Title of Degree: MA in Remote Sensing & Geospatial Sciences

1. Please provide the name, title, email address, and phone number of the primary contact person for this academic program:

   Mark Friedl, Professor of Earth and Environment
   friedl@bu.edu, 617-353-5745

2. Please describe briefly the proposed change to the existing degree:

   • The title has been updated – it was previously “MA in Remote Sensing and Geographic Information Systems.”
   • The number of required credits has been reduced from 40 to 32.
   • Course requirements have been revised and updated.

3. Please describe and provide a rationale for the proposed change to the existing degree:

   The existing degree has not been updated since its inception, roughly 20 years ago. The proposed updates will allow students to complete their M.A. in one academic year, which is consistent with other professional M.A. programs in this field at peer institutions, reflects changes in curriculum that have occurred over the last two decades in the department, and will provide a more focused set of courses that address the need for post-bachelor training on this rapidly evolving field.

4. Please describe how the proposed change(s) advances the Strategic Plans of the department, of the school/college, and of the University:

   The proposed changes directly support the department of Earth & Environment’s strategic focus in earth observations and geographic Information systems, and also advance the University’s goal of increasing enrollment in professional M.A. programs.
5. Please list the program requirements for the current and revised programs: (expand the table as needed and denote new courses in bold print)

<table>
<thead>
<tr>
<th>Current program – 10 courses (40 credits)</th>
<th>Revised program – 8 courses (32 Credits)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CORE Courses (2 courses)</strong></td>
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</tr>
<tr>
<td>CAS GE 501: Advanced Topics in Remote Sensing</td>
<td>same</td>
</tr>
<tr>
<td>CAS GE 505: Geographic Information Systems (GIS)</td>
<td>same</td>
</tr>
<tr>
<td></td>
<td>One course in Statistical Methods</td>
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<tr>
<td></td>
<td>CAS GE 509: Applied Environmental Statistics or CAS GE 516: Multivariate Analysis for Geographers</td>
</tr>
<tr>
<td><strong>Three courses from following list:</strong></td>
<td></td>
</tr>
<tr>
<td>GRS GE 640: Digital Image Processing - Remote Sensing</td>
<td><em>(now on list of additional courses)</em></td>
</tr>
<tr>
<td>GRS GE 645: Physical Models in Remote Sensing</td>
<td><em>(now on list of additional courses)</em></td>
</tr>
<tr>
<td>GRS GE 646: Remote Sensing of the Lower Atmosphere</td>
<td>n/a</td>
</tr>
<tr>
<td>GRS GE 648: Remote Sensing of Vegetation</td>
<td><em>(now on list of additional courses)</em></td>
</tr>
<tr>
<td>GRS GE 805: Spatial Data Analysis Using Geographic Information Systems (GIS)</td>
<td><em>(now on list of additional courses)</em></td>
</tr>
<tr>
<td><strong>Theories and Concepts (one course)</strong></td>
<td></td>
</tr>
<tr>
<td>CAS GE 503: Micrometeorology: Energy and Mass Transfer at the Earth’s Surface</td>
<td><em>(now on list of additional courses)</em></td>
</tr>
<tr>
<td>CAS GE 510: Physical Principles of the Environment</td>
<td>n/a</td>
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<tr>
<td>GRS BI 648: Biodiversity and Conservation Biology</td>
<td>n/a</td>
</tr>
<tr>
<td>GRS ES 623: Ecosystem Biogeochemistry</td>
<td>n/a</td>
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<tr>
<td><strong>Modeling and Analysis (one course)</strong></td>
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</tr>
<tr>
<td>CAS GE 550: Modeling Environmental and Social Systems</td>
<td>n/a</td>
</tr>
<tr>
<td>GRS GE 712: Regional Energy Modeling</td>
<td>n/a</td>
</tr>
</tbody>
</table>
### Three Additional Courses

Three additional courses chosen in consultation with advisor

### Five additional courses from list below*

*the course taken to fulfill the statistical methods requirement cannot be double counted as an elective.*

Up to two courses not on this list (e.g., from Math and Statistics, Computer Science, Earth & Environment, or Biology) may be taken with permission of the program director

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS GE 502</td>
<td>Field Measurements for Remote Sensing</td>
</tr>
<tr>
<td>CAS GE 503</td>
<td>Micrometeorology: Energy and Mass Transfer at the Earth's Surface</td>
</tr>
<tr>
<td>CAS GE 509</td>
<td>Applied Environmental Statistics</td>
</tr>
<tr>
<td>CAS GE 516</td>
<td>Multivariate Analysis for Geographers</td>
</tr>
<tr>
<td>CAS GE 529</td>
<td>Modeling and Monitoring Terrestrial Ecosystem Processes</td>
</tr>
<tr>
<td>CAS GE 585</td>
<td>Ecological Forecasting and Informatics</td>
</tr>
<tr>
<td>GRS GE 640</td>
<td>Digital Image Processing - Remote Sensing</td>
</tr>
<tr>
<td>GRS GE 645</td>
<td>Physical Models in Remote Sensing</td>
</tr>
<tr>
<td>GRS GE 648</td>
<td>Remote Sensing of Vegetation (<em>to be taught within next three years</em>)</td>
</tr>
<tr>
<td>GRS GE 805</td>
<td>Spatial Analysis Using Geographic Information Systems (GIS)</td>
</tr>
<tr>
<td>GRS GE 840</td>
<td>Advanced Topics in Remote Sensing</td>
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<tr>
<td>GRS GE 841</td>
<td>Seminar in Remote Sensing</td>
</tr>
<tr>
<td>GRS GE 845</td>
<td>Advanced Topics in Geographic Information Systems (GIS)</td>
</tr>
<tr>
<td>GRS GE 846</td>
<td>Seminar in Geographic Information Systems (GIS)</td>
</tr>
</tbody>
</table>

6. **Is this change a result of program learning outcomes assessment and/or academic program review? If yes, please describe:**

This change is a direct outcome of extensive discussions among the faculty in Earth & Environment regarding the strategic vision (and implementation thereof) for the department following the merger of the former departments of Geography & Environment and Earth Sciences.
7. Please list learning outcomes for the revised program:

1. Demonstrate advanced knowledge of theory of remote sensing and GIS including sensor systems, basic radiative transfer, cartographic projections and display, and spatial databases, and of fundamental concepts in geospatial analysis and modeling techniques.
2. Quantitatively analyze data to evaluate scientific hypotheses and arguments in remote sensing and geographic information science.
3. Communicate effectively, both verbally and in writing, advanced concepts in remote sensing and geographic information systems.
4. Demonstrate understanding of the broader impacts and applications of remote sensing and GIS for natural sciences, social sciences, and for society at large.
5. Apply a range of geospatial analysis techniques using remote sensing and GIS tools toward solving quantitative problems in one or more core disciplinary areas such as geography, ecology, environmental sciences, biogeosciences, urban planning or natural resources management.

8. How does the change place your program in the context of programs at peer institutions?

Boston University has an internationally recognized research program in remote sensing, which has provided a “passive” recruitment tool for our MA program. In recent years, the current MA program (“Environmental Remote Sensing & GIS”) has experienced decreased enrollments, largely due to lack of attention, while peer institutions have successfully built MA programs in this area with substantial (and growing) enrollments. The proposed revisions will serve to revitalize the MA in Remote Sensing & Geospatial Sciences program and make it more topical and attractive to potential students.

9. How does the change affect other academic units and existing programs at the University?

There is no impact on other units and existing programs from these revisions.

10. How will you notify current students of the proposed changes and implement the requirements? How will you assure that students are able to complete their programs under the requirements that were in place at the time of their matriculation?

Current students will be notified of these changes by the Graduate Program coordinator in Earth & Environment. There should be no impact from these changes on the ability of current students to complete requirements that were in place when they matriculated.

11. Please document any implications that the change has on professional accreditation or licensure at the program or school/college level:
There are no implications of this nature.

12. If the change includes a new course or courses, please indicate who will teach the course and how the rest of that faculty member’s course load will be affected (redistributed, absorbed, etc.):

No new courses are being proposed as part of this revision, and all courses included in the proposed MA will be offered by faculty who are currently on staff, or by new faculty who we have received permission to search for.

13. Please list the resources needed including IT, new faculty, new staff, reassignment of faculty from existing courses to new ones (especially if the existing course(s) is not being removed from the bulletin), technology enhanced classrooms, office space, and other facilities:

We require no new resources to implement these revisions.

14. Please describe the budgetary impact that the proposed change will have:

We anticipate that the loss in tuition revenue resulting from reducing the required credits from 40 to 32 will be more than offset by increased enrollment in the program. Aside from the new revenues this program will generate, there are no budget impacts from the proposed changes.

15. Please provide the bulletin copy related to the proposed academic change, listing ALL program requirements as you wish them to appear in the Bulletin:

MA in Remote Sensing & Geospatial Sciences

The Remote Sensing & Geospatial Sciences (RS & GS) MA program is designed for students with diverse natural science and social science backgrounds who desire specialized training in the use of remote sensing and Geographic Information Systems (GIS) in environmental and natural resource analysis and management. The curriculum is designed to train students in both the underlying theory and application of remote sensing (e.g., image processing), spatial analytical methods (e.g., spatial statistics), and digital cartography and geographic information systems. Students are trained for careers in the private, public, and nonprofit sectors where there is high demand for professionals with advanced technical skills who can organize and analyze spatial data sets. Applicants to the RS & GS program are expected to have basic competency in calculus and statistics. Candidates who do not have the required quantitative skills may be admitted, but will be required to do independent work or additional coursework to acquire the necessary background. Students should consult the director of graduate studies to ascertain if they have the required background.

Course Requirements
At least eight courses (32 credits) must be completed as follows:

- **Core Courses**
  - CAS GE 501 Advanced Topics in Remote Sensing
  - CAS GE 505 Geographic Information Systems (GIS)
  - CAS GE 509 Applied Environmental Statistics or CAS GE 516 Multivariate Analysis for Geographers*

- **Electives (five courses, selected in consultation with advisor)****
  - CAS GE 502 Field Methods in Remote Sensing
  - CAS GE 509 Applied Environmental Statistics
  - CAS GE 516 Multivariate Analysis for Geographers
  - CAS GE 529 Modeling and Monitoring Terrestrial Ecosystem Processes
  - CAS GE 585 Ecological Forecasting and Informatics
  - GRS GE 640 Digital Image Processing in Remote Sensing
  - GRS GE 645 Physical Models of Remote Sensing
  - GRS GE 648 Remote Sensing of Vegetation
  - GRS GE 805 Spatial Data Analysis Using Geographic Information Systems
  - GRS GE 840 Advanced Topics in Remote Sensing
  - GRS GE 845 Advanced Topics in Geographic Information Systems

*Course taken to fulfill statistical methods requirement cannot be double counted as an elective.

**With the prior approval of an advisor, students in the program may select graduate-level (500 and higher) courses beyond the approved list of electives to fulfill the elective requirement.