Assessment Report on the Masters in Biology, Masters in Environmental Science, and Ph.D. in Regulatory Biology, 2010

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Graduate Program Directors

1. **Introduction**

    a. Important overview information for assessment reviewers: Our department is relatively large with significant breadth in expertise. Our doctoral program is jointly composed of our departmental faculty and adjunct members of the Cleveland Clinic's Lerner Research Institute.

    b. Changes: There have been no changes that have influenced student learning outcomes.

    c. Response to the previous assessment review:

c. We thank the reviewers of the 2009 report for noting the effort that went into improving the clarity of the 2009 report relative to the 2008 report. As such, there were no additional recommendations to be addressed.

2. **Goals**

a. The goals (as well as outcome measures) are attached as appendix A(techniques), B(poster), C (candidacy), D1 (defense:thesis/dissertation), D2 (defense: non-thesis) and E (exit) to this report but can be summarized as follows:

> Appendix A: An assessment of incoming and outgoing knowledge of techniques, statistics and grant writing. The techniques are divided into five categories (listed in the form under the numbers 1,3,4,5 and 8) that represent the breadth of the department with the realization that overlap exists. Common to all are sections 2 (statistics), 6 (literature research and presentations) and section 8 (general alb techniques). Unique to the doctoral program is section 7 (grant writing).
> Appendix B: Poster evaluation: This is divided into three categories of goals/objectives/criteria each with 3-5 subdivisions. Each subdivision has 3 potential outcomes of excellent/satisfactory/unsatisfactory and criteria for these ranking is provided. The categories are: (1) Essential knowledge and critical perspective pertaining to a major substantive area of biology that the student has selected, (2) ability to execute original research of publishable quality, and (3) effective communication in written and oral form (an additional section specific to environmental science is included to asses familiarity with law, policy and technology issues.)
> Appendix C: candidacy exam specific to doctoral students: Same objectives and measures as for the Poster evaluation with the addition of the ability to "initiate and plan" under section (2) and a 4th category: Familiarity with fundamental biological principles outside the students chosen field that is appropriate to the doctoral level.

Appendix D1a: defense evaluation for doctoral students: Same objectives and measures as for the candidacy exam with the addition of 2 subdivisions under category (2) and a request that the advisor indicate the number of publications.
Appendix D1b: defense evaluation for Masters students (thesis); Same objectives and measures as for the Poster evaluation with the addition of 2 subdivisions under category (2) and a request that the advisor indicate the number of publications.
Appendix D2: defense evaluation for Masters students (non-thesis): Same objectives and measures used for the Poster evaluation.
Appendix E: Exit survey: This form documents the degree information and time in program, current employment and program review.

b. Program goals for these programs were adapted in 2003 by the department's Graduate Committee from pre-existing program objectives and then discussed and approved by the entire faculty of the department. Development of the goals, as well as the outcomes measures, took into consideration model assessment forms provided by the Assessment Office and forms obtained from other departments.

c. The Assessment Office was consulted during this process and final versions of the goals and outcome measures were approved by the Assessment Office in 2003.

3. Outcomes

a. The intended outcome is that students in our respective programs will be able to be successful in the acquisition of their next position. Masters level students will either enter the workforce or pursue higher education. Doctoral level students will sometimes enter the workforce but are more likely to be hired as post-doctoral fellows. Appendix E will provide us with this information if it is available at the time of their departure. This overall outcome depends on their mastery of the outcomes represented by the 15-17 subdivisions represented on the forms provided as appendices B-D2 and on the number or level of mastery of the techniques (appendix A). Proof that students learned what they were expected to learn is provided by an increase in the number or level of mastery of the techniques, by an improvement in the level of achievement on the goals/outcomes forms (ie: compare poster scores at year one with year two) and ultimately by the acquisition of their next position.

b. Outcome measures matched to program goals were developed as described in 2b. The initial assessment forms and procedure were modified based on experience in the first year and from input provided by the Assessment Office. Each student is evaluated by every member of their respective committee (ie: Masters students are evaluated by three reviewers for their defense performance and Doctoral students are evaluated by six reviewers for their candidacy exam and defense performance).
c. These have not been modified.

4. Data Collection

a. A Direct method of assessing student learning is the assessment of a "standardized performance or project". We use the forms provided as appendices B-D2 to assess two "standardized performances" for doctoral students (the candidacy exam and the defense) and one for Masters students (the defense). All are assessed in a "standardized project" (the poster

presentation) and this occurs annually for each student. A Indirect method of assessing student learning is the use of "questionnaires or surveys" . Students fill out a questionnaire (appendix A) upon entry and exit. They also fill out a survey (appendix E).

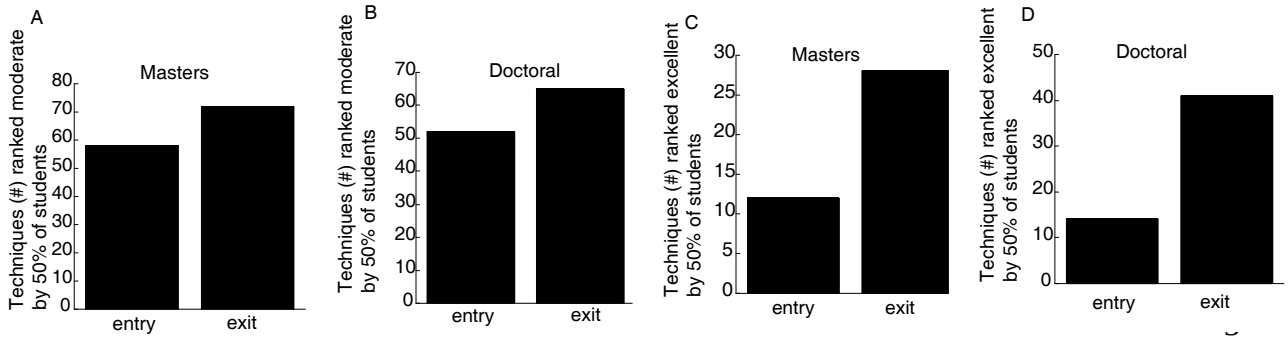
b. The final versions of these forms were approved by the Assessment Office and have not been modified.

5. Data analysis and findings

a. Results are still quite preliminary as we still only have data from a minority of students at both matriculation and graduation. Nonetheless, we have now also initiated tracking of individual students as they progress through the program and this will more informative than a batch analysis. In the 2009/2010 academic year, five Masters students and nine Doctoral students completed their respective programs and average data for each group is presented in Figures 2, 4-6. Still, batch analysis from year to year and from entry to graduation can provide overall "on average" information on the program.

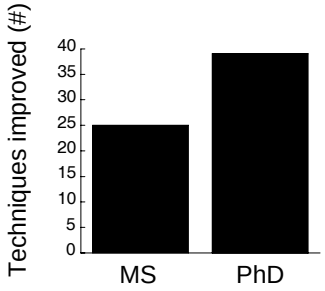
Technique evaluation: We have focused on the number of techniques that at least 50% of the students rank as "moderate" or "excellent" with respect to knowledge/experience at entry when compared to graduation. At entry, 50% of Masters students claim to have moderate knowledge/experience of 58 techniques while at graduation this has increased to 72 techniques (Fig. 1A). When comparing Doctoral students at entry and graduation we find a similar increase, albeit from 52 to 65 (Fig. 1B). At first glance one might find it curious that doctoral students at both entry and graduation claim to have moderate knowledge/experience of fewer techniques than Masters students. However, we find that generally the more you really learn/understand the more you realize what true limitations exist. For instance, this graduate program director with 19 years post Ph.D. lab experience has a moderate/excellent understanding of only 44 of the techniques listed. At entry, Masters students claim to have excellent knowledge/experience of 12 techniques while at graduation this has increased to 28 techniques. When comparing Doctoral students at entry and graduation we find a greater increase from 14-41. We are pleased by this increase for both Masters and Doctoral students and expected that Doctoral students who spend on average twice as long in the program would have acquired excellent knowledge/understanding of more techniques than Masters students. Any analysis of techniques must consider the breadth of techniques listed. Some research projects require extreme expertise in a few techniques while others require a moderate understanding of many techniques. It is most important that scientists be able to learn a new technique if/when necessary. Finally, when compared to last year, the numbers are similar and this is not surprising because this is a batch analysis. We have initiated review of students on an individual basis.

Figure 1



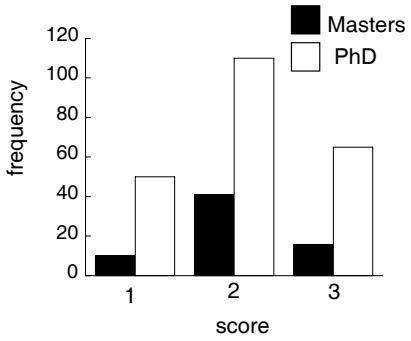
For the individual comparison, we have decided to focus on the number of techniques improved. For MS students, the number increased by 25 while for PhD students it increased by 39, likely reflecting the length of time in the program and the level of difficulty in the research project.

Figure 2



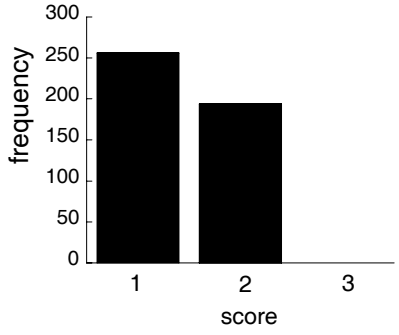
Poster evaluation: Since the scores in each of the 3 overall categories are reflective of the overall score, here we have compared the number of students earning an overall score in 2009 and 2010. With scores of 1, 2 or 3 corresponding to excellent, satisfactory or unsatisfactory, respectively. In general, Doctoral students score better than Masters students (Fig. 3). We see no difference this year when compared to last year and indeed this could be expected since each year we have roughly the same number of new students and roughly the same number of senior students graduate. Again, it will eventually be better to compare individual students over time.

Figure 3



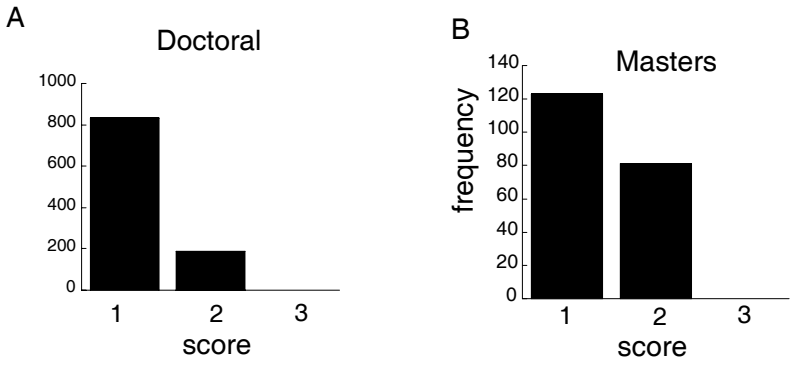
Candidacy exam evalutation (doctoral only): As was the case in 2009, there were no failed exams in 2010. This could be due in part to two grant-writing courses that were started several years ago. The results for the five students who passed show the expected relationship between exam outcome and assessment score and are similar to those passing last year (Figure 4). Again, scores of 1, 2 or 3 correspond to excellent, satisfactory or unsatisfactory, respectively.

Figure 4



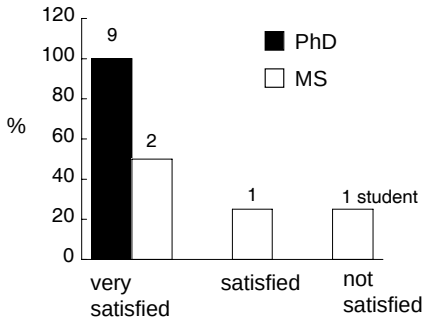
Defense exam evaluation: When compared to last years batch analysis, this is a 2-fold improvement in the ratio of 1 scores to 2 scores for MS students and a 3-fold improvement in the ratio of 1 scores to 2 scores for doctoral students. Doctoral scores are better overall than MS scores as is expected. Also, the ratio of 1 scores to 2 scores are better overall for doctoral defense exams than for the candidacy exams which would be expected if students were continuing to improve with time in the program (compare Figure 5A with Figure 4). Again, scores of 1, 2 or 3 correspond to excellent, satisfactory or unsatisfactory, respectively. Also, eventually it will be preferable to compare individual doctoral students at the time of candidacy and at the time of defense.

Figure 5



Exit evaluations: As reported last year after "batch analysis", in 2009, 82% of doctoral students and 95% of MS students were either "very satisfied" or "satisfied" with their training. In contrast, with only 4 MS students considered for this year, only 75% were either "very satisfied" or "satisfied". This one person represented a very special case. Considering nine doctoral students, 100% were "very satisfied".

Figure 6



b. There were no reviewer comments from the previous year.

6. Review of findings

a. The 2009 report was discussed at the Fall 2009 Faculty meeting. Summaries of the data for 2010 were reviewed by the graduate committee which consists of 5 members from CSU and 3 members from the Cleveland Clinic and the graduate program directors discussed them with the

Chair. The results and conclusions of the 2010 report will be discussed by the entire BGES faculty at a faculty meeting next fall, the next opportunity. This process is followed every year.
b. The reviewer's comments from the previous year indicate that we did not share assessment data with the faculty but were planning to do so and this is mentioned above.

7. Follow-up actions

a. In general, the data indicates that our students are improving in all categories deemed by the department to be necessary for their future success in their respective chosen field. As mentioned previously, our department has significant breadth in expertise and as such so do our students. Thus, we will continue with our successful approach. Obviously, if we could hire more faculty we could add more courses allowing for additional expertise and train more students.

b. There were no reviewer comments from the previous year.

Appendix A

Survey of Graduate Student Knowledge of Essential Methods and Techniques

Assessment of Student Academic Achievement/BGES Graduate Program

This evaluation is to be completed by each BGES graduate student once at entering and once upon completing the program. This survey is for our program assessment only; **your answers will be used solely for statistical purposes and will not be seen by your Major Advisor, Committee or course instructors**.

For each row, **please check the appropriate boxes for <u>both theoretical and practical knowledge</u>**; leaving blank anything that does not apply. Return this form to the departmental secretary.

Your Name: _____ ***Occasion (Program Entry/Completion):*** _____ ***Date:*** _____

Your Current Program: _____ ***Primary Area of Interest (e.g., cell, molecular, ecology, etc.):*** _____

Area / Specific Techniques	***Theoretical Knowledge***			***Practical Experience***		
Level Descriptions / ***Techniques***	**Excellent** *Know uses and limitations, how to interpret results, discussed at length, e.g., in seminars or workshops*	**Moderate** *Know basic use, encountered in courses or reading*	**Cursory/None** *Unknown or have seen the name*	**Excellent** *Used routinely in research*	**Moderate** *Used a few times in lab courses*	**Cursory/None** *Unknown or never actually used*
1. Molecular/Cellular Biology ***Area's importance to you*** major minor none						
a. Plasmid DNA purification and manipulation	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
b. RNA purification	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
c. Polymerase chain reaction (PCR)	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
d. DNA ligation and bacterial transformation	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
e. Northern and Southern Blotting	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
f. Western Blotting	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
g. Cell culture	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
h. Recombinant protein expression in bacteria/yeast	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
i. Mammalian cell transfection	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
j. Basics of general enzyme assay	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
k. Agarose and polyacrylamide gel electrophoresis	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
l. Immunostain	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory

m. Pull downs/IP's	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
2. Statistics/Modeling ***Area's importance to you*** major minor none						
a. Means, variance, STD, confidence intervals	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
b. T-tests and other two sample tests	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
c. ANOVA and multiple two-sample comparisons	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
d. Linear regression	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
e. Chi square	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
f. Non-parametric tests: e.g., Mann-Whitney U, Wilcoxon	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
g. Experimental Design	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
h. Null hypothesis, ∀ and ∃ (or Type 1 and 2) errors	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
3. Ecology/Environmental Science ***Area's importance to you*** major minor none						
a. GPS systems	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
b. Population census techniques, e.g., marking/recapture	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
c. Transect design, density estimates	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
d. Water chemistry analysis	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
e. Defining biological indicator species	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
f. Mathematical modeling	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
4. Evolution/systematics ***Area's importance to you*** major minor none						
a. DNA and protein sequence analysis	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
b. Genetic analysis of populations	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
c. Genetic markers–allozymes	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
d. Genetic markers–RFLPs	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
e. Genetic markers–RAPDs	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
f. Genetic markers–microsatellites	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
g. Fundamentals of nomenclature–botany or zoology	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory

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b. Writing and criticizing grant applications	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
8. General laboratory techniques						
a. Radiation Safety	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory
b. Chemical Safety	Excellent	Moderate	Cursory	Excellent	Moderate	Cursory

Appendix B

Poster Evaluation

Assessment of Student Academic Achievement Objectives/BGES Graduate Program

This evaluation is to be completed by each member person selected to evaluate Poster presentations. Return form to the department secretary. Please check the appropriate box in each row, leaving blank anything that does not apply. Evaluation is with respect to discipline norms.

Student's Name: _____ ***Student's Program:*** _____ ***Number of years in program:*** _____

Date: _____ ***Person completing evaluation:*** _____ ***GCCAS***

Objectives/Criteria for Evaluation	**Level of Achievement**		
The objectives are to develop in the student:	**Excellent**	**Satisfactory**	**Unsatisfactory**
1. Essential knowledge and critical perspective pertaining to the major substantive area of biology that the student has selected			
a. Depth of knowledge	Student shows excellent understanding of fundamental principles in the area; good working knowledge of literature: readily cites many relevant articles.	Student displays good understanding of fundamentals; generally familiar with key literature.	Understanding of fundamental principles directly related to the area is weak; unfamiliar with important literature.
b. Breadth of knowledge	Student shows good understanding of related subjects.	Knowledge of related subjects is adequate.	Knowledge of related subjects is weak.
c. Knowledge of standard methods	Student shows excellent understanding of experimental methods, their uses and limitations.	Knowledge of methods is adequate: familiar with standard methods and their application.	Knowledge of methods is weak, liable to lead to inappropriate usage and interpretations.
d. Critical perspective on literature	Excellent understanding; Can critique articles and explain their place in the field as a whole	Can cite key findings and some weaknesses of individual articles; can explain some relationships.	Unable to critique literature and relate one finding to another.
2. Ability to execute original research of publishable quality			
a. Adequacy of the scope of the research	Work has examined several facets of the problem	Amount of work is adequate, perhaps limited to one aspect.	Amount of work done is inadequate.
b. Adequacy of the depth of the research	Work has probed deeply the chosen problem; logically compelling	Work answers some basic questions of the problem.	Work only touched the surface of the problem.
c. Logic of the research plan	Proceeds in an orderly logical fashion,	Addresses major alternatives and	Does not address major

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	considering all alternatives and controls.	controls.	alternative explanations
3. Effective communication in written and oral form.			
a. Quality of the writing style	Written sentences are complete and grammatical, stylistically pleasing. Words are chosen for their precise meaning.	Writing is grammatically correct. Paragraphs and sentences may not flow together perfectly.	Writing contains many grammatical errors.
b. Organization of the presentation	Presentation is clear, logical and organized. Viewer can follow line of reasoning.	Viewer can follow and understand the presentation.	Poster is poorly organized, jumps from topic to topic.
c. Clarity of language usage	Comfortable delivery, easily audible and understandable by all.	Generally understandable. May have some grammatical errors, incomplete sentences, or imprecise formulations.	Pronunciation, grammatical errors, or delivery make speaker difficult to understand or hear.
d. Ability to answer questions	Answered questions directly, clearly and to the point.	Student can answer questions, but with some difficulty. May need some prompting.	Difficulty understanding questions and/or unable to answer important questions, even with prompting.
e. Quality of visual presentation	Graphics and visual aids enhance the presentation; prepared in a professional manner.	Visual aids are adequate for the presentation.	Visual aids are inadequate (writing too small, poorly labeled; too much or too little information).
4. Complete this section for MASTERS - ENVIRONMENTAL SCIENCE Degree Program ONLY: **Familiarity with related areas of environmental science, including law, policy, and technology issues.**			
a. Familiarity with law and policy issues related to the work	**Student shows excellent understanding and ability to discuss implications.**	**Student displays some understanding and ability to discuss implications.**	**Student is unfamiliar with related areas; unable to speak to related aspects**
b. Familiarity with technology issues related to the work	**Student shows excellent understanding and ability to discuss implications.**	**Student displays some understanding and ability to discuss implications.**	**Student is unfamiliar with related areas; unable to speak to related aspects**

Have any papers resulting from the work been accepted for publication in peer-reviewed journals? _____Yes _____No
If yes, how many? _____

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Appendix C

Doctor of Regulatory Biology
Assessment of Student Academic Achievement Objectives/BGES Graduate Program

This evaluation is to be completed by each member of the student's doctoral dissertation committee, upon completion of the exam or defense. Return form to the department secretary. Please check the appropriate box in each row, leaving blank anything that does not apply. Evaluation is with respect to discipline norms for the doctoral level.

Student's Name: _____ ***Occasion (Circle one): Cand.Exam/ Defense*** ***Date: _____***

Outcome voted by evaluator (circle one): Pass/Retry/Fail ***Person completing evaluation: _____***

Objectives/Criteria for Evaluation	**Level of Achievement**		
The objectives are to develop in the student:	**Excellent**	**Satisfactory**	**Unsatisfactory**
1. Essential knowledge and critical perspective pertaining to the major substantive area of biology that the student has selected			
a. Depth of knowledge	Student shows excellent understanding of fundamental principles in the area; good working knowledge of literature: readily cites many relevant articles.	Student displays good understanding of fundamentals; generally familiar with key literature.	Understanding of fundamental principles directly related to the area is weak; unfamiliar with important literature.
b. Breadth of knowledge	Student shows good understanding of related subjects.	Knowledge of related subjects is adequate.	Knowledge of related subjects is weak.
c. Knowledge of methods, both standard and advanced	Student shows excellent understanding of experimental methods, their uses and limitations.	Knowledge of methods is adequate: familiar with standard methods and their application.	Knowledge of methods is weak, liable to lead to inappropriate usage and interpretations.
d. Critical perspective on literature	Excellent understanding; Can critique articles and explain their place in the field as a whole	Can cite key findings and some weaknesses of individual articles; can explain some relationships.	Unable to critique literature and relate one finding to another.
2. Ability to initiate, plan and execute original research of publishable quality			
a. Adequacy of the scope of the research	Work has examined many facets of the problem	Amount of work is adequate, perhaps neglecting some aspects.	Amount of work done is inadequate.
b. Adequacy of the depth of the research	Work has probed deeply the chosen problem; logically compelling	Work answers the basic questions of the problem.	Work only touched the surface of the problem.
c. Logic of the research plan	Proceeds in an orderly logical fashion, considering all alternatives and controls.	Addresses major alternatives and controls.	Does not address major alternative explanations

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d. Novelty of the research	Research is an innovative idea from the student; student shows creativity in designing experiments and solving problems.	Student contributed originality to designing experiments and solving problems.	The student followed directions from his/her advisor.
e. Skill in execution (Defense only)	**Routine and difficult techniques carried out well with skill.**	**Routine techniques applied well, providing clear results.**	**Shoddy experimental technique; data unconvincing.**
f. Impact on advancement of the field (Defense only)	**Work has strong impact on the field.**	**Work has incremental impact on field.**	**Work has no impact on the field.**
3. Effective communication in written and oral form.			
a. Quality of the writing style	Written sentences are complete and grammatical, stylistically pleasing. Words are chosen for their precise meaning.	Writing is grammatically correct. Paragraphs and sentences may not flow together perfectly.	Writing contains many grammatical errors.
b. Organization of the written proposal/dissertation	Logically organized and easy to follow.	Organization is clear.	Poorly organized.
c. Organization of the presentation	Presentation is clear, logical and organized. Listener can follow line of reasoning. Pacing is correct for the audience.	Listener can follow and understand the presentation.	Talk is poorly organized. Speaker jumps from topic to topic.
d. Clarity of language usage	Comfortable delivery, easily audible and understandable by all.	Generally understandable. May have some grammatical errors, incomplete sentences, or imprecise formulations.	Pronunciation, grammatical errors, or delivery make speaker difficult to understand or hear.
e. Ability to answer questions	Answered questions directly, clearly and to the point.	Student can answer questions, but with some difficulty. May need some prompting.	Difficulty understanding questions and/or unable to answer important questions, even with prompting.
f. Quality of visual presentation	Visual aids enhance the presentation and are prepared in a professional manner.	Visual aids are adequate for the presentation.	Visual aids are inadequate (writing too small, too much or too little information per slide).
4. Familiarity with fundamental biological principles and issues outside the student's chosen field that is appropriate to the doctoral level or a beginning assistant professor, e.g., evolution, systematics, ecology, physiology, genetics, biochemistry, statistics, etc.			
a. Depth of knowledge	Student shows excellent understanding of fundamental principles.	Student displays good understanding of fundamentals.	Student is unfamiliar with fundamental principles.

To be answered by the research advisor only:

Have any papers resulting from the dissertation work been accepted for publication in peer-reviewed journals? _____Yes _____No

If yes, how many? _____ (Please submit or have student submit a complete list.)

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Appendix D1a

Doctor of Regulatory Biology
Assessment of Student Academic Achievement Objectives/BGES Graduate Program

This evaluation is to be completed by each member of the student's doctoral dissertation committee, upon completion of the exam or defense. Return form to the department secretary. Please check the appropriate box in each row, leaving blank anything that does not apply. Evaluation is with respect to discipline norms for the doctoral level.

Student's Name: _____ ***Occasion (Circle one): Cand.Exam/ Defense*** ***Date: _____***

Outcome voted by evaluator (circle one): Pass/Retry/Fail ***Person completing evaluation: _____***

Objectives/Criteria for Evaluation	**Level of Achievement**		
The objectives are to develop in the student:	**Excellent**	**Satisfactory**	**Unsatisfactory**
1. Essential knowledge and critical perspective pertaining to the major substantive area of biology that the student has selected			
a. Depth of knowledge	Student shows excellent understanding of fundamental principles in the area; good working knowledge of literature: readily cites many relevant articles.	Student displays good understanding of fundamentals; generally familiar with key literature.	Understanding of fundamental principles directly related to the area is weak; unfamiliar with important literature.
b. Breadth of knowledge	Student shows good understanding of related subjects.	Knowledge of related subjects is adequate.	Knowledge of related subjects is weak.
c. Knowledge of methods, both standard and advanced	Student shows excellent understanding of experimental methods, their uses and limitations.	Knowledge of methods is adequate: familiar with standard methods and their application.	Knowledge of methods is weak, liable to lead to inappropriate usage and interpretations.
d. Critical perspective on literature	Excellent understanding; Can critique articles and explain their place in the field as a whole	Can cite key findings and some weaknesses of individual articles; can explain some relationships.	Unable to critique literature and relate one finding to another.
2. Ability to initiate, plan and execute original research of publishable quality			
a. Adequacy of the scope of the research	Work has examined many facets of the problem	Amount of work is adequate, perhaps neglecting some aspects.	Amount of work done is inadequate.
b. Adequacy of the depth of the research	Work has probed deeply the chosen problem; logically compelling	Work answers the basic questions of the problem.	Work only touched the surface of the problem.
c. Logic of the research plan	Proceeds in an orderly logical fashion, considering all alternatives and controls.	Addresses major alternatives and controls.	Does not address major alternative explanations

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d. Novelty of the research	Research is an innovative idea from the student; student shows creativity in designing experiments and solving problems.	Student contributed originality to designing experiments and solving problems.	The student followed directions from his/her advisor.
e. Skill in execution (Defense only)	**Routine and difficult techniques carried out well with skill.**	**Routine techniques applied well, providing clear results.**	**Shoddy experimental technique; data unconvincing.**
f. Impact on advancement of the field (Defense only)	**Work has strong impact on the field.**	**Work has incremental impact on field.**	**Work has no impact on the field.**
3. Effective communication in written and oral form.			
a. Quality of the writing style	Written sentences are complete and grammatical, stylistically pleasing. Words are chosen for their precise meaning.	Writing is grammatically correct. Paragraphs and sentences may not flow together perfectly.	Writing contains many grammatical errors.
b. Organization of the written proposal/dissertation	Logically organized and easy to follow.	Organization is clear.	Poorly organized.
c. Organization of the presentation	Presentation is clear, logical and organized. Listener can follow line of reasoning. Pacing is correct for the audience.	Listener can follow and understand the presentation.	Talk is poorly organized. Speaker jumps from topic to topic.
d. Clarity of language usage	Comfortable delivery, easily audible and understandable by all.	Generally understandable. May have some grammatical errors, incomplete sentences, or imprecise formulations.	Pronunciation, grammatical errors, or delivery make speaker difficult to understand or hear.
e. Ability to answer questions	Answered questions directly, clearly and to the point.	Student can answer questions, but with some difficulty. May need some prompting.	Difficulty understanding questions and/or unable to answer important questions, even with prompting.
f. Quality of visual presentation	Visual aids enhance the presentation and are prepared in a professional manner.	Visual aids are adequate for the presentation.	Visual aids are inadequate (writing too small, too much or too little information per slide).
4. Familiarity with fundamental biological principles and issues outside the student's chosen field that is appropriate to the doctoral level or a beginning assistant professor, e.g., evolution, systematics, ecology, physiology, genetics, biochemistry, statistics, etc.			
a. Depth of knowledge	Student shows excellent understanding of fundamental principles.	Student displays good understanding of fundamentals.	Student is unfamiliar with fundamental principles.

To be answered by the research advisor only:

Have any papers resulting from the dissertation work been accepted for publication in peer-reviewed journals? _____Yes _____No

If yes, how many? _____ (Please submit or have student submit a complete list.)

TURN TO OTHER SIDE →

Masters in Biology/Environmental Science

Appendix D1b

Assessment of Student Academic Achievement Objectives/BGES Graduate Program

This evaluation is to be completed by each member of the student's Advisory Committee, upon completion of the defense. Return form to the department secretary. Please check the appropriate box in each row, leaving blank anything that does not apply. Evaluation is with respect to discipline norms for the Masters level.

Student's Name: _____ Occasion (Defense) Date: _____ Person completing evaluation: _____

Outcome voted by evaluator (circle one): Pass/Retry/Fail

Objectives/Criteria for Evaluation	**Level of Achievement**		
The objectives are to develop in the student:	**Excellent**	**Satisfactory**	**Unsatisfactory**
1. Essential knowledge and critical perspective pertaining to the major substantive area of biology that the student has selected			
a. Depth of knowledge	Student shows excellent understanding of fundamental principles in the area; good working knowledge of literature: readily cites many relevant articles.	Student displays good understanding of fundamentals; generally familiar with key literature.	Understanding of fundamental principles directly related to the area is weak; unfamiliar with important literature.
b. Breadth of knowledge	Student shows good understanding of related subjects.	Knowledge of related subjects is adequate.	Knowledge of related subjects is weak.
c. Knowledge of standard methods	Student shows excellent understanding of experimental methods, their uses and limitations.	Knowledge of methods is adequate: familiar with standard methods and their application.	Knowledge of methods is weak, liable to lead to inappropriate usage and interpretations.
d. Critical perspective on literature	Excellent understanding; Can critique articles and explain their place in the field as a whole	Can cite key findings and some weaknesses of individual articles; can explain some relationships.	Unable to critique literature and relate one finding to another.
2. Ability to execute original research of publishable quality			
a. Adequacy of the scope of the research	Work has examined several facets of the problem	Amount of work is adequate, perhaps limited to one aspect.	Amount of work done is inadequate.
b. Adequacy of the depth of the research	Work has probed deeply the chosen problem; logically compelling	Work answers some basic questions of the problem.	Work only touched the surface of the problem.
c. Logic of the research plan	Proceeds in an orderly logical fashion, considering all alternatives and controls.	Addresses major alternatives and controls.	Does not address major alternative explanations
d. Novelty of the research	Research is an innovative idea from the student; student shows creativity in designing experiments and solving problems.	Student contributed originality to designing experiments and solving problems.	The student followed directions from his/her advisor.

TURN TO OTHER SIDE →

e. Skill in execution (Defense only)	**Routine and difficult techniques carried out well with skill.**	**Routine techniques applied well, providing clear results.**	**Shoddy experimental technique; data unconvincing.**
f. Impact on advancement of the field (Defense only)	**Work has strong impact on the field.**	**Work has incremental impact on field.**	**Work has no impact on the field.**
3. Effective communication in written and oral form.			
a. Quality of the writing style	Written sentences are complete and grammatical, stylistically pleasing. Words are chosen for their precise meaning.	Writing is grammatically correct. Paragraphs and sentences may not flow together perfectly.	Writing contains many grammatical errors.
b. Organization of the written thesis	Logically organized and easy to follow.	Organization is clear.	Poorly organized.
c. Organization of the presentation	Presentation is clear, logical and organized. Listener can follow line of reasoning. Pacing is correct for the audience.	Listener can follow and understand the presentation.	Presentation is poorly organized. Speaker jumps from topic to topic.
d. Clarity of language usage	Comfortable delivery, easily audible and understandable by all.	Generally understandable. May have some grammatical errors, incomplete sentences, or imprecise formulations.	Pronunciation, grammatical errors, or delivery make speaker difficult to understand or hear.
e. Ability to answer questions	Answered questions directly, clearly and to the point.	Student can answer questions, but with some difficulty. May need some prompting.	Difficulty understanding questions and/or unable to answer important questions, even with prompting.
f. Quality of visual presentation	Visual aids enhance the presentation and are prepared in a professional manner.	Visual aids are adequate for the presentation.	Visual aids are inadequate (writing too small, too much or too little information per slide).
4. Complete this section for MASTERS – ENVIRONMENTAL SCIENCE Degree Program ONLY: Familiarity with related areas of environmental science, including law, policy, and technology issues.			
a. Familiarity with law and policy issues related to the work	**Student shows excellent understanding and ability to discuss implications.**	**Student displays some understanding and ability to discuss implications.**	**Student is unfamiliar with related areas; unable to speak to related aspects**
b. Familiarity with technology issues related to the work	**Student shows excellent understanding and ability to discuss implications.**	**Student displays some understanding and ability to discuss implications.**	**Student is unfamiliar with related areas; unable to speak to related aspects**

To be answered by the research advisor only:

Have any papers resulting from the dissertation work been accepted for publication in peer-reviewed journals? _____Yes _____No

If yes, how many? _____ (Please submit or have student submit a complete list.)

TURN TO OTHER SIDE →

Non-Thesis Masters in Biology/Environmental Science

Appendix D2

Assessment of Student Academic Achievement Objectives/BGES Graduate Program

This evaluation is to be completed by each member of the student's Advisory Committee, upon completion of the exam or defense. Return form to the department secretary. Please check the appropriate box in each row, leaving blank anything that does not apply. Evaluation is with respect to discipline norms for the Masters level.

Student's Name: _____ ***Occasion (Exam)*** ***Date:*** _____

Outcome voted by evaluator (circle one): Pass/Retry/Fail ***Person completing evaluation:*** _____

Objectives/Criteria for Evaluation	**Level of Achievement**		
The objectives are to develop in the student:	**Excellent**	**Satisfactory**	**Unsatisfactory**
1. Essential knowledge and critical perspective pertaining to the major substantive area of biology that the student has selected			
a. Depth of knowledge	Student shows excellent understanding of fundamental principles in the area; good working knowledge of literature: readily cites many relevant articles.	Student displays good understanding of fundamentals; generally familiar with key literature.	Understanding of fundamental principles directly related to the area is weak; unfamiliar with important literature.
b. Breadth of knowledge	Student shows good understanding of related subjects.	Knowledge of related subjects is adequate.	Knowledge of related subjects is weak.
c. Knowledge of standard methods	Student shows excellent understanding of experimental methods, their uses and limitations.	Knowledge of methods is adequate: familiar with standard methods and their application.	Knowledge of methods is weak, liable to lead to inappropriate usage and interpretations.
d. Critical perspective on literature	Excellent understanding; Can critique articles and explain their place in the field as a whole	Can cite key findings and some weaknesses of individual articles; can explain some relationships.	Unable to critique literature and relate one finding to another.
2. Ability to critically read and evaluate the original scientific literature, as evidenced by the library research paper			
a. Adequacy of the scope of the literature research paper	Work has examined several facets of the problem	Amount of work is adequate, perhaps limited to one aspect.	Amount of work done is inadequate.
b. Adequacy of the depth of the literature research paper	Work has probed deeply the chosen problem; logically compelling; raises novel questions.	Work addressed some basic questions of the problem.	Work only touched the surface of the problem.

TURN TO OTHER SIDE →

c. Critical perspective on literature	Excellent understanding; Can critique articles and explain their place in the field as a whole	Can cite key findings and some weaknesses of individual articles; can explain some relationships.	Unable to critique literature and relate one finding to another.
d. Novelty of the treatment	Student independently raises novel questions and relationships.	Student contributed some original material and interpretations.	The student essentially followed directions from his/her advisor.
3. Effective communication in written and oral form.			
a. Quality of the writing style	Written sentences are complete and grammatical, stylistically pleasing. Words are chosen for their precise meaning.	Writing is grammatically correct. Paragraphs and sentences may not flow together perfectly.	Writing contains many grammatical errors.
b. Organization of the research paper	Logically organized and easy to follow.	Organization is clear.	P**-oorly organized.
c. Organization of the presentation	Presentation is clear, logical and organized. Listener can follow line of reasoning. Pacing is correct for the audience.	Listener can follow and understand the presentation.	Presentation is poorly organized. Speaker jumps from topic to topic.
d. Clarity of language usage	Comfortable delivery, easily audible and understandable by all.	Generally understandable. May have some grammatical errors, incomplete sentences, or imprecise formulations.	Pronunciation, grammatical errors, or delivery make speaker difficult to understand or hear.
e. Ability to answer questions	Answered questions directly, clearly and to the point.	Student can answer questions, but with some difficulty. May need some prompting.	Difficulty understanding questions and/or unable to answer important questions, even with prompting.
f. Quality of visual presentation	Visual aids enhance the presentation and are prepared in a professional manner.	Visual aids are adequate for the presentation.	Visual aids are inadequate (writing too small, too much or too little information per slide).
4. Complete this section for NON-THESIS MASTERS IN ENVIRONMENTAL SCIENCE Program ONLY: Familiarity with related areas of environmental science, including law, policy, and technology issues.			
a. Familiarity with law and policy issues related to the work	**Student shows excellent understanding and ability to discuss implications.**	**Student displays some understanding and ability to discuss implications.**	**Student is unfamiliar with related areas; unable to speak to related aspects**
b. Familiarity with technology issues related to the work	**Student shows excellent understanding and ability to discuss implications.**	**Student displays some understanding and ability to discuss implications.**	**Student is unfamiliar with related areas; unable to speak to related aspects**

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Appendix E

BGES Graduate Program Exit Survey

In order to track our graduates and for statistical purposes to help us evaluate our graduate programs, we would appreciate your answering the following brief questionnaire. (Complete both sides. Circle or fill in blanks as appropriate. Add comments as desired.)

Your Name: **Date:**

Mailing Address:

email:

I. Degree information

A. Highest CSU/BGES degree completed:

PhD MS Biology (thesis) MS Envir. Sci MS non-thesis

B. **If you enrolled in any of the following programs at CSU after completing the degree above please circle the most recent:**

PhD MS Biology (thesis) MS Envir. Sci MS non-thesis

C. Highest degree completed anywhere/Name of Institution _____

PhD MS Biology (thesis) MS Envir. Sci MS non-thesis

D. Approximate number of years enrolled in the CSU program _____

1. Primary enrollment status: *Full-time Part-time*

2. **Primary source of financial support in your final year at CSU:**

TA RA Non-CSU work Other (e.g., spouse, savings)

II. Current employment

A. Status or job category:

College/University Teaching *K-12 Teaching*

Government/Public Sector Research *Non-profit Organization*

Private Sector: R & D *Private Sector: non R&D*

Self-employed *Actively job searching*

Further Education (Degree program and Institution):

Other (describe briefly)

B. Current employer:

1. Name:

2. Location (City, State):

3. **Type of business/activity:**

4. **Were you employed in this a job before entering the CSU program or during a significant portion of your studies?** *yes* *no*

5. **Was this your first employment after you left CSU/BGES?** *yes* *no* **If not, please briefly describe your first employer and job after leaving CSU/BGES:**

C. **Current job title or position:**

D. **Brief description of your current job:**

E. **How well does this employment utilize your training at CSU ?**

very well *well* *moderately* *a little* *not at all*

F. **How does this employment match your career goals when you entered the CSU program?**

very well *well* *moderately* *a little* *not at all*

G. **How does this employment match your present career goals?**

very well *well* *moderately* *a little* *not at all*

III. **Program review**

A. **Overall satisfaction with your CSU graduate training:**
very satisfied *satisfied* *indifferent* *dissatisfied* *very dissatisfied*

B. **What did you like best about your experience at CSU?**

C. **What did you like least about your experience at CSU?**

D. **Would you recommend the CSU graduate program to others in your position?**
yes, definitely *yes, qualified* *neutral* *probably not* *definitely not*

E. **If you left <u>before completing</u> the BGES program in which you were enrolled, what were your reasons for leaving (circle more than one if they apply)?**
change in career goals *program transfer* *job opportunity*
financial grounds *personal or familial reasons* *program dissatisfaction*
other (please describe)

1. **At the time you left, did you feel you were making good progress in the program?** *yes* *no*

A. **How many manuscripts, if any, have you published either alone or as coauthor ?**
_____ How many of these manuscripts were written as part of your CSU/BGES

program? _____ On how many are you first author? _____ Please send us a complete list of publications, if this is convenient.

B. **Please note any additional comments or suggestions concerning the program:**

Thank your very much for your cooperation. Please keep us informed of changes in your address and job.

BGES Graduate Program Office *email: gpd.bges@csuohio.edu*