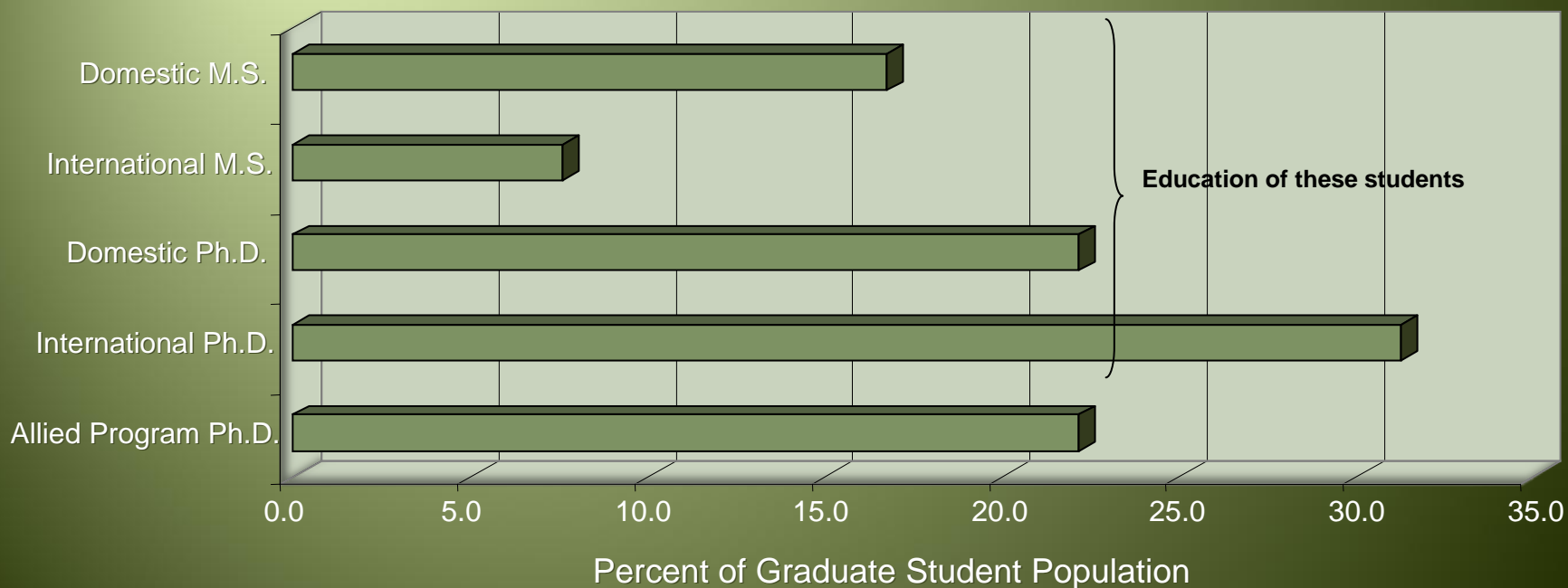
- Surveys Sent: 873
- Responses Received: 389 (45% response rate)
- Includes 61 text pages of comments



# Ad Hoc Committee Surveys

## Survey of Plant Pathology Graduate Program Heads

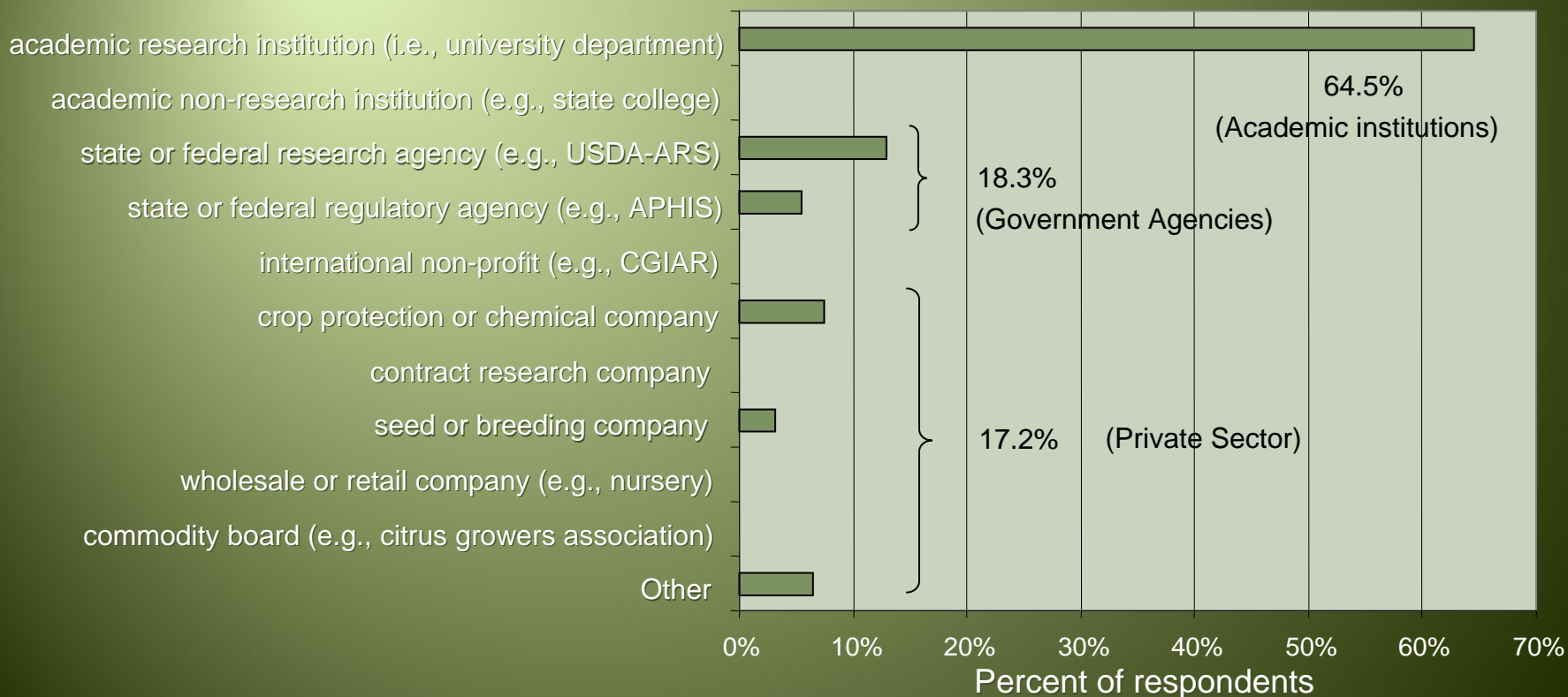
- Surveys Sent: 51
- Valid Responses Received: 28 (55%)
- Includes 2 pages of comments



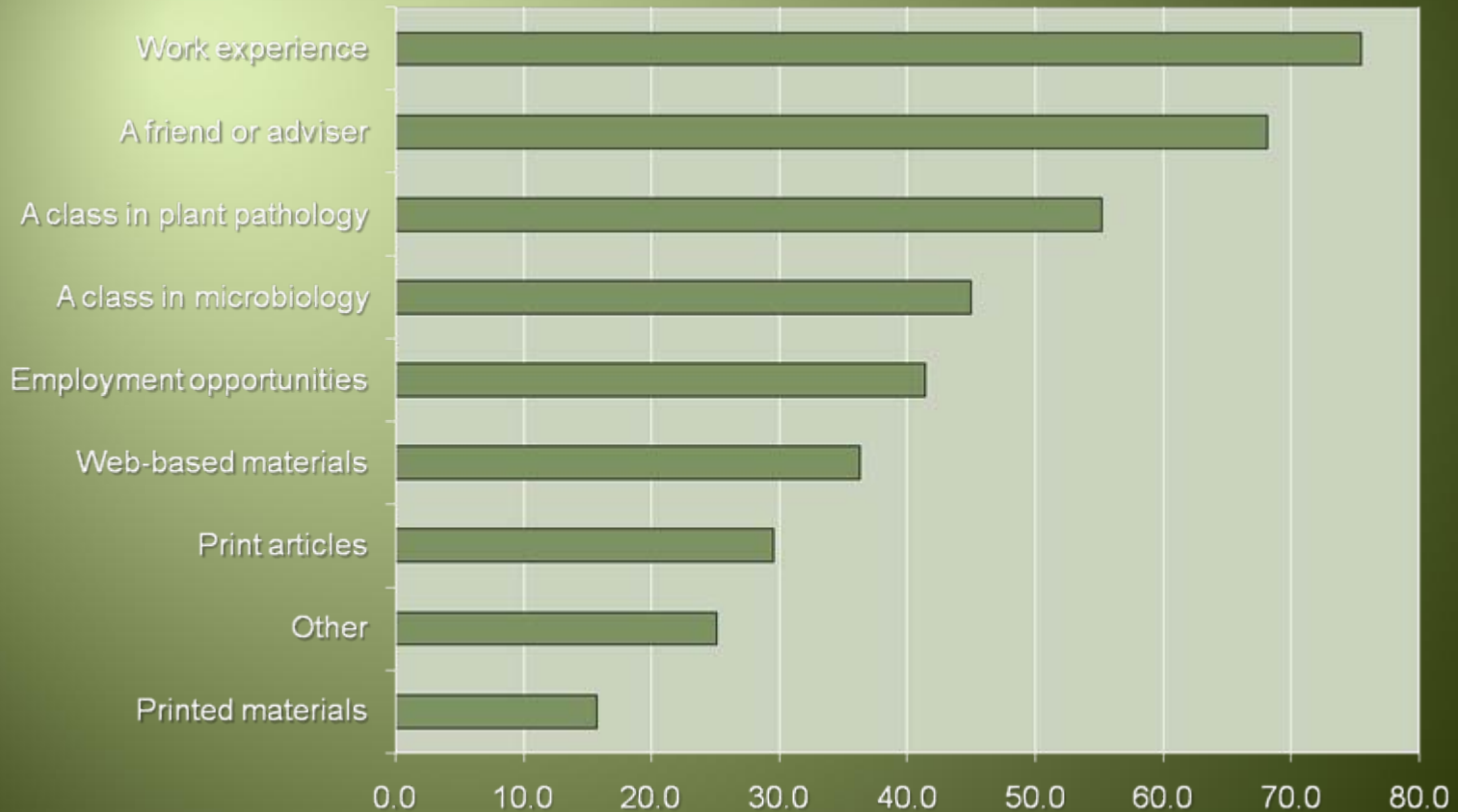
# Ad Hoc Committee Surveys

## Survey of Plant Pathology Employers

- Surveys Sent: 397
- Responses Received: 107 (27% response rate)
- Includes 13 pages of comments

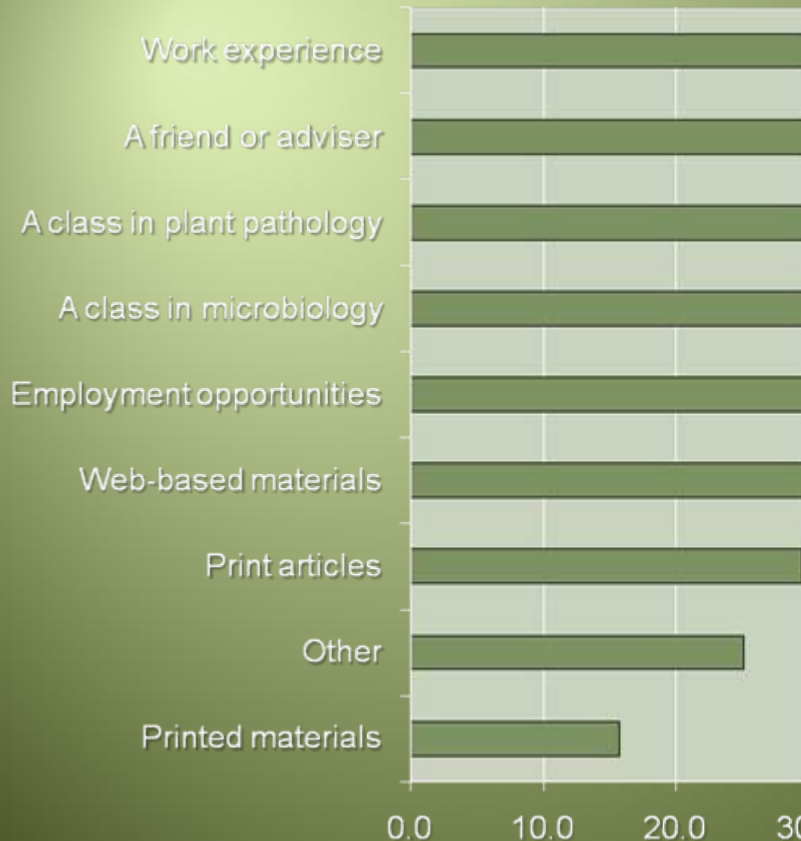


# Attracting Plant Science Students into Plant Pathology



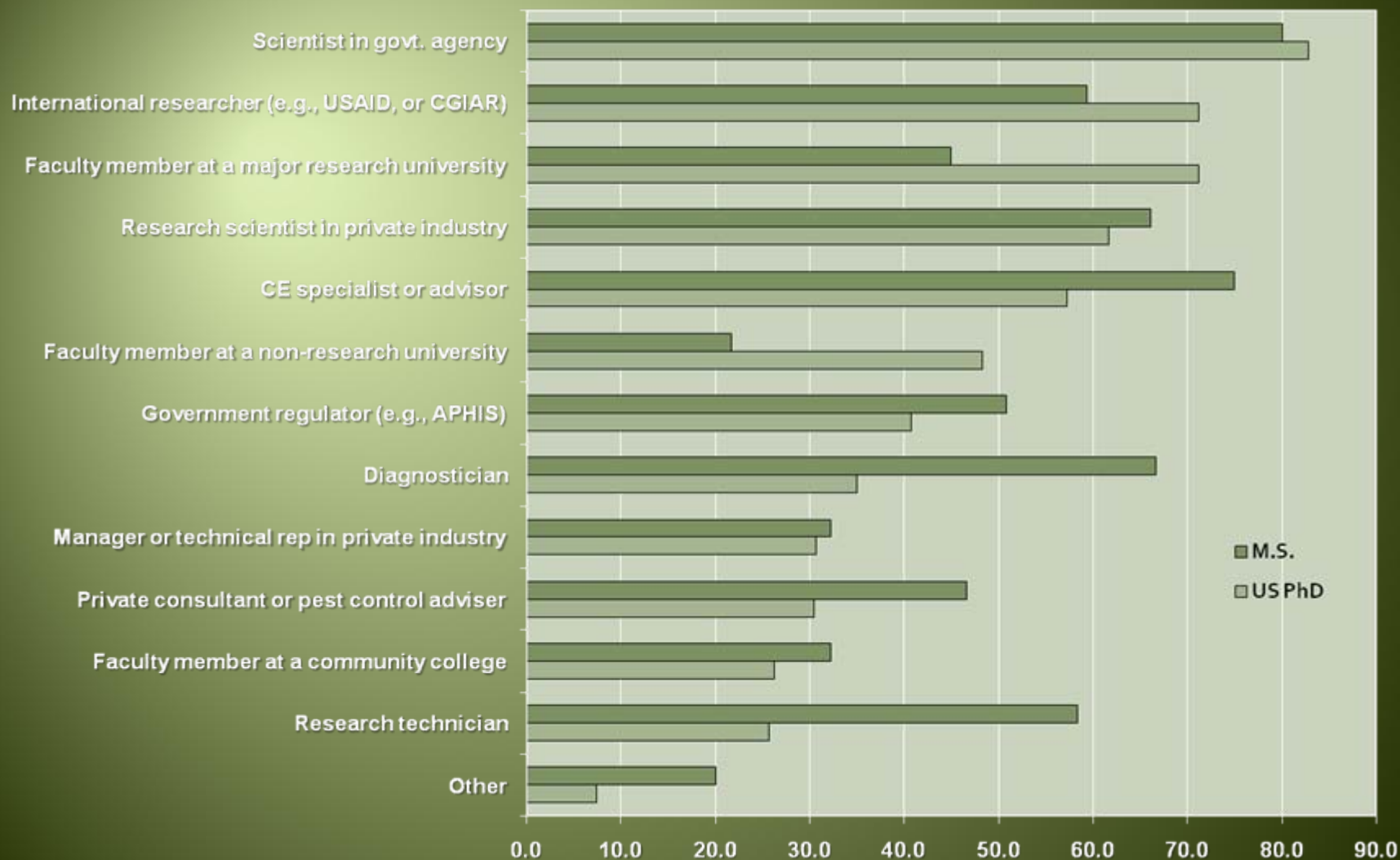


# Attracting Plant Science Students into Plant Pathology



Undergraduate research experiences, and engaging, hands-on courses are crucial to attracting student interest.

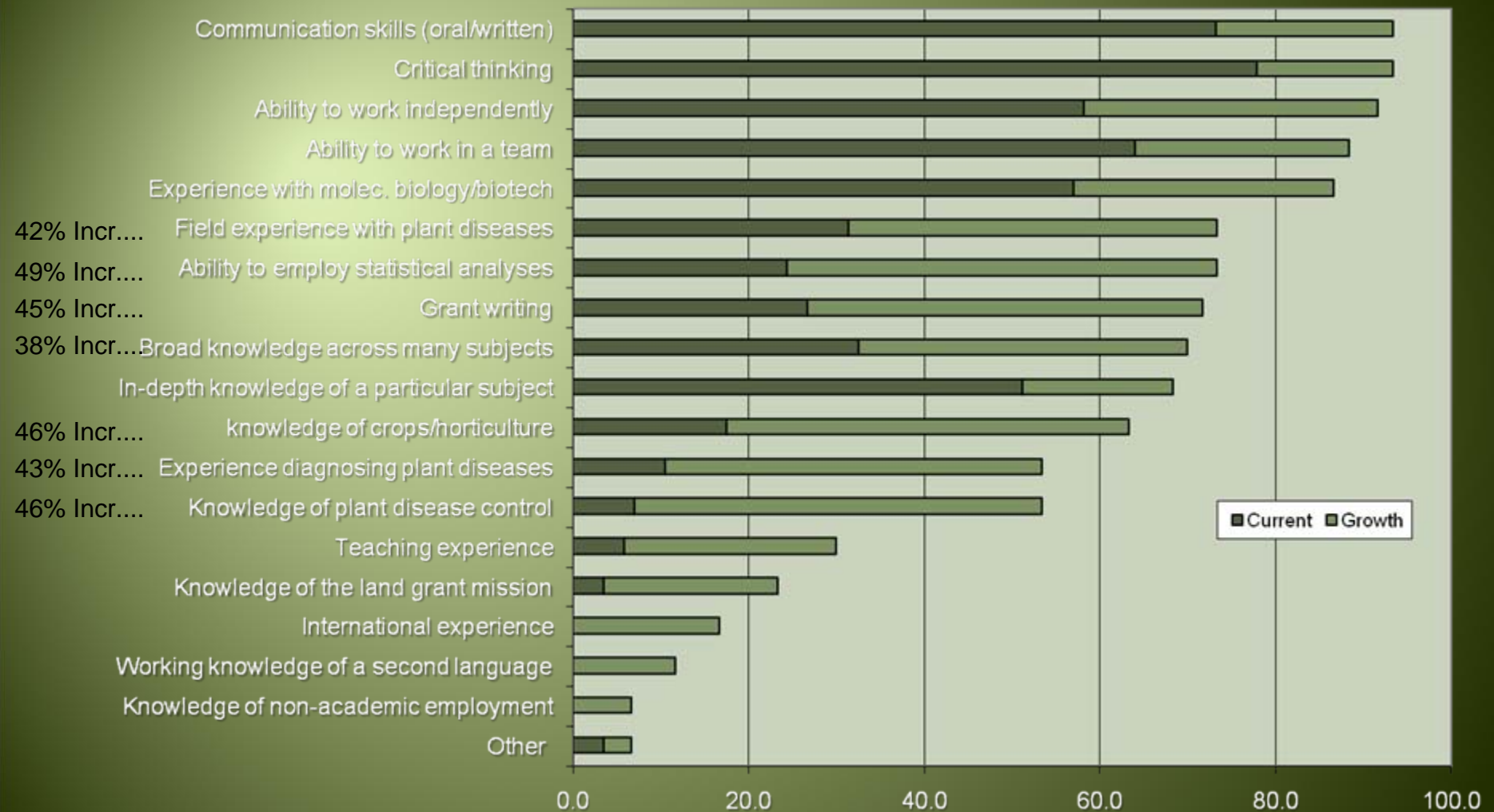
# Student Career Aspirations



“Beside each of the following employment possibilities, please rate your level of interest in such a position”

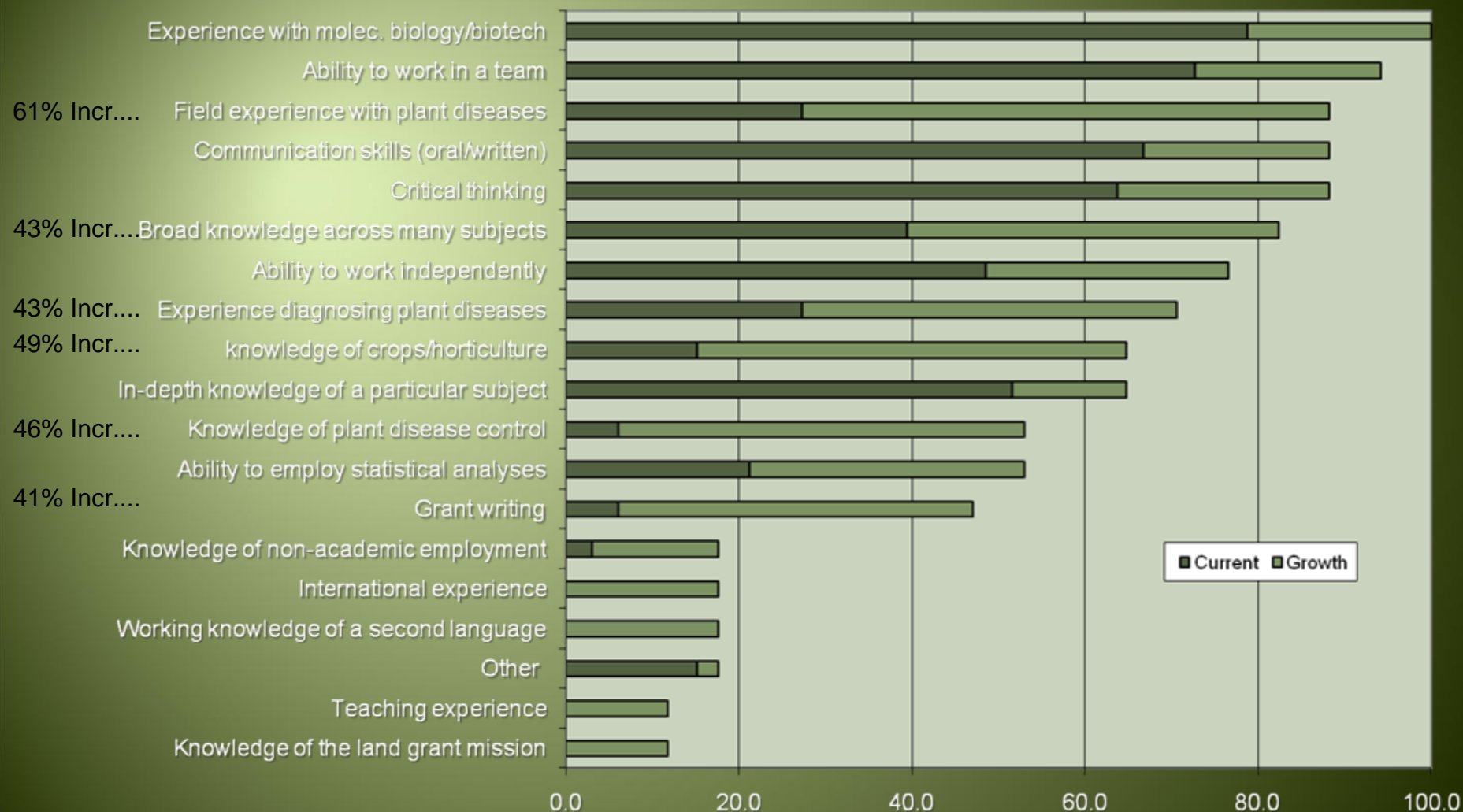


# Academic Employer Needs



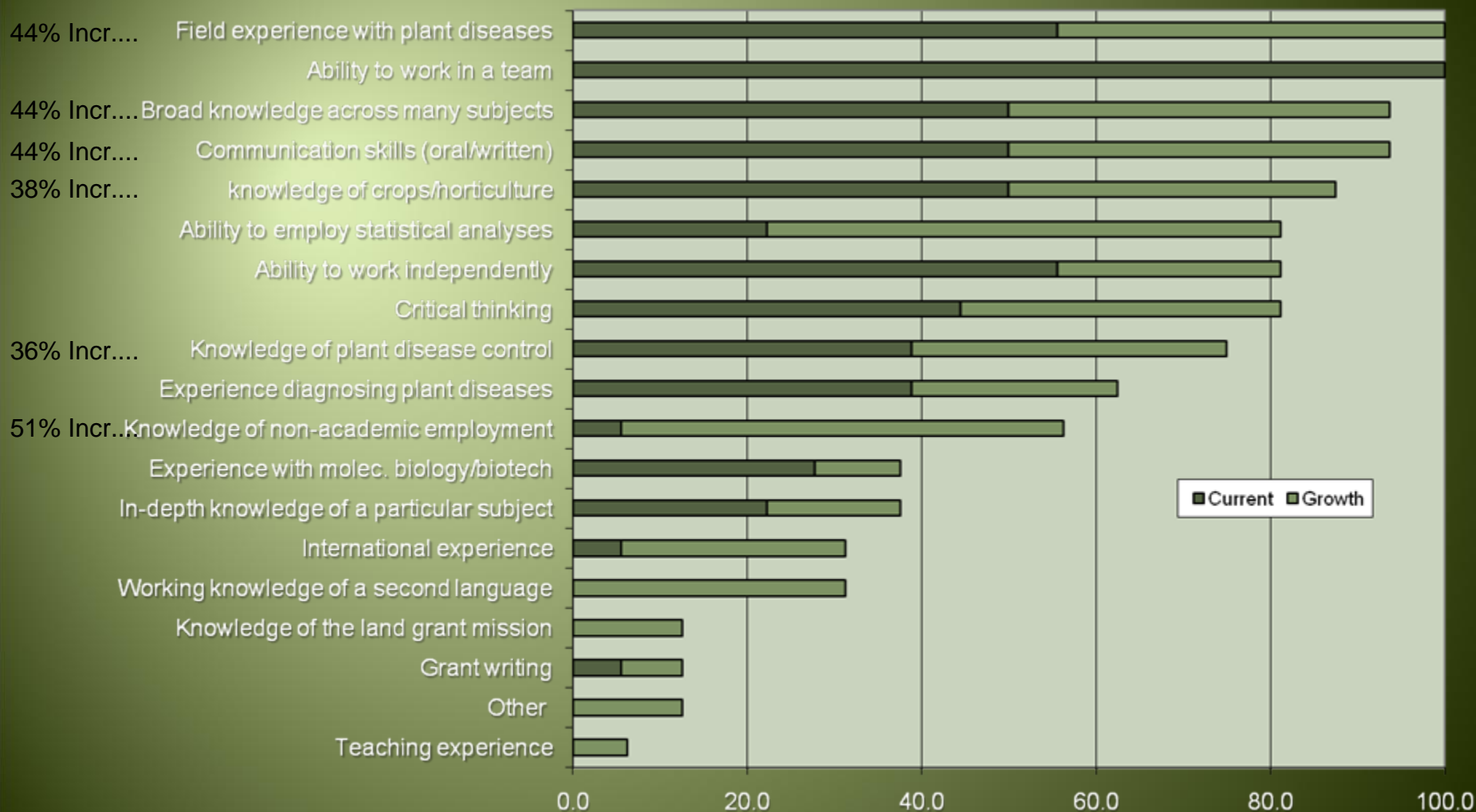
What skill sets do you currently value in candidates? What skill sets do you anticipate valuing 10 years from now?

# Government Employer Needs



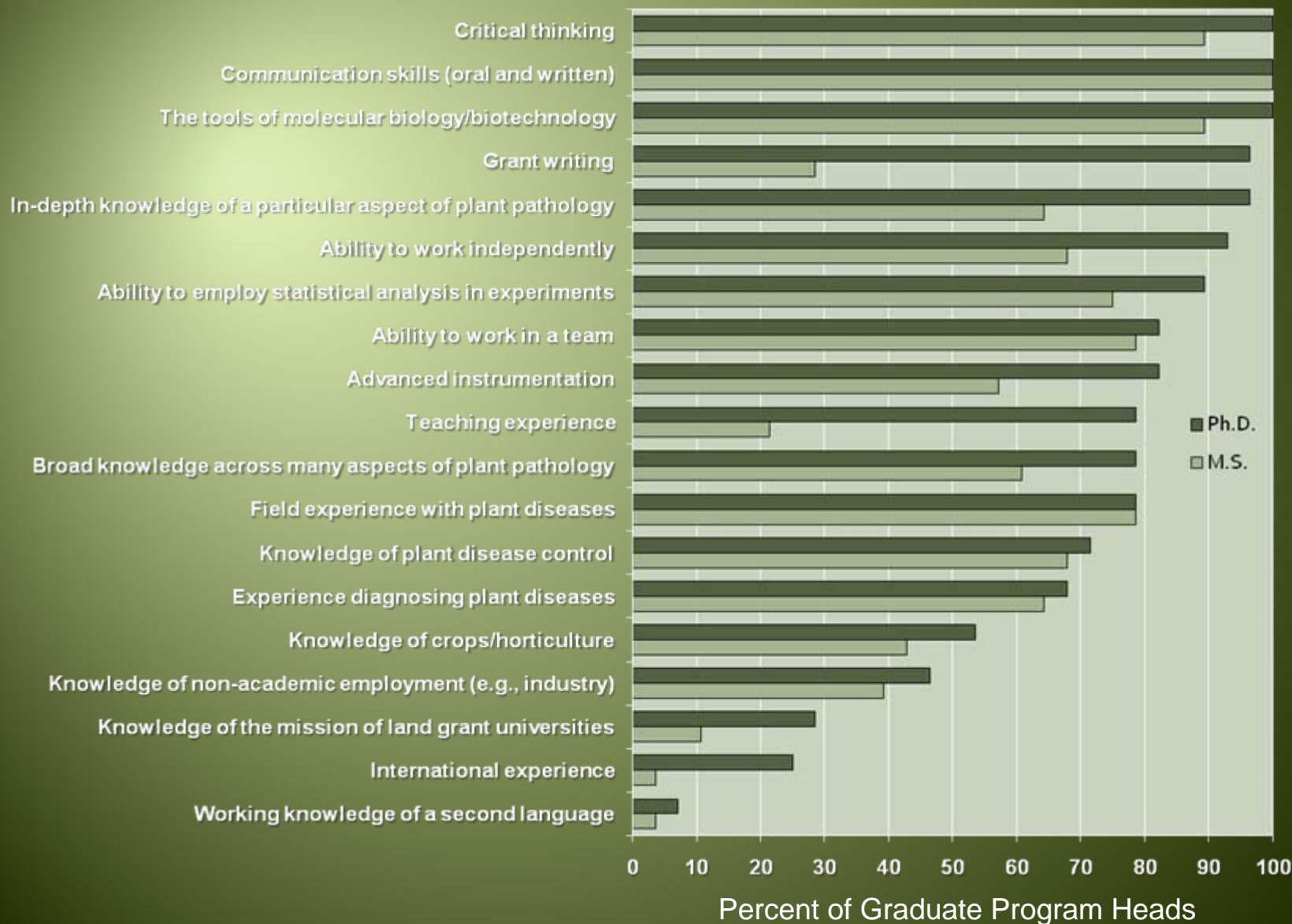
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# Private-Sector Employer Needs



What skill sets do you currently value in candidates? What skill sets do you anticipate valuing 10 years from now?

# What are Critical Elements of Education?



# Employer Confidence

Attribute	Employment sector		
	Academic	Government	Private
Experience with molec. biology/biotech	94	76	80
Ability to work independently	73	80	87
Ability to work in a team	73	76	75
In-depth knowledge of a particular subject	67	64	89
Ability to employ statistical analyses	60	50	62
Communication skills (oral/written)	58	47	60
Critical thinking	51	53	57
Working knowledge of a second language	45	40	14
knowledge of crops/horticulture	45	25	67
Knowledge of plant disease control	44	22	50
International experience	42	60	14
Experience diagnosing plant diseases	41	15	50
Knowledge of non-academic employment	40	0	44
Grant writing	37	33	38
Field experience with plant diseases	35	20	44
Teaching experience	33	33	29
Broad knowledge across many subjects	33	33	47
Knowledge of the land grant mission	29	33	29

The percent of academic, government and private sector employers with a high degree of confidence that they will be successful in finding top-quality candidates with the listed attributes.

Educational Attribute	Importance	Ability to Provide	
		Now	Future
Critical thinking	100	77	85
Communication skills (oral and written)	100	85	88
The tools of molecular biology/biotechnology	100	96	96
Grant writing	96	54	73
In-depth knowledge of a particular aspect of plant pathology	96	100	92
Ability to work independently	93	92	96
Ability to employ statistical analysis in experiments	89	69	81
Ability to work in a team	82	81	81
Advanced instrumentation	82	69	81
Teaching experience	79	65	73
Broad knowledge across many aspects of plant pathology	79	72	60
Field experience with plant diseases	79	81	65
Knowledge of plant disease control	71	73	42
Experience diagnosing plant diseases	68	77	73
Knowledge of crops/horticulture	54	65	52
Knowledge of non-academic employment (e.g., industry)	46	42	46
Knowledge of the mission of land grant universities	29	64	64
International experience	25	27	42
Working knowledge of a second language	7	15	19

The percent of responding graduate program heads who regarded various educational attributes as very important for Ph.D. students, compared to the percent of programs that reported they were well-equipped to provide those attributes now, and the percent feeling they will be well-equipped provide those attributes 10 years into the future.



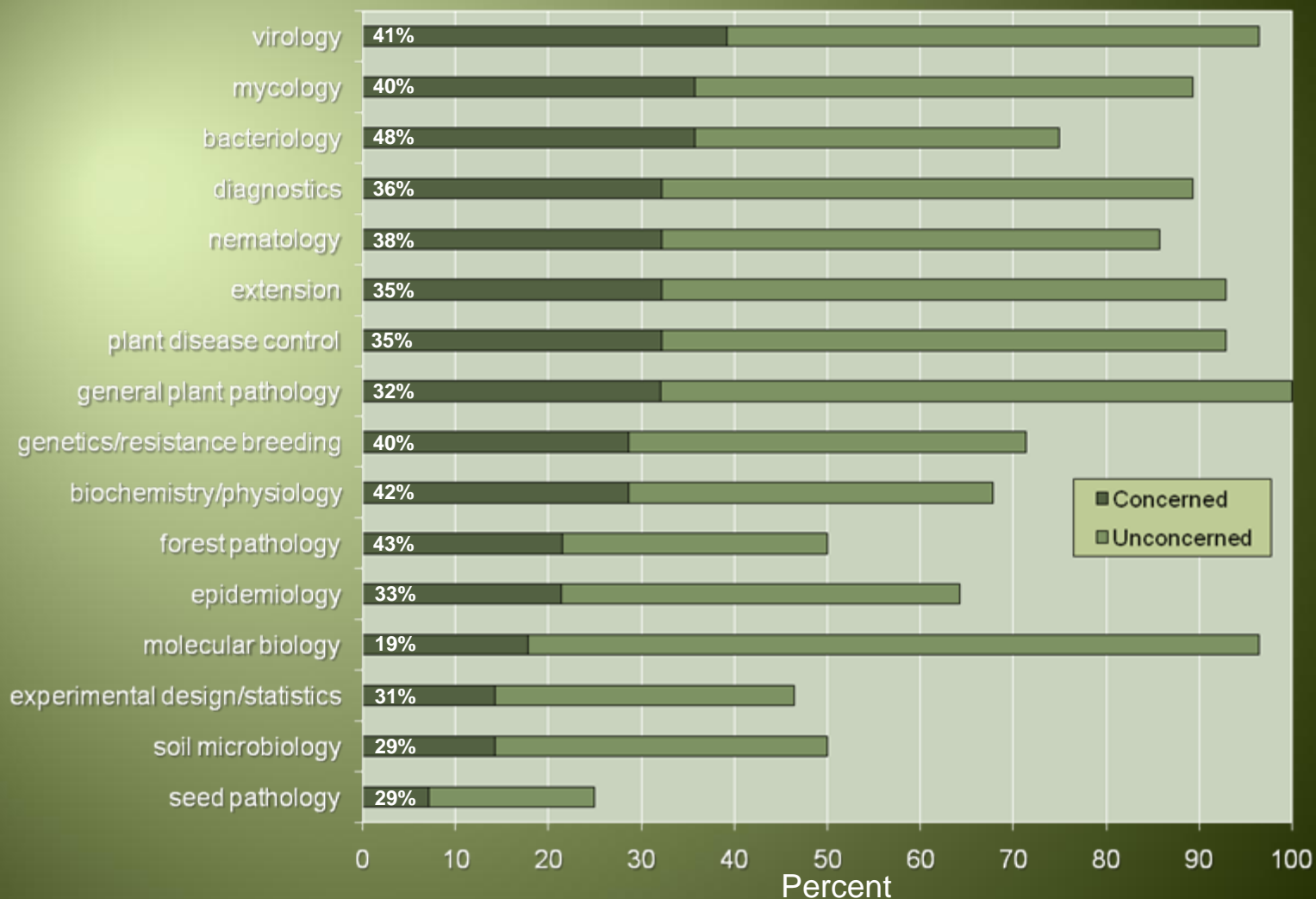
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Experience	US PhD	Int'l PhD	M.S.	Post-Doc
Teamwork	0	0	2	0
Teaching/Communication	11	2	0	8
Resources/Equipment/Facilities	3	10	2	0
Personal Growth	5	5	13	15
Networking/Collaboration	9	19	4	11
International Experiences	4	10	2	9
Independence/Freedom	0	0	2	2
Importance Of Project	0	0	0	0
Financial Support	5	14	6	6
Faculty Or Faculty Mentor	5	12	4	2
Depth Of Training/Experience	1	2	4	5
Coursework	12	10	19	2
Career Preparation	20	2	9	20
Broader Training/Experience	27	14	34	22

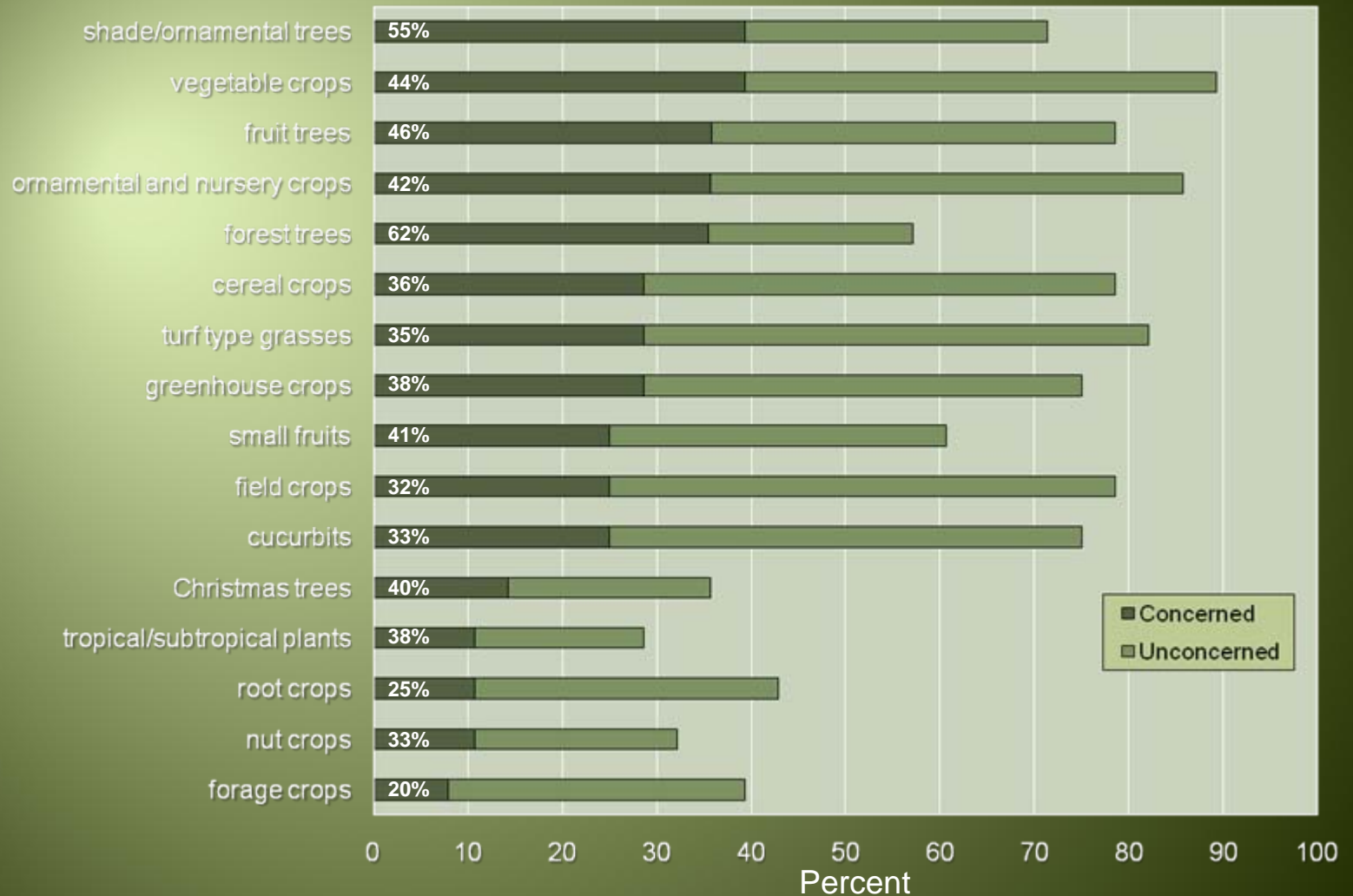
The percent of students and post-docs who identified particular experiences that could be improved for an even better graduate school experience.

# Perceived Vulnerabilities



The percent of responding graduate programs possessing the listed specializations, and the relative percent of programs that are concerned or unconcerned about their future.

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# Perceived Vulnerabilities

For those subject matter areas for which you indicated future concern, what is the nature of your concern?

- Retirement without subsequent replacement
- The competition among departments to re-fill their respective positions is quite strong.
- We just aren't getting positions refilled automatically any more. Often several years gap where it goes uncovered
- Lack of opportunity to fill positions.
- We have lost positions and have not been given permission to refill
- Retirement of faculty; a small pool of talented people
- Lack of qualified replacements for retirements; lack of campus or industry funding for research support
- Finding well-qualified individuals with sufficient interest to cover the area in question while also having the inclination and ability to sustain a federally-funded research program.
- Lack of faculty with that area of expertise
- Lack of enough trained people to fill the need

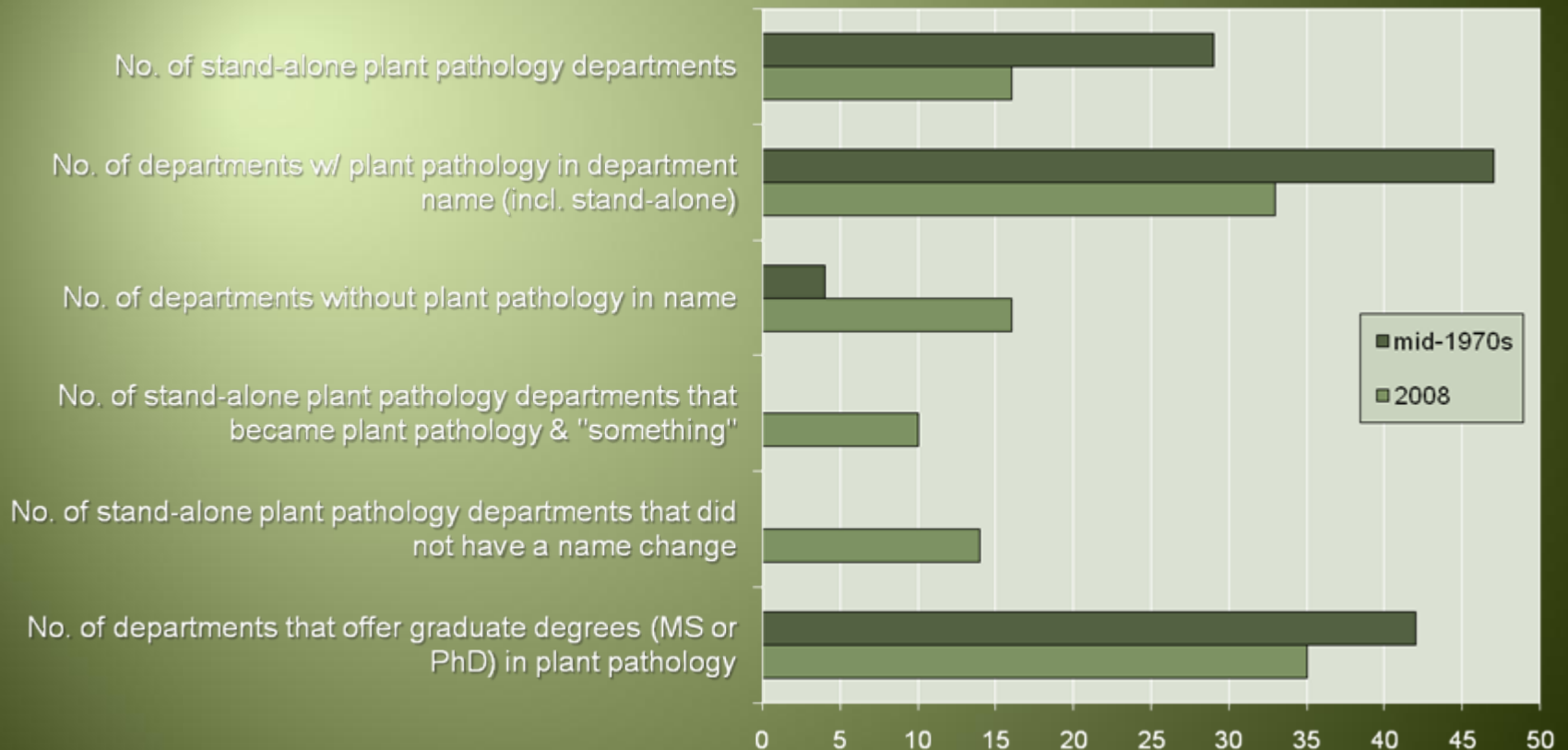
# What Does the Future Hold?

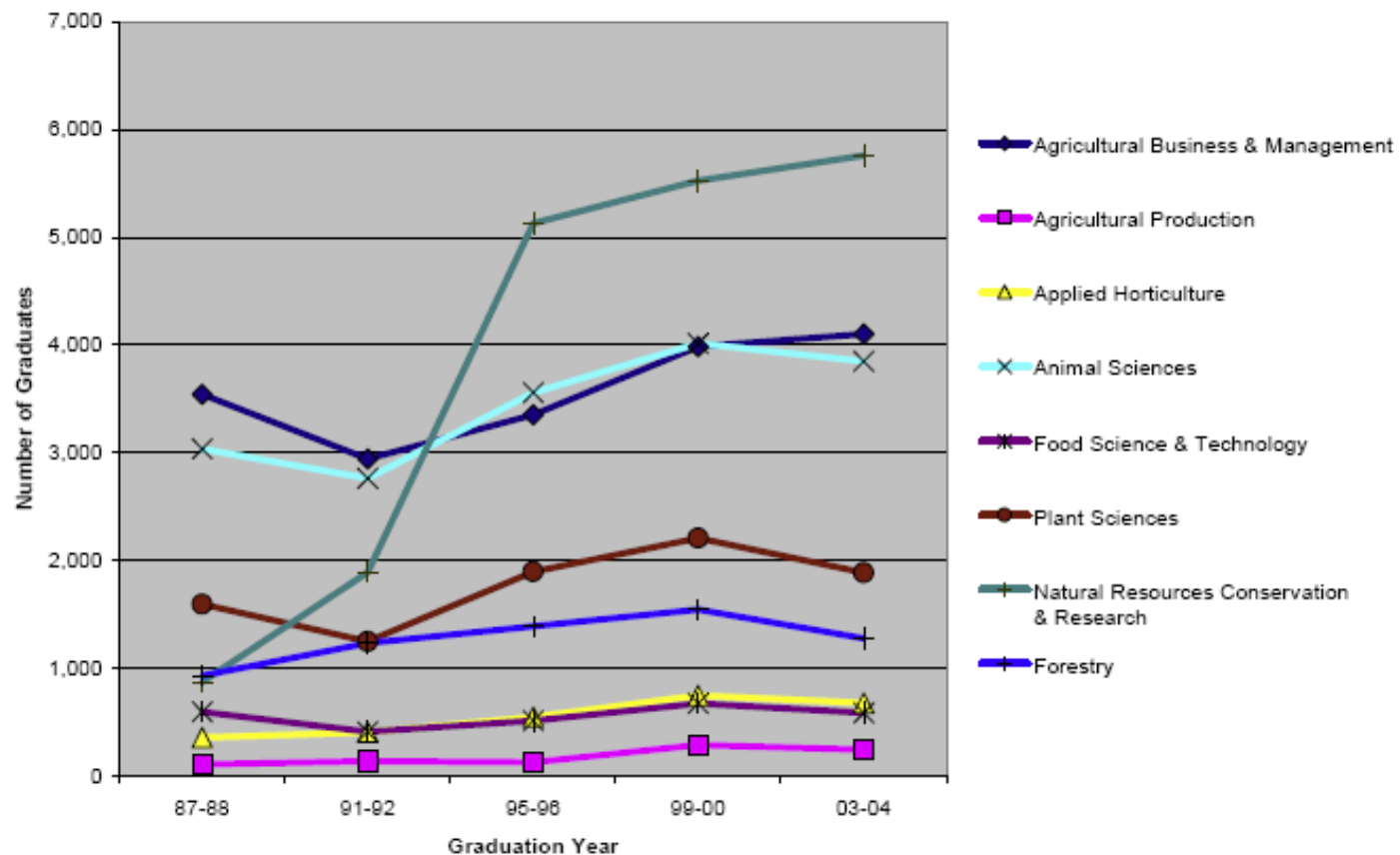
Statement	Percent of Respondents				
	+2	+1	0	-1	-2
There will be fewer free-standing plant pathology departments in the future	41	41	19	0	0
Plant pathology graduate programs can thrive in combined departments	22	22	22	19	15
The future of fundamental plant pathology research looks bright	37	33	22	7	0
The future of applied plant pathology research looks bright	30	26	33	7	4
The future of extension plant pathology looks bright	19	26	44	7	4
The career opportunities for specialists in plant pathology looks bright	22	56	15	4	4
The career opportunities for generalists in plant pathology looks bright	11	48	30	7	4
Industry should play a greater role in graduate education	44	30	19	7	0

The percent of graduate program heads who indicated varying levels of agreement with each statement (+2 indicates strong agreement, while -2 indicates strong disagreement).



# What Does the Future Hold?

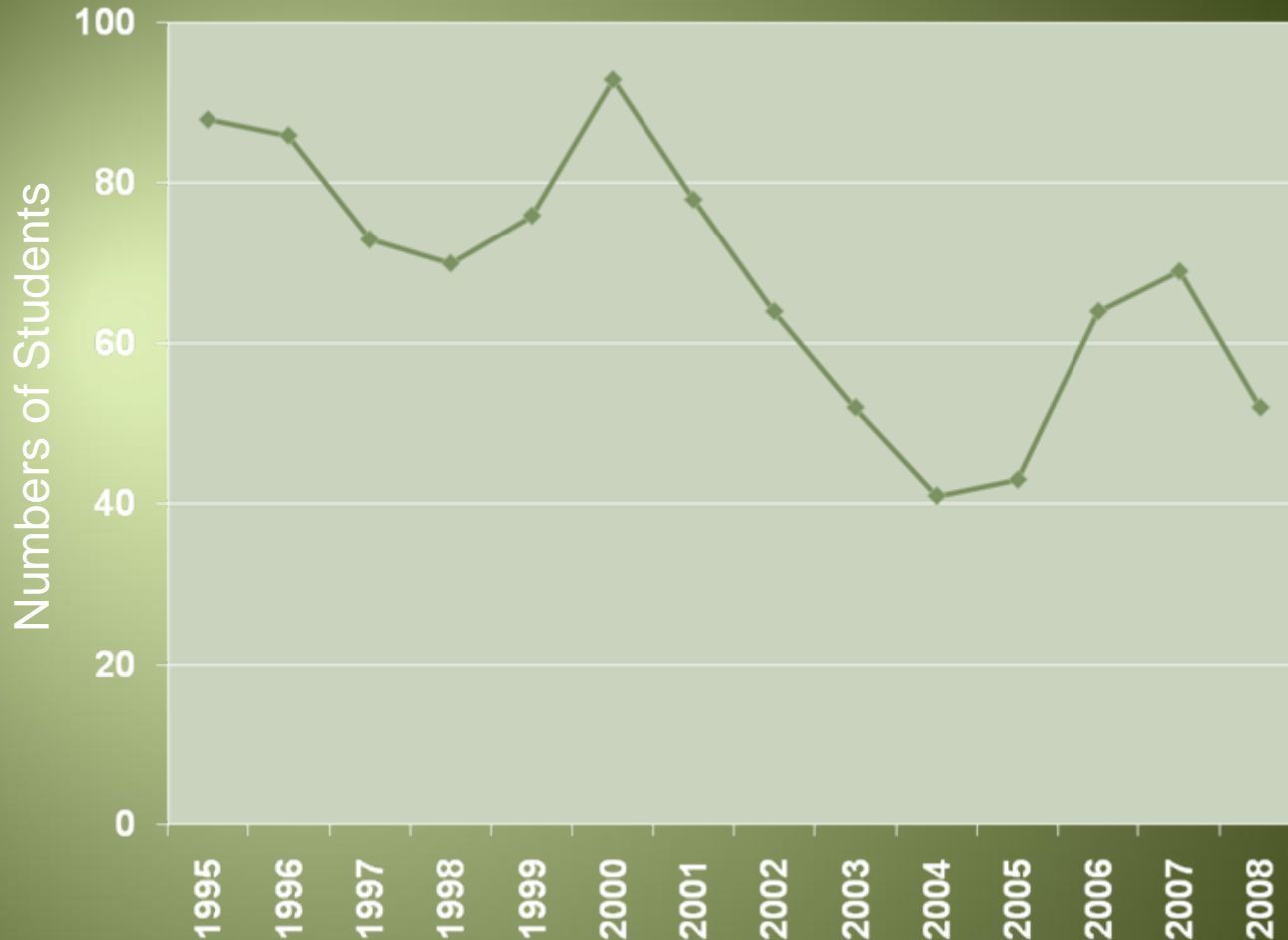




**Figure 1.** Number of baccalaureate degrees awarded in selected agricultural and natural-resources fields, United States, 1987–2004. From Gilmore et al. (2006; Appendix C). Data source: National Center for Education Statistics Completion Reports.

Enrollments in the plant sciences hit a low point in 1991-92, peaked in 1999-2000, and have been declining since.

## UCD "Plant Science" Enrollments



Crop Science & Management (Initiated 1997)  
Agricultural Mgmt & Rangeland Resource (Initiated 2002)  
Agriculture & Environmental Education (Initiated 2007)  
~~Agricultural Science & Mgmt (Terminated 1998)~~  
~~Plant Science (Terminated 1998)~~  
~~Agricultural Systems & Environ (Terminated 2005)~~

Not doing any better than the national average, in spite of faculty efforts to restructure majors and attract greater interest.

} Majors that have been dropped since 1995

# Summary

The concerns that led to the creation of the ad hoc committee (“Where are all the broadly-trained plant pathologists”) seem justified.

It is not just government or private sector employers who worry about the ability to recruit broadly-trained people, but also academic institutions.

There is a need to bolster the capability of graduate programs to provide students with “real world” experiences.

There is a need for graduate programs to provide students with greater information and preparation for an array of career paths.

We need to be concerned about bolstering undergraduate enrollments in the plant sciences (actually in all the agricultural sciences).

We need to elevate the perception of the agricultural sciences as both essential and cutting-edge...on a par with the STEM disciplines (Science, Technology, Engineering and Math) as called for in the recently-released report of the National Academies.