<table>
<thead>
<tr>
<th><strong>Inputs</strong></th>
<th><strong>Strategies</strong></th>
<th><strong>Outputs</strong></th>
<th><strong>Outcomes</strong></th>
<th><strong>Impacts</strong></th>
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</thead>
<tbody>
<tr>
<td>Undergraduate Students</td>
<td>Provide various opportunities for a wide variety of students to engage in significant mentored and interdisciplinary summer research experiences in ecology at Washington &amp; Jefferson College (current depts involved: BIO, EVS, ITL, &amp; MTH)</td>
<td>Number and demographics of all HHMI-supported on-campus summer LEM research students</td>
<td>Students value their summer experience (primarily through student, peer, and mentor perceptions and attitudes)—SURE survey</td>
<td>Students who value scientific research and understand how science and the research enterprise works</td>
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<tr>
<td>Research Mentors – undergraduate peers, postdocs, and faculty</td>
<td>Summer on-campus research by undergraduate interns will reach more undergraduates through the contribution of information (and the development of research protocols/experiences) to existing Biology courses, EVS courses, and other courses in the W&amp;J curriculum (through the use of a dedicated server and website)</td>
<td>Number and demographics of HHMI-supported on-campus summer LEM research students graduating in natural sciences and mathematics and ITL</td>
<td>Students are more interested in and value research in science/mathematics or other related disciplines</td>
<td>Graduates who are engaged in science-related professions</td>
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<tr>
<td>On-campus Summer Research Projects</td>
<td>Efforts will be made to recruit students for internships 1) from different classes (Freshmen, Sophomores, Juniors, Seniors), 2) from a variety of academic departments, 3) with different levels of research experience, and 4) from underrepresented minority groups</td>
<td>Number and demographics of all HHMI-supported on-campus summer LEM research students continuing to engage in science, mathematics, and ITL</td>
<td>Students have increased content knowledge and test scores in science and related disciplines</td>
<td>Increasing the number of faculty who mentor undergraduate students who contribute to the research enterprise</td>
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<tr>
<td>Research Equipment and Supplies</td>
<td>Recruit and match students with appropriate faculty/postdoc (ITL and BIO) mentors and train potential student mentors</td>
<td>Number and demographics of non-HHMI supported on-campus summer LEM research students who were affected by HHMI research support (e.g., attended science seminars, or decided to engage in research without HHMI support)</td>
<td>Students have enhanced knowledge regarding graduate and professional school in the sciences and related disciplines</td>
<td>Institutions place a high value on providing significant undergraduate research as part of the institution’s culture</td>
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<td>Research Infrastructure—laboratories, classrooms, and housing for summer interns</td>
<td>Supportive Research Environment</td>
<td>Number and demographics of mentors (undergraduate peers and postdocs)</td>
<td>Students can communicate science effectively</td>
<td></td>
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<tr>
<td>Collaborating Institutions—4th year for LEM</td>
<td>On-campus Research Directors</td>
<td>Number and characteristics of faculty who take undergraduate on-campus summer research students</td>
<td>Students’ career expectations relative to science careers post-baccalaureate degree are more realistic/informed/ enhanced</td>
<td></td>
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<tr>
<td>Supportive Research Environment</td>
<td>Short-term Mentors and Mentorship</td>
<td>Research projects information: Name of project, department(s), and mentor name</td>
<td>Students continue in science through various post-baccalaureate degree programs (M.S., Ph.D., M.D.-Ph.D., M.D, etc.)</td>
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<tr>
<td>Long-term Mentors and Mentorship</td>
<td>Follow-up: Short-term—student progress at W&amp;J; Long-term—1-5 years post graduation</td>
<td>Student success in research projects: publications, awards, and poster/presentations at meetings (on- and off-campus)</td>
<td>Students continuing in science through other avenues (postbac programs, research lab techs, etc.)</td>
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<tr>
<td>Leadership: Internal and external advisory boards for HHMI, President and Academic Affairs at W&amp;J</td>
<td>Leadership: Internal and external advisory boards for HHMI, President and Academic Affairs at W&amp;J</td>
<td>General objectives for student interns and faculty mentors associated with the LEM project:</td>
<td>Mentors have enhanced mentoring skills</td>
<td></td>
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<td></td>
<td>Supportive Research Environment</td>
<td>General objectives for student interns and faculty mentors associated with the LEM project: 1. Implement new AFS property and research management protocols including detailed methods for managing and archiving collected data. 2. Finalize and implement protocols for collecting long-term data on plant/animal</td>
<td>An increasing number of faculty continue their involvement in providing research experiences to undergraduates</td>
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<td></td>
<td>On-campus Research Directors</td>
<td>Learning outcomes for interns associated with LEM:</td>
<td>New institutional or other sources of support for undergraduate research experiences are created or found</td>
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<tr>
<td></td>
<td>Short-term Mentors and Mentorship</td>
<td>Learning outcomes for interns associated with LEM:</td>
<td></td>
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**Washington & Jefferson College On-campus Summer Student Research—LEM**
| 1. Understand and apply the common methodologies in ecology and field biology for assessing plant/animal populations and diversity, water quality, and spatial characteristics of landscapes and ecosystems using GPS and GIS. |
| 2. Accurately collect data in the field and manage that data using ‘current’ computer software and hardware. |
| 3. Identify the common plants and animals of SW PA and give the appropriate scientific nomenclature for those species. |
| 4. Construct a relevant hypothesis based on background information on a specific question and develop one or more testable predictions for that hypothesis; and design and implement a ‘field’ research study that will test predictions based on a specific hypothesis and relevant background information. |
| 5. Effectively communicate the results and conclusions of their research through the use of written reports and poster presentations. |

| 1. Establish permanent sampling plots and locations for vegetation and herpetofauna sampling. |
| 2. Construct new deer exclosures and associated control plots. |
| 3. Construct drift fence sampling arrays. |
| 4. Begin collecting baseline data. |

**NAME:** On-campus Summer Research—Long-term Ecological Monitoring (LEM), Summer 2009

**INSTITUTION:** Washington & Jefferson College
## Washington & Jefferson College On-campus Summer Student Research

<table>
<thead>
<tr>
<th>Evaluation Questions for OUTCOMES</th>
<th>Possible Indicators/Measures</th>
<th>Possible Data Collection Methods and Information Sources</th>
<th>Rank/Priority (include brief rationale)</th>
</tr>
</thead>
</table>
| 1. Was the research experience valuable or not valuable for the students both short term and long term? What are the perspectives of the students, mentors, and supervisors on the students' experiences? | 1. a) Continue to major in science  
 b) Graduate with science degree  
 c) Pursue additional research experiences before graduation  
 d) Expect to continue in research post-research experience  
 e) Value summer research experience—satisfaction surveys (SURE)  
 f) Express student-specified gains | 1. a) Student Exit Questionnaire  
 b) Interview  
 c) Supervisor, Mentor, Summer Program Director, and Selector Feedback  
 e) Focus Group  
 f) SURE | The first question is the most pressing, not only because we can get the answer sooner, but also because the response to the question can inform us how to improve the overall program and possibly help us take action to impact the students and programs quickly (formative assessment). The second question takes time to answer, but the answers are relatively easier to obtain. The third and fourth questions are more difficult to answer given that students, faculty, and the institutional outcomes will need to be obtained in the long-term and the results would likely be more qualitative. |
| 2. What do students do after they graduate from their colleges/universities? How do students continue to be involved in science after they graduate from their colleges/universities? | 2. a) Pursue science and research-related activities after graduation, particularly through their job/education (post-graduation surveys—1, 5, and 10 years)  
 b) Pursue science and research-related activities five years after graduation, particularly through their job/education (post-graduation surveys—5 years)  
 c) Pursue science and research-related activities ten years after graduation, particularly through their job/education (post-graduation survey—10 years) | 2. a) Tracking Questionnaire  
 b) Contacting Undergraduate Institution and Selector  
 c) Alumni search  
 d) National Surveys (NSF, AAMC, etc.)  
 e) Grants, honors, and awards  
 e) Publication searches  
 f) Citation Impact | |
| 3. How are students contributing to science and/or research after the experience? | 3. a) Applied, received, and accepted academic faculty positions, including type of faculty positions (e.g. tenure-track)  
 b) Employed in research or science jobs (e.g. academic research, industry, government, NGO’s, associations, and societies)  
 d) Mentoring undergraduate students  
 e) Earned honors and awards in research and education | 3. a) Tracking Questionnaire  
 b) Alumni search  
 d) Focus Group  
 e) Peer review through panels, awards, etc. gauging research and mentoring contributions | |
| 4. How are mentors (at all levels) affected by their mentorship experiences? | 4. a) Success in desired career track  
 b) Better mentoring provided to other mentees | 4. a) Student, faculty, and administration surveys and interviews  
 b) Increase in support for undergraduate student research activities | |
| 5. How are the faculty and the grantee institution affected by HHMI support for student research? | 5. a) Students and faculty who are engaged in research without HHMI support  
 b) Institutional changes as a result of HHMI support for undergraduate student research | 5. a) Tracking of number and quality of undergraduate student research experiences at a given institution  
 b) External awards/funding for undergraduate student research  
 d) Faculty research grants | |