PROPOSAL FOR A

NEW MEXICO JOINT DOCTORAL PROGRAM IN GEOGRAPHY

to be offered cooperatively by
University of New Mexico & New Mexico State University

submitted February 2016
revision submitted July 2017

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1. EXECUTIVE SUMMARY

The New Mexico Joint Doctoral Program in Geography is designed to leverage existing geography-related resources at UNM and NMSU to develop a nationally competitive PhD program focused on integrative human-environment dynamics. This program will build on the two universities' successful master's degree programs to offer a rigorous research-based PhD program that recruits and trains the next generation of resource managers, policy thinkers, geospatial innovators, professional scientists, and academic leaders who are needed to solve complex contemporary problems in dynamic environments. Our innovative joint-program structure combines both theory and practice, offering students a unique opportunity to develop both academic and practical expertise that crosses conventional disciplinary boundaries.

1.1 Description

The New Mexico Joint Doctoral Program in Geography will be administered and delivered collaboratively across both campuses, with dedicated staff support in UNM's Department of Geography & Environmental Studies. A joint admissions committee will select each cohort to match student interests with faculty expertise at both institutions, maintaining high admissions standards. Applicants will designate either UNM or NMSU as the home institution, but courses will be delivered in both locations, including a number of courses that use creative instructional models to maximize scholarly exchange without necessitating residency requirements. The joint program will require the completion of three core seminar courses, coursework sufficient to achieve competency in three subject areas, written comprehensive exams, an oral defense of the research proposal and an oral defense of the written dissertation. The program is designed to be completed in as little as four years of full-time study, and we expect that some portion of each cohort will complete the program on a part-time basis while maintaining employment in a geography-related field.

1.2 Evidence of Need

The US Department of Labor projects that employment of geographers will grow 35 percent from 2010 to 2020, compared to 14 percent for all occupations (U.S. Department of Labor, see Appendix A). This growing labor market indicates a simultaneous need for expanded geographical research and graduate training. Because there is no PhD program in Geography offered at any private or public institution of higher education in New Mexico, this need is currently being met regionally in neighboring states. We receive inquiries about the potential for a UNM PhD program on a regular basis from our own MS graduates and from professionals working in central New Mexico's geography-related agencies, labs, and industries (e.g. Sandia National Labs, Office of the State Engineer, City of Albuquerque). Beyond this robust local need for doctoral training, we expect a national flow of applicants who will be attracted to New Mexico by the joint program's focus on environmental change and drylands resource management in a region dominated by complex cultural landscapes.

Another area of potential demand for this PhD program is international, as evidenced by UNM's collaboration with the Universidad Central de Ecuador (UCE), which has been sending its own faculty to UNM to earn PhDs. Many of these students are explicitly seeking PhD training focused on environment, development, and

sustainability, which our joint doctoral program will be uniquely qualified to provide. Having seen success with the UCE collaboration, the Latin American and Iberian Institute is currently pursuing other similar collaborations with Latin American universities, and GES is considered a top destination for potential recruits.

1.3 Program Content

Both UNM and NMSU currently have well-respected departments of geography that explore socio-ecological phenomena through the various lenses of human-environment geography (*e.g. resource conservation, policy, law, history, economics*), physical geography (*e.g. biogeography, geomorphology, hydrogeography*), and Geographic Information Science & Technology (*GIS&T, e.g. GIS, remote sensing, spatial modeling, geovisualization*). The New Mexico Joint Doctoral Program in Geography will be built at the intersection of these lenses, delivering an interdisciplinary program focused on human-environment dynamics and the development of integrative theories, methods, and applications relevant to this scholarship.

1.4 Evaluation and Assessment

Program evaluation will be conducted on a regular basis by a joint steering committee drawn from the Geography faculties at both universities. Summative assessment will be based on graduates' employment placement; formative learning assessment will be based primarily on comprehensive exams and dissertations.

1.5 Existing Resources to be Leveraged

Because both UNM and NMSU already have existing graduate programs in Geography at the Master's level, many structural resources are already in place to develop the joint PhD program and prepare for its launch. Resources to be leveraged at both universities include existing faculty lines (13 at UNM and 5 at NMSU), existing facilities (dedicated labs for GIS&T at both institutions), and existing graduate curricula at UNM (MS Geography with two concentrations; graduate certificate in Geography, Environment & Law; and PhD concentration within the Latin American Studies program) and NMSU (Master's in Applied Geography, and active participation in the administration of the interdisciplinary PhD in Water Science and Management).

1.6 Required Resources at UNM: to be funded by the College of Arts & Sciences

As the administrative home of the joint program, UNM will require an additional staff person (1.0FTE) to serve as program manager and to provide research support to both faculty and students. UNM will also require a minimum of six additional GA lines (3.0FTE) for recruiting and supporting competitive PhD students, three of which will be funded by A&S (1.5FTE). When used as teaching assistants, these GAs will increase our teaching capacity, thus allowing for higher undergrad enrollments while also offsetting the need for new faculty to cover additions to our graduate course offerings. The increased teaching and advising loads associated with providing education and research training for PhD students, however, will nonetheless require the net addition of one faculty member at UNM in the early years of the program. The Dean of Arts & Sciences has committed to fund all resources described in this paragraph and they are included in

his hiring plans and funding priorities over the next half-dozen years, reflecting that the development of this program fits within UNM's existing resource allocations.

1.7 Required Resources at UNM: to be funded by other sources

Development of a successful PhD program with strong employment placement for graduates will require additional resources at UNM to fund competitive recruiting packages (including three GA lines beyond those to be funded by A&S above) and student research, including support for publications and conference travel. Delivery of the joint program will also require an augmentation of our computing infrastructure, research equipment, and workspace facilities. For all of these necessary resources, we will seek competitive external funding through agencies and donors committed to interdisciplinary and environment-related research. Our intended program focus intersects directly with the NSF's foundation-wide initiative in Science, Engineering and Education for Sustainability (SEES), which prioritizes "the simultaneous consideration of social, economic, and environmental systems and the long-term viability of those systems." We expect that a doctoral program offered jointly by two Hispanic-Serving Institutions will compete successfully for research and infrastructure funding from state and federal agencies, as well as private organizations.

1.8 Projected Enrollment and Costs

We expect to keep the program small in its early years, enrolling ~5 students per year until external funding sources increase our ability to recruit and support larger cohorts. Startup costs (~$70,000) are focused on one faculty hire and on critical infrastructure updates for our dedicated computing and lab facilities that support both teaching and research. As the program becomes more established and begins to generate significant research funding, additional facilities augmentation will be pursued through external funding. Recurring costs (eventually ~$350,000) are focused on staff, student, and faculty lines that increase research and teaching capacity, as described above.

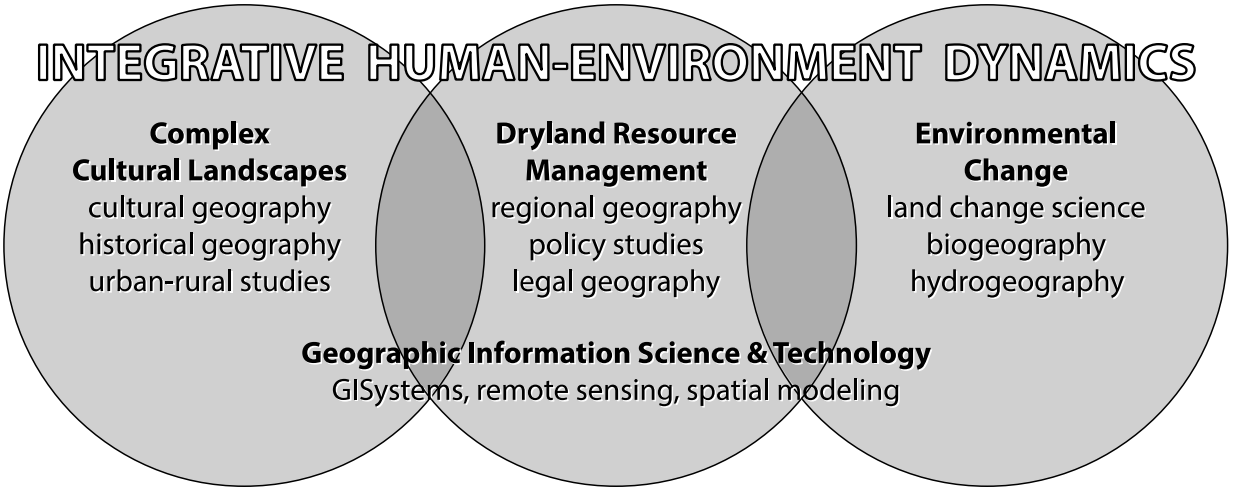
1.9 Conclusion

As inherently interdisciplinary scholars, geographers are well positioned to lead meaningful collaborations in integrative human-environment research. UNM's faculty and student geographers already collaborate actively with Biology, American Studies, Anthropology, Economics, Latin-American Studies, Community and Regional Planning, Civil Engineering, and History. The New Mexico Joint Doctoral Program in Geography will provide further benefit to both institutions by increasing capacity to engage in cross-cutting research and program-building around the issues of environment and sustainability. In addition, the new program will provide broad benefits to the State by recruiting top-notch scholars to New Mexico for a unique educational opportunity and by preparing graduates for leadership positions in New Mexico's many industries, agencies, and labs that address complex problems in dynamic human-environment contexts.

2. PROGRAM DESCRIPTION AND PURPOSE

2.1 Overview

The New Mexico Joint Doctoral Program in Geography is a rigorous research-based program that focuses on integrative human-environment dynamics, with research foci in the areas of environmental change, dryland resource management, and complex cultural landscapes. Our research employs a wide variety of methods – qualitative, quantitative, mixed – with a particularly strong expertise in the theory and application of Geographic Information Science & Technology.



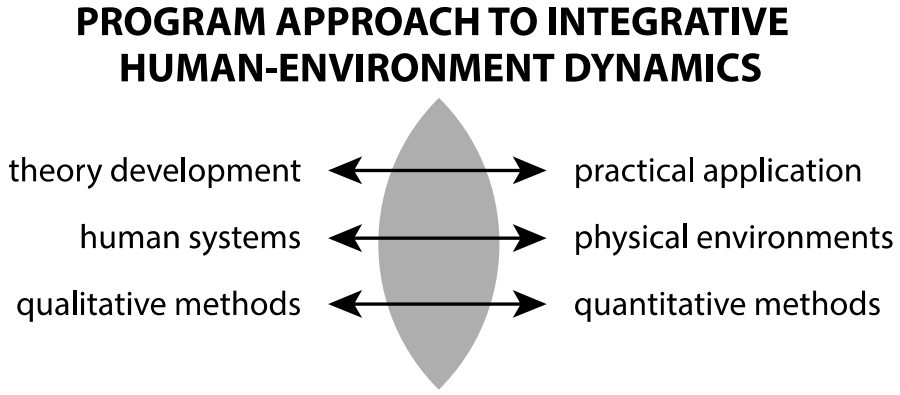
The program is designed to leverage the strengths of New Mexico's existing graduate programs, faculties, and facilities at UNM's Department of Geography & Environmental Studies and NMSU's Department of Geography to deliver an innovative PhD program that puts integrative thinking at the center of its structure, curriculum, and research agenda.

2.2 Program Goals

Currently, the Department of Geography & Environmental Studies at UNM is known both for a sustained focus on theory and policy in natural resource management and for the development of cutting-edge theory and methods in Geographic Information Science & Technology (GIS&T). NMSU's Department of Geography, alternately, has a robust program in applied geography that generates healthy undergraduate enrollments as well as a steady flow of external funding for applied projects in resource conservation, mapping, and geography education.

We see tremendous potential to leverage these differences for the creation of a truly revolutionary doctoral program that merges theory and praxis in fundamental ways, empowering scholars to work both within and outside of traditional intellectual and professional spheres, while also preparing students for a wide range of leadership positions within and beyond the academy. The

joint nature of the proposed program represents more than the mere union of two departments on two different campuses. We have envisioned a curriculum that both reflects and responds to complex place-based differences, changing human-environment systems, and the evolving place of higher education in modern society. Our innovative joint-program structure requires students to develop expertise in both qualitative and quantitative research methods, to develop sophisticated understandings of both human and environmental systems, and to cross disciplinary boundaries in building theory and developing geographic applications.



2.2.1 Mission

The New Mexico Joint Doctoral Program in Geography prepares the next generation of resource managers, policy thinkers, geospatial innovators, professional scientists, and academic leaders who solve complex contemporary problems in dynamic environments. We achieve this mission through research, teaching, mentoring, service, and outreach that:

- Combines theory and praxis, with applied geography projects informing theory development.
- Conceptualizes human and physical systems as inseparable parts of an integrated whole.
- Emphasizes the integration of qualitative and quantitative techniques to solve real-world problems.

2.2.2 Research Goals

The primary reason for developing a joint doctoral program (rather than simply maintaining two existing master's programs in Geography) is to significantly increase geographic research capacity across both institutions. Our research goals are categorized at three different scales:

- Discipline – We aim to become a national leader in geographic research approaches that integrate qualitative and quantitative techniques to understand human-environment dynamics.
- Institution – We aim to provide an interdisciplinary anchor for UNM's and NMSU's environment-focused research programs, building institutional capacity across the natural sciences, social sciences, and humanities.

- State – We aim to connect our research expertise with New Mexico's needs relating to the study of dynamic cultural landscapes and physical environments.

2.2.3 Learning Goals

The primary objective of our teaching and mentoring is to produce graduates who are well prepared for professional careers within and beyond the academy. Broadly, we intend for all students to graduate with:

- Broad capability in the discipline of geography, with a critical understanding of how their specific areas of theoretical, methodological, and practical expertise relate to scholarship in other areas of the discipline;
- Advanced competency in the design and implementation of original research;
- Ability to engage in contemporary problem solving; and
- Professional skills in communication, teaching and mentorship.

2.2.4 Service Goals

Faculty service to the profession aims to establish the New Mexico Joint Doctoral Program in Geography as a disciplinary leader in innovative scholarly approaches to human-environment dynamics. This is accomplished primarily through:

- Leadership in regional and national organizations, and
- Scholarly service as editors, reviewers, and funding panelists.

In addition, we aim to contribute actively to campus initiatives, governance, and interdisciplinary program-building.

2.2.5 Outreach Goals

As New Mexico's only doctoral program in Geography, we are keenly aware of the role we will play as standard-bearers for geography education and outreach in the state. In this role, we aim to support ongoing K-12 geography education initiatives and to promote broad awareness of the benefits of an integrated perspective on complex human-environment dynamics.

2.3 Joint Program Structure

The New Mexico Joint Doctoral Program in Geography is a single academic program delivered jointly across two campuses, with collaborative participation from both faculties. Although development of a joint program is a complex undertaking that requires very clear administrative and structural design, this program will be much greater than the sum of its parts. The program is structured to promote (and indeed require) authentic student engagement with both faculties, institutions, cities and regions. This engagement is critical to the development of an integrative scholarly perspective based in real-world problem-solving across a variety of dynamic human-environment contexts. All aspects of the program's structural design are meant to maximize the scholarly benefits of student engagement with both UNM and NMSU in a truly joint fashion.

2.3.1 Admissions

At the time of application, potential students will identify a desired primary advisor and will apply formally to that professor's home institution. After an administrative check to ensure that candidates meet minimum requirements, the home institution will conduct a first round of admissions review and forward acceptable applications to the secondary campus. The second round of review will determine whether there is at least one sponsor at the secondary campus and will evaluate the applicants' overall fit with faculty expertise and research strengths. The final decision on admission of candidates to the program will be made by a joint review committee, while the final ranking of candidates for funding priority will be made at the home institution, based on the funding availability and service loads of that institution's faculty.

2.3.2 Curriculum

As described in the section on "Proposed Curriculum," courses will be delivered in a variety of formats, with many courses using innovative instructional modes that allow for students from either campus to attend. The first-year core courses, in particular, will be structured to maximize new students' engagement with faculty and peers on both campuses. At the same time, co-teaching arrangements in the core courses will allow for regular faculty communication and coordination on program goals.

2.3.4 Cross-Enrollment

The New Mexico Joint Doctoral Program in Geography relies on the state's newly developed "cross enrollment" protocol, which allows students to register seamlessly for graduate courses at multiple New Mexico institutions of higher education, in cases where a course is not offered at the home institution. To register for courses at a secondary ("host") institution, the cross-enrollment protocol requires simply that the student get permission to register for a designated cross-enrollment course at the *home* institution, which then triggers an administrative process that admits the student and enrolls him/her at the *host* institution. After the course is completed, grades are reported to the home institution, and the course credits will be transcripted at the home institution. Under this program, tuition is paid to the home campus, but any special fees are paid to the host institution. Student credit hours are awarded to the host institution that is actually delivering the course. This protocol will allow students in the New Mexico Joint Doctoral Program in Geography to take courses at either UNM or NMSU (as long as courses taken at the host institution are not offered at the home institution), thus facilitating the creation of a totally joint curriculum. In the event that a student desires to switch advisors within the Joint Doctoral Program, thus necessitating a change in the home institution, the registrars of the two institutions will work together to facilitate an advisor change without any prejudice against the student's standing or progress.

2.3.5 Doctoral Committee Coordination

As described in the section on "Proposed Curriculum," every student will have a joint Committee on Studies, which will necessarily include two faculty members from each institution and one external member at the home institution. This

structural requirement is meant primarily to ensure that students engage with faculty from both institutions, but it will also serve to promote cross-faculty communication and regular participation in the standards-based gatekeeping work that typically accompanies the evaluation of comprehensive exams and dissertation defenses.

2.3.6 Communication Structure

The New Mexico Joint Doctoral Program in Geography will have a single dedicated staff coordinator to provide administrative support in the areas of registration (admissions, enrollment, and transcription), research (including grant writing, conference travel, and publication support), and advising (re committee formation, program of study, and career planning). This program coordinator will be housed at UNM but will provide support to all doctoral students across both campuses.

In addition to the program coordinator, the graduate program directors from both UNM and NMSU will serve as liaisons on day-to-day activities and student issues. A larger Joint Steering Committee for the program will take responsibility for screening applications; making admissions decisions; reviewing and advising curriculum; handling conflicts, grievances, and appeals that cannot be resolved within the student's research committee; and maintaining communication between both institutions on relevant issues as they arise. Composition of the Joint Steering Committee will reflect representation of faculty from both institutions, specifically including, at a minimum, the graduate program director and at least one additional faculty member from each department. Committee membership may change annually, based on teaching assignments, interest, sabbatical leave, and other fluctuations of effort among faculty members.

To ensure effective and open communication lines, a single listserv will be created for all doctoral students, regardless of home institution. Similarly, a single doctoral program listserv will be created for faculty at both institutions. In addition to the email listservs, more robust digital technology options will be explored to select a standard communication platform for regular use across the two campuses. Finally, we envision holding at least two face-to-face meetings annually for all members of the Steering Committee: at either UNM or NMSU at the start of the academic year, and at the regional conference of the Southwest Division of the American Association of Geographers (SWAAG)

2.4 Purpose of the Joint PhD Geography Program

It has become increasingly clear that finding solutions to some of the most difficult environmental problems will require highly skilled professionals with multiple disciplinary perspectives. National-level research bodies – like the National Science Foundation and the National Research Council – now acknowledge the fundamental necessity of interdisciplinary perspectives that cross spatial scales. The NSF launched its Foundation-wide SEES Initiative (Science, Engineering and Education for Sustainability) to steer investment into interdisciplinary research that explores the integration of social systems, physical environments, and the structures that influence how humans alter their environments in pursuit of sustainability. As stated in the NSF SEES program

announcement, "Fundamental to all sustainability research is the simultaneous consideration of social, economic, and environmental systems and the long-term viability of those systems."[1] Similarly, the NRC's recent report, *Understanding the Changing Planet*, notes that "Innovation in the geographical sciences has the potential to advance knowledge of place-based environmental change, sustainability, and the impacts of a rapidly changing economy and society."[2]

The New Mexico Joint Doctoral Program in Geography is accordingly designed to recruit and train highly skilled researchers who understand the interdependence of theory and practice, who can solve complex real-world problems, and who are capable of thinking in integrative ways about human-environment dynamics. Our graduates will be well placed to deal with the changing landscapes that define New Mexico and, more broadly, the American Southwest. From water resource issues, rapid urban growth, and urban/wildland interface conflicts to questions about the appropriate use of public lands, mining impacts and "sacrifice zones," the Southwest is a hotbed of cultural and environmental complexity that requires new research approaches to effectively understand and address associated challenges.

Beyond New Mexico and the Southwest, however, many regions in the United States and around the globe face similar issues. Our doctoral program focuses specifically on research areas that have immediate regional applicability – environmental change, aridlands resource management, complex cultural landscapes, and Geographic Information Science & Technology – but our broader purpose is to build a program that is nationally recognized for academic leadership in the area of integrative human-environment dynamics. This leadership will not only provide national-caliber graduate training to New Mexico's own citizens but will also attract students to New Mexico to undertake doctoral study in a regional setting that allows for extensive practical application.

2.5 Relationship to Plans for UNM Geography & Environmental Studies

UNM's Department of Geography & Environmental Studies underwent an Academic Program Review (APR) in 2007-2008, and faculty members engaged at that time in a comprehensive strategic planning effort as part of the preparatory self-study. One of seven key goals to emerge from that effort was "Lay the ground for the future addition of a PhD program in Geography." External reviewers confirmed the importance of this goal, particularly given the lack of any Geography PhD program in the state of New Mexico, and provided an action plan with concrete intermediate steps to strengthen the master's program in order to prepare for future PhD program development effort. Subsequent departmental efforts have been focused on strengthening the existing master's program,

[1] Available at http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504707.
[2] Committee on Strategic Directions for the Geographical Sciences in the Next Decade, Board on Earth Sciences and Resources, Division on Earth and Life Studies, National Research Council of the National Academies (2010) *Understanding the Changing Planet: Strategic Directions for the Geographical Sciences*. Washington, DC: National Academies Press.

increasing the size and quality of the faculty, and identifying additional resources in terms of both student support and facilities, all with an eye toward building the capacity necessary to undertake a PhD program proposal.

This commitment was renewed in a 2011 faculty retreat, where the UNM faculty in GES strategically evaluated existing degree programs and initiated a multi-pronged process of program-building to increase our institutional readiness for proposing a PhD program in Geography at UNM. Since 2011, the department has created a minor in Law, Environment and Geography in collaboration with UNM's Law School, a minor in GIScience, a shared-credit degree program with UNM's Department of Economics (that enables students to acquire both a Bachelor and Master Degree in 5 years), and a Graduate Certificate in Law, Environment and Geography, also in collaboration with UNM's Law School. These collaborative programs have not only leveraged the expertise of Geography faculty members for the benefit of UNM, but they also indicate strong preparation for a joint PhD program with NMSU.

By strategically broadening and strengthening curricular programs in our areas of expertise, we have vastly improved the quality of our annual master's cohorts in the last four years. This in turn has helped us attract and retain highly qualified faculty members who have further improved our research profile and added significantly to our activity levels in sponsored research. Our current hiring plan is focused on adding faculty with expertise that intersects with and adds to our existing strengths, while also expanding our ability to engage in integrative research and attract high-quality graduate students. The next steps in our strategic plan call for evaluation of a potential GIScience certificate program and implementation of a focused PhD program.

2.6 Relationship to UNM Mission and Strategic Plan

The University of New Mexico's *UNM 2020 a View to the Horizon* articulates UNM's mission, its vision, and its institution-wide strategies and goals for realizing this plan. The creation of the New Mexico Joint Doctoral Program in Geography will directly enhance core components of the University's strategic vision and help fulfill many of the goals set forth by the UNM 2020 plan, as follows:

2.6.1 Discovery and Innovation

UNM 2020 envisions the University as a leader in "basic and applied research and the translation of that research into knowledge and applications of value to academic communities and the public." A fundamental part of this vision is the spread of interdisciplinary teams that focus on some of the most important social challenges of our time. Likewise, a commitment to an "interdisciplinary education model designed to produce competence-based value" is core to this vision. The Joint Doctoral Program in Geography will directly contribute to this vision by building a program that is premised upon integrative, interdisciplinary, multi-methodology research and education. By premising the PhD course of study upon a pedagogy and research that bridges theoretical and applied

approaches, the Joint Doctoral Program in Geography will directly contribute to the creation of applied yet theoretically robust solutions to the very real problems facing New Mexico and the region. And by training PhD students through a curriculum that requires understanding of multiple methodologies and the essential interrelations between applied and theoretical approaches, the Joint Doctoral Program in Geography will facilitate the training of students who are both committed to create positive change and have the broad ranging competencies required to build careers implementing positive change.

2.6.2 Students: The Lobo Experience

UNM 2020 envisions the University as an institutional leader in creating multidimensional programs "that go far beyond 'segmentation' initiatives' to more inclusive topic, challenge, skill and competency based sharing that brings diverse perspectives to challenges shared by all." The Joint Doctoral Program in Geography will directly contribute to this vision by building a program that is premised upon integrative approaches to research and education. By premising the PhD course of study upon a pedagogy and research that bridges theoretical and applied approaches, the Joint Doctoral Program in Geography will stress the very kind of topic, challenge, skill and competency based sharing that is at the heart of the "Lobo Experience" vision for students.

2.6.3 Strategic Partnerships

UNM 2020 envisions the University as engaging in a robust network of relations with other educational institutions as well as a system of public/private initiatives as part of a broader effort to "define new relationships that hold promise against society's most complex challenges." The Joint Doctoral Program in Geography is exactly the kind of strategic partnership envisioned by UNM 2020. By bringing together the respective academic, research, and methodological strengths of UNM and NMSU, the program will provide resources for the University, the state, and our communities that are far greater than the sum of its parts. Moreover, given the two departments' existing partnerships with such key institutions as the National Park Service, the Bureau of Land Management, the Department of Justice, the Federal Highway Administration, the Jornada and Sevilleta Long-Term Ecological Research Programs, Doña Ana County, the Earth Data Analysis Center, and a variety of state agencies (e.g. NM Department of Transportation, NM Department of Housing and Urban Development, NM Department of Health), the opportunity for both departments to engage in strategic partnerships will increase exponentially.

As an example, GES faculty began participating this past year in the New Mexico Collaborative Research and Development Council (NM-CRDC), organized by New Mexico's U.S. Senators Martin Heinrich and Tom Udall. The NM-CRDC is designed to foster collaboration between the federal and state research facilities (e.g. national labs, military bases, and universities) with a goal of increasing innovation and subsequently attracting economic activity to New Mexico. The Executive Committee of the NM-CRDC has identified remote sensing from unmanned airborne systems (UAS) and big data exploitation as two of six priority

clusters of research activity. The UAS remote sensing (UAS-RS) cluster is the most established, having already held two meetings and scheduled a full day workshop for February 2016, where UNM Geography and Environmental Studies will present on at least 4 different active UAS-RS research projects. As routine operators of UAS for remote sensing and a center of excellence for remote sensing methods in the state, UNM Geography and Environmental Studies is well poised to contribute substantially to both the UAS-RS and Big Data exploitation clusters through collaborations with Sandia and Los Alamos National Labs and New Mexico State University's Physical Sciences Laboratory.

Beyond contributing to important research and development in New Mexico, these relationships will also serve to broaden the career opportunities of the PhD graduates. The blending of preparation in basic and applied research will produce graduates with a diverse skills and competencies that will be of interest to these types of employers.

2.6.4 Market Position and Brand

UNM 2020 envisions the University as building its market position and brand on a reputation as a destination university that provides "tremendous value to state, national, and global students seeking an education relevant to diverse social and economic environments." By offering a uniquely integrative program that is premised upon the locational advantages and specialties of both UNM and NMSU, the New Mexico Joint Doctoral Program in Geography will draw students from around the world who are interested in developing integrative competencies in a particularly multicultural, and environmentally critical context. Because the New Mexico Joint Doctoral Program in Geography has been designed from the ground up to offer a unique program that is literally rooted in the social, economic and environmental contexts of New Mexico, it promises to contribute to ongoing efforts to establish UNM as a destination university.

2.7 Relationship to Specific UNM 2020 Goals

2.7.1 Goal: Become a Destination University

As discussed above, the Joint Doctoral Program in Geography would offer a uniquely interdisciplinary program focused on human-environment dynamics and the development of integrative theories, methods, and applications relevant to this scholarship. As such, it would not directly compete with other PhD programs in the region or even the US. Rather, it would capitalize on UNM's locational advantages and programmatic innovations in creating a "one of a kind" PhD track.

2.7.2 Goal: Prepare Lobos for Lifelong Success.

While the contributions of the New Mexico Joint Doctoral Program in Geography to students' lifelong success are outlined above, the program would specifically address one of the key objectives under this goal: to "increase the number of doctorates awarded" by UNM. Because our program will offer the only PhD in

Geography in New Mexico, citizens will finally be able to obtain the highest degree available in Geography without having to go out-of-state.

2.7.3 Goal: Advance Discovery And Innovation

Over the last several years, UNM's Department of Geography & Environmental Studies has seen a marked increased in funded and collaborative research, with major recent grant awards for innovative techniques in infrastructure assessment, methods for disaster response, and studies of landscape change. In the last couple years, our faculty have published highly influential publications in environmental policy and theory, historical biogeography, urban legal geographies, critical physical geography, and time-sensitive remote sensing. The addition of a doctoral program will provide even greater capacity to fulfill one key UNM2020 objective: creating "structures and processes that support collaborative and interdisciplinary team research and scholarship." Since the New Mexico Joint Doctoral Program in Geography will be fundamentally oriented toward collaborative and interdisciplinary research that spans campuses, methodologies, and specialties, it will allow for significant advancements in geospatial discovery and innovation.

2.7.4 Goal: Advance And Accelerate Economic Development

UNM 2020 states that "elevating economic development to the goal level is a strong statement of the commitment UNM has to partnering with and enhancing the communities served." In keeping with this goal, the New Mexico Joint Doctoral Program in Geography is premised upon engaging PhD candidates with research rooted in the real-world problems of social and economic development in New Mexico. The program will also explicitly emphasize non-academic career tracks in addition to the traditional academic doctorate track. Increased research activity and high-level training, particularly in GIS&T, trains both existing and new residents of New Mexico in the skills necessary to launch new research and technology ventures.

2.8 Relationship to other offerings at UNM

Overall, the New Mexico Joint Doctoral Program in Geography will enhance UNM's interdisciplinary capacity in environment-related research and teaching without duplicating any existing programs or courses. UNM's faculty and student geographers already collaborate actively with Biology, American Studies, Anthropology, Communication & Journalism, Economics, Latin-American Studies, Community and Regional Planning, Civil Engineering, and History, and we expect that the development of a doctoral program will only enhance these existing partnerships. The new program will provide further benefit to UNM by increasing its institutional capacity to engage in cross-cutting research and program-building around the issues of environment and sustainability.

2.8.1 Research

As inherently interdisciplinary scholars, geographers are typically well positioned to lead meaningful collaborations in integrative human-environment research. Geography faculty at UNM currently study pressing environmental issues –

related to energy development, food production, water policy, etc. – in a wide variety of projects that integrate approaches from natural sciences, social sciences, and humanities. With the addition of doctoral students as scholars and research practitioners, our ability to undertake large collaborative projects will expand, leading directly to increased external funding for research activities, facilities, and publications. This will allow UNM's faculty and student geographers to contribute more meaningfully to major collaborations, including the development of environment-related research centers or mapping support operations that enhance existing initiatives in other departments and colleges. Our long list of affiliated faculty members indicates the interdisciplinary scope and impact of our collaborative potential in research. We expect that the development of the New Mexico Joint Doctoral Program in Geography will allow us to more fully realize the potential of these existing relationships, leveraging our interdisciplinary perspective into a vibrant and substantial research presence at UNM that tackles human-environment dynamics from an integrated perspective.

2.8.2 Teaching

There are a number of units on the UNM campus that already provide course offerings on environmental or spatial topics. Through our faculty affiliations, we regularly seek feedback on these courses and provide cross-listings in Geography & Environmental Studies where possible. The New Mexico Joint Doctoral Program will support the continuation of robust cross-listing opportunities, with the expectation that (a) Geography doctoral students will engage in graduate courses offered by other units, and (b) students from other environment-related units will take advantage of the courses offered in our department, especially in the realm of spatial techniques. Although UNM students from other departments would need to use the cross-enrollment protocol to take advantage of any courses offered remotely at NMSU, we envision that the doctoral program would continue to serve students needs in multiple units.

We have discussed the joint doctoral program with the following units – Biology, Earth and Planetary Science, Anthropology, Economics, American Studies, Communication & Journalism, History, Civil Engineering, Law, Community & Regional Planning, Political Science, Water Resources, Sustainability Studies, Latin American Studies, National Security Studies, Art & Ecology, Landscape Architecture, Peace Studies, and the Center for Health Policy – and have received positive feedback on the potential for curricular synergy. As a result, we feel confident in putting forward a proposed curriculum (see below) that includes numerous cross-listing opportunities as a vital part of our proposed interdisciplinary program.

2.8.3 Programs

In addition to enhancing interdisciplinary research and teaching engagement with faculty and students in other UNM departments, we anticipate that the New Mexico Joint Doctoral Program will provide significant benefit to a number of existing interdisciplinary programs, either by explicitly contributing to research

and teaching initiatives or by providing a path for students interested in pursuing interdisciplinary graduate work. We have consulted with all of the following units to ensure that our proposed program would maximize potential benefit without duplicating existing resources:

- *Water Resources Program* – Although the WRP is narrowly focused on providing an applied master's degree, there is good potential for cross-listing and co-teaching in the areas of water policy and modeling. There is potential that students would graduate with a Master's in Water Resources and enter the Joint Doctoral Program in Geography. Geography faculty currently serve on the advisory board for the WRP, and we have jointly targeted a faculty hire within a water resources cluster.
- *Sustainability Studies* – Currently housed in the Department of Biology, the Sustainability Studies program offers an undergrad minor for students interested in interdisciplinary environmental topics. A number of Geography majors participate in this program, and Geography faculty also serve as affiliated faculty in Sustainability Studies. The Joint Doctoral Program in Geography would provide a meaningful degree path for students who want to continue their interdisciplinary training at the graduate level.
- *Latin American Studies* – The Latin American and Iberian Institute is a major presence on the UNM campus, with significant funding to support interdisciplinary engagement and research at both the faculty and student levels. Its academic arm, Latin American Studies, has recently revived the interdisciplinary PhD program and added a number of concentrations in the social and environmental sciences. This is partly due to the unit's need to support a steady flow of PhD students who are coming to UNM from the Universidad Central de Ecuador (UCE), where faculty members are now required to attain the PhD in order to maintain their professorships. Geography has been active in this program because several Geography faculty serve as affiliated faculty in LAII, and we now provide an environment-focused concentration in the Latin American Studies PhD program. The joint doctoral program in Geography will provide another degree option for UCE faculty and will enhance cross-listing options for LAS students more generally.
- *Global and National Security Studies* – The UNM Provost recently convened a committee to explore and propose programmatic opportunities related to National Security Studies. Geography faculty are represented in this committee and have proposed a suite of courses to fulfill two potential tracks related to National Security: environmental analysis and geospatial analysis. Although it is not yet decided what form a National Security Studies program would take at UNM, the potential addition of undergraduate and graduate degrees and/or certificates in this area would clearly be enhanced by robust course offerings and research opportunities in Geography. The joint doctoral program in Geography would therefore offer significant potential to contribute in this area.
- *RWJ Center for Health Policy* – As the Robert Wood Johnson Foundation's support for a health-focused center has declined, it is not yet clear exactly how the RWJ Center for Health Policy will evolve within the new IPEAR. The

director expects, however, that it will continue to engage in community-based participatory policy work that draws from multiple disciplinary perspectives. If this is the case, the joint doctoral program in Geography could play a significant role at the center by steering policy-oriented student and faculty research toward practical applications in the health domain. We have already identified the need for a health geographer in our hiring plan, and this position would be expected to contribute to the center's evolution and to the development of other health-related research initiatives on campus.

2.9 Timeline for Program Development and Implementation

Assuming timely approval, we optimistically expect that the New Mexico Joint Doctoral Program in Geography could begin accepting and enrolling students as early as 2019-20-18 under the following timeline scenario:

- 2016-2018 proposal review at UNM & NMSU
- 2018-2019 HED and legislative review
- 2019- 2020: provisional admissions process & first cohort begins program

Basic resources are already in place on both campuses in terms of faculty, facilities, and student support services. Support that has been promised for additional Graduate Assistantship packages and critical faculty lines at UNM is expected to take effect over the next few years, in time for a program launch by 2019. Curricular additions are proposed as part of this package and would take effect as soon as the program as a whole is approved.

2.10 Proposed Curriculum

The proposed curriculum for the New Mexico Joint Doctoral Program in Geography fulfills all requirements outlined by the University of New Mexico Graduate School and is designed to be able to be completed in as little as four years of full-time study. It builds from the existing Master's Programs in Geography at UNM and NMSU, leveraging significant pedagogical expertise and classroom facilities to offer a robust and well-rounded PhD curriculum that will require adding only a few key courses. To achieve program goals for student learning, we will create a suite of 600-level core required seminars, add new courses that complement areas of existing strength, and change our instructional model for existing courses to maximize curricular availability for students across both campuses. Although this curriculum is not dependent on taking courses outside the two departments of Geography, we expect that many doctoral students will take advantage of offerings in other UNM and NMSU departments, including Biology, Earth and Planetary Sciences, Economics, Anthropology, Civil Engineering, Community and Regional Planning, Statistics, and Surveying. A number of these non-Geography courses are explicitly included in the program curriculum as electives, while others may be counted toward a student's program of study with the approval of his or her advisor and committee. The full curriculum is detailed in the following sections and can also be viewed "at a glance" in table format on the last page of this section. Catalog language for the program description is included as Appendix A, followed by curriculum proposals

for new courses (Appendix B), catalog descriptions for all existing UNM courses (Appendix C) and sample syllabi for all UNM courses (Appendix D).

2.10.1 Learning Goals

The primary objective of our teaching and mentoring is to produce graduates who are well prepared for professional careers within and beyond the academy. Broadly, we intend for all students to graduate with:

1. Broad capability in the discipline of geography, with a critical understanding of how specific areas of theoretical, methodological, and practical expertise relate to scholarship in other areas of the discipline;
2. Advanced competency in the design and implementation of original research;
3. Ability to engage in contemporary problem solving; and
4. Professional skills in communication, teaching and mentorship.

2.10 2 Program Requirements

To achieve these learning goals, we have drafted the following program requirements, which will apply to all students in the joint doctoral program, regardless of whether UNM or NMSU is the home institution.

- Maintenance of an overall GPA of 3.0
- Completion of 48 credit hours, 18 of which are dissertation credits
- Completion of all core courses with a grade of B or better
- Demonstrated competency in three subject areas: human geography, physical geography, and Geographic Information Science & Technology. The doctoral committee will evaluate existing competencies in a first-semester diagnostic interview and will then provide individualized guidelines for the student's program of study that lead to successful demonstration of these competencies.
- Successful advancement to candidacy, which will be determined through (1) written comprehensive exams that demonstrate broad competency across the discipline of geography, and (2) an oral exam that requires the student to defend a research proposal, demonstrate research expertise, and address any concerns identified during the evaluation of the student's written exam.
- Completion of a written doctoral dissertation, with a successful oral defense. Due to the interdisciplinary nature of the joint doctoral program, we expect that dissertations will exhibit variable formats, but in all cases a dissertation must comprise a unified body of original research, as guided by the doctoral committee and advisor.

2.10.3 Core Courses

All students in the New Mexico Joint Doctoral Program will take a series of three core seminars that are designed to provide training in the integrative research approaches that are at the heart of the program. UNM and NMSU will share responsibility for teaching these courses, with the first- and second-semester core courses taught using a nontraditional delivery method that we refer to as the "intensive distance seminar." (See individual core course descriptions for more

detail.) This approach will ensure that all first-year students are able to engage with both campuses and faculties early in their tenure in the program, providing ample opportunity to make progress on committee formation, topic selection, and research design. The final core course will be taken in the student's second year and will be taught locally on each campus, as described below.

- **GEOG 601: Geographic Theory and Application** – This course provides a traditional first-semester overview of geographic history and philosophy, but it does so within a framework that incorporates significant focus on the relationship between theory and praxis. Since this relationship is critical to our conception of the joint doctoral program, this introductory course will carry enormous responsibility for setting intellectual and practical expectations for new students. We envision that teaching responsibility for this course be shared between UNM and NMSU, using innovative instructional models to promote student engagement with student peers and faculty members on both campuses. It will include one face-to-face meeting on each campus during the semester. These meetings will be intensive in nature, including both a seminar meeting and a field component. The two face-to-face meetings will require the instructor and students to travel to the partner institution once during the semester, with travel funding provided directly by the program through class fees. Other class meetings during the semester will be taught in a face-to-face seminar format that is also broadcast to desktops at the partner institution, allowing students from the "distant" campus to engage in seminar discussion via video technology. [Course will be offered every fall semester.]

- **GEOG 602: Integrative Research Design** – This course provides a comprehensive introduction to research design in geography, guiding students through the completion of a literature review, research question, and methodological design. Unlike traditional research design classes, however, this course focuses explicitly on the integration of qualitative and quantitative methods to conduct cutting-edge interdisciplinary research. This focus will provide advanced research training that addresses the core focus of our program: human-environment dynamics. Like GEOG 601, responsibility for this course will be shared between UNM and NMSU under an instructional model that allows for cross-institutional engagement through two intensive face-to-face meetings (one at each campus, with funding provided by the program for instructor/student travel to the partner institution) and video-enable seminar meetings. When taught at UNM, the course will meet jointly with our existing GEOG502 course in research design, although GEOG502 students would not be expected to participate in NMSU-based activities. [Course will be offered every spring semester.]

- **GEOG 603: Professional Geographic Practice** – This core course focuses on a variety of professional development topics that prepare students for teaching and applied community engagement projects. All students in this course will receive training in professional communication, professional

ethics, and grantwriting. Depending on their individual professional goals, however, the course will allow students to undertake practical training in a variety of areas that range from academic teaching to applied policy work to scientific communication. As a starting point, the course will be developed using the American Association of Geographer's publication series for curricular support.[3] All students in the New Mexico Joint Doctoral Program in Geography are expected to engage in applied projects as part of their research design, and this course will lay the foundation for these pursuits. Unlike GEOG 601 and GEOG 602, the final core course will be taught independently on each campus, to maximize the potential for faculty-student interaction on specific location-based project planning. We expect that some students will opt to pursue applied projects that extend beyond this course into an independent-study course or a multi-year dissertation project. [Course will be offered every fall semester.]

2.10.4 Elective Curriculum Overview

Beyond the required core courses, the New Mexico Joint Doctoral Program in Geography focuses on three primary areas of research expertise that require foundational training in three sub-disciplinary fields: human geography, physical geography, and GIS&T. In order to complete the program successfully, each student must demonstrate competency in all three areas while also developing a specialized area of research focus. Our curriculum is therefore designed to provide a variety of courses in the three main sub-disciplines, giving students ample opportunity to develop broad competencies through coursework while also working to design advanced integrative research.

At the time of admission, the faculty review committee will determine whether students have any deficiencies in human geography, physical geography, or GIS&T and will identify courses that can be used to remedy deficiencies in the relevant area. Courses taken to remove deficiencies may not satisfy other degree requirements.

Curricular details for each subfield are provided below, with clarifications regarding (a) which courses already exist at either UNM or NMSU, (b) the frequency with which existing courses are offered, (c) which courses are proposed for addition at each campus, whether now or in the foreseeable future, and (d) which existing or new courses will be taught using innovative instructional models that allow students to enroll from either institution. Please see also the "curriculum-at-a-glance" (Table 2.1) for a summary of course offerings and formats across the two institutions. A seven-year course rotation is provided in Appendix L and discussed in Section 6 ("Institutional Readiness for the Program") in terms of how the curriculum will be staffed in the program's early years. Formal titles for existing and new courses are included below, while catalog descriptions and all related curriculum forms (including Form B

[3] Michael Solem, Kenneth Foote, and Janice Monk, eds. (2008) *Aspiring Academics*, Prentice Hall. Michael Solem and Kenneth Foote (2008) *Teaching College Geography*, Prentice Hall. Association of American Geographers (2012) *Practicing Geography*, Prentice Hall.

applications and syllabi) are included as appendices. Please note that any 400-level courses listed below are already available for graduate credit and would be suitable for PhD students.

2.10.5 Sub-Curriculum in Human Geography

Courses in Human Geography will be offered either by UNM or NMSU as part of their regular course rotation. Each such course will be offered either as a "local" course that must be taken in person at the campus offering the class, or as a "distance capable" course that can be taken in person at the campus offering the class or by distance learning from the partner campus. As shown below, the bulk of the human geography courses will be offered at UNM, with a large number of them available to students at NMSU via distance learning. A qualitative methods course will be added at UNM to round out this sub-curriculum, and Form B paperwork for this course has been submitted in conjunction with this program proposal. One additional graduate seminar is envisioned for future addition, based on program enrollment and faculty staffing levels.

As with the other two sub-disciplines, there is no set number of courses the PhD candidate must successfully complete. Rather, the determination of needed coursework to establish a proper competency in human geography will be determined by the individual candidate's committee, in consultation with the student, and with reference to the student's prior studies and life experience.

UNM: Local Courses at Grad Level, Human Geography

- GEOG*445 Geography of New Mexico and the Southwest [annual]
- GEOG466/566 The City [annual]
- ECON540 Natural Resource, Envt'l and Ecological Modeling I [biennial]
- ECON542 Topics in Envt'l, Resource and Ecological Economics [biennial]
- ECON543 Natural Resource, Envt'l and Ecological Modeling II [biennial]
- ECON544 Environmental Economics [biennial]
- WR571 Water Resources I – Contemporary Issues [annual]
- WR572 Water Resources II – Models [annual]
- HIST500 Topics: Digital Mapping in the Humanities [biennial]
- HIST500 Topics: Representing Urban Space [biennial]

UNM: Distance-Capable Courses at Graduate Level, Human Geography

- GEOG514 Natural Resources Management Seminar [annual]
- GEOG515 Cultural and Political Ecology [annual]
- GEOG516 Seminar: Globalization [biennial]
- GEOG517 Legal Geography [biennial, eventually annual]
- GEOG461/561 Environmental Management [annual]
- GEOG462/562 Water Resources Management [annual]
- GEOG463/563 Public Land Management [annual]
- GEOG464/564 Food and Natural Resources [annual]
- GEOG467/567 Governing the Global Environment [biennial]
- GEOG590 Qualitative Research Methods [new course, annual]

NMSU: Local Courses at Graduate Level, Human Geography

- GEOG555 Southwest Environments [annual]
- GEOG583 Field Explorations in Geography [annual]

NMSU: Distance-Capable Courses at Graduate Level, Human Geography

- GEOG567 Transportation Geography [annual]
- GEOG598 Topics Environmental Planning [annual]

2.10.6 Sub-Curriculum in Physical Geography

Courses in Physical Geography will be offered either by UNM or NMSU as part of their regular course rotation. Each such course will be offered either as a "local" course that must be taken in person at the campus offering the class, or as a "distance capable" course that can be taken in person at the campus offering the class or by distance learning from the partner campus. As shown below, the bulk of the physical geography courses will be offered at NMSU or in UNM departments outside Geography & Environmental Studies. Two courses will be added at UNM to round out this sub-curriculum, and Form B paperwork has been submitted concurrently with this program proposal, or will be submitted shortly thereafter. In this sub-curriculum, very few courses will be available to students via distance learning, which will make it necessary for admissions committees to ensure that applicants with a primary interest in physical geography are well matched for their designated advisor and home institution.

All students must develop appropriate methodological competency in physical-geographic research. As with the other two concentrations, however, there is no set number of courses the PhD candidate must successfully complete in physical geography. Rather, the determination of needed coursework to establish proper competencies in physical geography and relevant research methodologies will be determined by the individual candidate's committee, in consultation with the student, and with reference to the student's prior studies and life experience.

UNM Local Courses at Graduate Level, Physical Geography

- GEOG*450 Environmental Hazards [annual]
- GEOG551 Drylands [new course, annual]
- CE534 Environmental Engineering Chemistry [annual]
- CE541 Hydrogeology [annual]
- CE542 Intermediate Hydrology [annual]
- CE545 Open Channel Hydraulics [annual]
- CE549 Vados Zone Hydrology [annual]
- CE565 Soil Behavior [annual]
- CRP516 The Natural History of Watersheds: A Field Approach [biennial]
- Any EPS course at the graduate level
- Any BIOL course at the graduate level
- Some courses in the GIS&T list (next sub-curriculum, below) may also be relevant for the student's Physical Geography competency. Additional relevant courses may be counted from the departments of Math & Stats, Earth & Planetary Science, Biology or other UNM units, with approval.

UNM Distance-Capable Courses at Graduate Level, Physical Geography

- At this time, there are no UNM courses in physical geography that will be offered in a delivery mode that supports distance learning.

NMSU Local Courses at Graduate Level, Physical Geography

- GEOG553 Applied Geomorphology [annual]
- GEOG557 Biogeography [annual]
- GEOG552 Landscape Ecology [annual]
- GEOL474 Groundwater Geology [annual]
- BIOL462 Conservation Biology [annual]
- BIOL507 Plant Systematics [annual]
- CE452 Geohydrology [annual]
- CE483 Surface Water Hydrology [annual]
- ES470 Environmental Impacts of Land Use [annual]
- FWCE457 Ecological Biometry [annual]
- FWCE462 Conservation Biology [annual]
- FWCE540 Wildlife Habitat Relationships [annual]
- SUR461 Introduction to Satellite Geodesy [annual]
- Some courses in the GIS&T list (next section, below) may also be relevant for the student's Physical Geography competency. Additional relevant courses may be counted from the departments of Statistics, Surveying or other NMSU units, with approval.

NMSU Distance-Capable Courses at Graduate Level, Physical Geography

- GEOG598 Climate Change and Surface Processes [annual]

2.10.7 Sub-Curriculum in Geographic Information Science & Technology

Courses in Geographic Information Science & Technology (GIS&T) will be offered either by UNM or NMSU as part of their regular course rotation. Each such course will be offered either as a "local" course that must be taken in person at the campus offering the class, or as a "distance capable" course that can be taken in person at the campus offering the class or by distance learning from the partner campus. As shown below, there are a number of equivalent courses that will be offered at both UNM and NMSU, owing largely to the existing curricular strength shared by both institutions in GIS&T master's-level education. We expect that virtually all courses in this sub-discipline could be offered in a distance-capable format, although this may not be necessary for those courses that are locally offered in both places on a regular rotation. All needed courses for this concentration currently exist or have recently been proposed as part of a more general curriculum review.

As with the other two sub-disciplines, there is no set number of courses the PhD candidate must successfully complete. Rather, the determination of needed coursework to establish a proper competency in GIS&T will be determined by the individual candidate's committee, in consultation with the student, and with reference to the student's prior studies and life experience.

UNM Local Courses at Graduate Level, GIS&T

- GEOG*481L Map Design and Geovisualization [annual]
- GEOG524 Remote Sensing Seminar [annual]
- GEOG525 Advanced GIScience Seminar [annual]
- CE547 GIS in Water Resources Engineering [annual]

UNM Distance-Capable Courses at Graduate Level, GIS&T

- GEOG522 / OILS 515 Introduction to Spatial Data Management [annual]
- GEOG527 Introductory Programming for GIScience [biennial]
- GEOG528 Advanced Programming for GIS [biennial]
- GEOG580L Spatial Statistics [annual]
- GEOG583L Remote Sensing Fundamentals [annual]
- GEOG584L Applications of Remote Sensing [annual]
- GEOG585L Internet Mapping [annual]
- GEOG586L Applications of GIS [annual]
- GEOG587L Spatial Analysis and Modeling [annual]
- GEOG588L GIS Concepts and Techniques [annual]

NMSU Distance-Capable Courses at Graduate Level, GIS&T

- GEOG521 Application and Modeling [annual]
- GEOG 571 Cartography and Geographic Information systems [annual]
- GEOG572 Geodatabase Design [annual]
- GEOG573 Introduction to Remote Sensing [annual]
- GEOG577 GIS&T [annual]
- GEOG578 Fundamentals of GIS&T [annual]
- GEOG 581 System Design for GIS&T [annual]
- GEOG582 Advanced Remote Sensing [annual]
- GEOG585 Advanced Spatial Analysis [annual]
- GEOG586 Geospatial Techn for Natural Resource Assessments [annual]
- GEOG598 GIS for Water Resources [annual]
- FWCE571 GIS Natural Resources [annual]

2.10.8 Joint Program Delivery

The New Mexico Joint Doctoral Program in Geography does not require that students maintain residency at different times in both Albuquerque and Las Cruces. The combined geography faculty at UNM and NMSU feel strongly, however, that the program's success hinges on an ability to foster authentic student engagement across the two faculties, campuses, and cities. To that end, our plan for program delivery includes numerous opportunities for academic engagement at both UNM and NMSU, regardless of which is the student's home institution. We will kick off each year with a field-based orientation experience for incoming students that will offer both (a) an opportunity for cohort-building and (b) an introduction to dynamic human-environment contexts in either Albuquerque or Las Cruces. Building from this annual kickoff experience, the first-year core courses (GEOG601 and GEOG602) will be delivered in compressed formats that integrate distance learning technologies with face-to-

face meetings of students and faculty at both campuses. Ideally, one face-to-face session would be incorporated with the annual kick-off event, with a second face-to-face session taking place at the other institution toward the end of the semester. The remainder of the core course meetings would be conducted via distance technologies on each campus, including digital videoconferencing and broadcast-to-desktop models, supplemented with standard web-based and email communications. Under this model, students from each campus would travel to the other campus once per semester, and we envision building travel costs into course fees as a matter of student convenience.

As mentioned above, the GEOG603 core seminar would be duplicated on each campus to facilitate intensive faculty participation in students' applied field projects. All other courses are offered either in "local" formats, meaning that students must be in residence (or must be willing to travel on a weekly basis) to enroll in the course, or are offered in "distance-capable" formats that allow for remote enrollment via distance learning and digital meeting technologies. In general, we do not anticipate offering duplicate courses on both campuses except for courses that are already required to support the existing Master's programs at UNM and NMSU. Courses that are oriented primarily toward doctoral students will typically be offered only at one institution or the other, depending on faculty expertise. (GEOG603 is the exception to this rule.) As a result, some students may choose to change their residency between Albuquerque and Las Cruces in any given semester. To assist students in determining whether and when this might be effective, we will provide a pre-matriculation questionnaire to gather information that can be used to advise each student on both curricular and residency issues related to the student's intended Program of Study. We will also maintain long-term projections for course offerings at each institution, to assist the Program Coordinator in advising students in this regard.

2.10.9 Graduate Committees

In addition to the institutional requirements that govern the formation of graduate committees at UNM and NMSU, the New Mexico Joint Doctoral Program in Geography requires that each student work with his/her advisor to develop a joint doctoral Committee on Studies, which will necessarily include two faculty members from each institution and one external member. We expect the external member will typically be a faculty member who is from the home institution but outside the home department. Eligibility to serve on doctoral committees is defined in the graduate catalogs at UNM and NMSU, and each institution will therefore follow its own procedures for evaluating graduate committees and qualifying "graduate" faculty. The joint doctoral Committee on Studies will be responsible for all facets of supervising dissertation research, including:

- developing the preliminary research proposal and external funding proposals (where applicable),
- developing expertise needed to conduct the proposed research,
- preparing for comprehensive written exams,
- preparing for the final research proposal defense/oral exam,

- conducting needed field and laboratory analysis,
- preparing for the final defense of the dissertation, and
- writing and revising the articles or other written documents that will summarize the research and comprise the finished product of the dissertation process

2.11 Institutional Priority

Prior to submission to the NMHED and NMGDC, a brief statement will be included regarding the institution's priority for this program, with reference to documentation provided by Provost's Office (see section 10).

CORE COURSES	Teaching Responsibility Shared by UNM and NMSU	
	GEOG601: Geographic Theory and Application[1] GEOG602: Integrative Research Design[1]	Teaching responsibility rotates between UNM and NMSU each year. Taught in a distance format suitable for attendance by all students in each cohort, regardless of home institution.
	GEOG603: Professional Geographic Practice[1]	Taught independently on each campus each year.

ELECTIVE COURSES		Offered by UNM		Offered by NMSU	
		Local to UNM only	Distance-Capable Course	Local to NMSU only	Distance-Capable Course
A list of suitable elective courses to be included in each student's program of study will be developed in consultation with the adviser and joint committee.	Human Geography Offerings	GEOG566 City as Human Env GEOG*445 Geog of NM & SW ECON540 Nat Res Modeling I ECON542 Ecol Economics ECON543 Nat Res Modelg II ECON544 Env Economics WR571 Water Res Issues WR572 Water Res Modeling CRP516 Watersheds	GEOG514 Nat Resources GEOG515 Cultural Political Ecol GEOG516 Globalization GEOG517 Legal Geography GEOG561 Env Mgmt GEOG562 Water Mgmt GEOG563 Public Lands GEOG564 Food Nat Resources GEOG567 Govern Global Envt GEOG590 Qual Methods[1]	GEOG583 Field Explorations	GEOG567 Transport Geog GEOG598 Env Planning
	Physical Geography Offerings	GEOG*450 Env Hazards GEOG551 Drylands CE534 Env Eng Chemistry CE541 Hydrogeology CE542 Intermed Hydrology CE545 Open Channel Hydr CE549 Vados Zone Hydrol CE565 Soil Behavior any EPS course at grad level any BIOL course at grad level	No distance-capable classes (Additional relevant courses may be counted from the departments of Math & Stats, Earth & Planetary Science, and Biology. Note: some courses in the GIS&T list (below) may also be relevant for the student's Physical Geography competency.)	GEOG535: Applied Geomorph GEOG555 SW Environments GEOG557: Biogeography GEOG552: Landscape Ecol GEOL474: Groundwater BIOL462: Conservation Biol BIOL507: Plant Systematics CE452: Geohydrology CE483: Surface Hydrology ES451: Climate in Real World ES471: Env Impacts Land Use FWCE462: Cons Biology FWCE457: Ecol Biometry FWCE540: Wildlife Habitat Rel SUR461: Satellite Geodesy	GEOG598 Climate Chg Proc (Additional relevant courses may be counted from the departments of Statistics, Surveying or other NMSU units. Note: some courses in the GIS&T list (below) may also be relevant for the student's Physical Geography competency.)
	Geographic Information Science & Technology Offerings	GEOG524 Adv Remote Sens GEOG525 GISci Seminar CE547 GIS Water Resources	GEOG*481L Map Design GEOG522 Spatial Data Mgmt GEOG527 Basic Programming GEOG528 Adv Programming GEOG580 Spatial Statistics GEOG583 Remote Sensing GEOG584 App Remote Sensing GEOG585 Internet Mapping GEOG586 Applicants of GIS GEOG587 Spatial Analysis GEOG588 Concepts/Techniques		GEOG521 Applic & Modeling GEOG571 Cartography & GIS GEOG572 Geodatabase Desn GEOG573 Intro Remote Sens GEOG577 GIS&T capstone GEOG578 Fundam GIS&T GOEG581 System Design GEOG582 Adv Remote Sens GEOG585 Adv Spatial Analysis GEOG586 Nat Res Assessmnt FWCE571 GIS Nat Resources

[1] Form B currently under review.

3. JUSTIFICATION FOR THE PROGRAM

3.1 Overview

The development of a New Mexico Joint Doctoral Program in Geography is amply justified on several levels.

- First, it will produce graduates with advanced training in integrative human-environment research methods and applications. These foundational skills will prepare program graduates for a variety of careers in New Mexico – including in scientific and industrial labs, government agencies, universities, and consulting firms – that require employees and leaders with broad training in both theory and methods appropriate for understanding the complexity of real world natural and human systems.
- Second, it will provide a much-needed educational opportunity for New Mexico residents who wish to undertake advanced, interdisciplinary graduate training on environment-related topics without leaving the state.
- Third, it will contribute directly to the goals of the University of New Mexico by generating significant external funding through increased research capacity in GES, by increasing project opportunities with partner agencies and institutions, by increasing graduate enrollments, and by deepening the institution's commitment to the study of environmental dynamics and challenges.
- Finally, it will attract students to New Mexico from other areas of North America and beyond. By committing current and future resources to the development of an innovative and high-quality program, we will build a national reputation that draws the most competitive applicants to New Mexico for graduate study in integrative human-environment dynamics.

3.2 Justification for Employment Need

Recent advances in geospatial technologies have prompted a mapping renaissance in which public agencies and private firms explore novel and high-impact ways to analyze and visualize environmental data and spatial patterns. Across North America and the globe, the geospatial industry is growing by leaps and bounds.

3.2.1 National Context: U.S. Department of Labor Reports

The U.S. Department of Labor provides the following profile of the technologies that are driving expansion of this diverse employment sector:

> Geospatial information is finding ever-increasing applications. The federal government uses it to manage forests, develop defense strategies, establish tax valuations and employ census data to determine voting districts. Utility companies use it to automate transmission and distribution networks and to build and service pipelines and communication networks. Cities are using geospatial technologies for applications as diverse as routing sanitation and emergency vehicles, replacing water mains, and matching equipment to job requirements. Private companies use geospatial information to make more

> informed decisions in areas ranging from site selection, to marketing demographics, to analyzing competition. Once a tool that was affordable only to the largest organizations, geospatial systems have become a cost-effective option for even the smallest organizations.
>
> There is a lack of public awareness of the impact of geospatial technology applications on daily professional and personal activities. With greater understanding will come greater interest in entering the profession, as well as greater demand for geospatial capabilities and applications across a wide range of other sectors. The Geospatial Information & Technology Association (GITA) reports that approximately 70 to 80 percent of the information managed by business is somehow connected to a specific location—an address, street, intersection, or 'xy' coordinate. This interest in location is drawing geospatial technology into nearly every corner of the business world. Because the technology's uses are so widespread and diverse, the geospatial market is growing at an annual rate of almost 35 percent, with the commercial subsection of this market is expanding at the rate of 100 percent each year.[4]

Driven by this rapid technological uptake, Geospatial Technologies has been identified by the U.S. Department of Labor as one of the three largest growth sectors in the next twenty years (after nano-technologies and bio-medical research). Accordingly, the sector has been designated as a job training initiative priority both because it is "expected to add substantial numbers of new jobs to the economy or affect the growth of other industries," and because it leads existing or emerging businesses to be "transformed by technology and innovation requiring new skill sets for workers."[5]

3.2.2 State Context: New Mexico's Geospatial Industry

To understand how this employment growth and training need impacts New Mexico, we conducted a focus group and followup interviews with agency and industry representatives from across the state in 2015. (See Appendix G for list of participants.) Participants provided feedback on (a) the need within their organizations for employees with PhD-level training, and (b) the desire within their own organizational ranks for advanced graduate training in Geography. This second topic is discussed in the next section below.

The focus group expressed strong support (even excitement) for the conceptual design of the New Mexico Joint Doctoral Program in Geography, especially its attention to the development of applied and professional research competencies alongside a rigorous theoretical program in integrative human-environment dynamics. There was consensus that geographers with advanced graduate

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[4] U.S. Department of Labor Employment and Training Administration, "Identifying and Addressing Workforce Challenges in America's Geospatial Technology Sector," 2 November 2005. [See Appendix F.]

[5] U.S. Department of Labor, "High Growth Job Training Initiative." Available at https://www.doleta.gov/business/PDF/5%20-%20HGJTI%20overview.pdf [last accessed 8 February 2016].

training are needed in various agencies and businesses throughout the state. In the private sector, Geography PhDs have great potential to make an impact as innovative and entrepreneurial leaders in a rapidly changing economic development context. Within the public sector, PhD credentials and research design experience are seen as critical to agency success with complex analytical projects.

We also asked the focus group to identify the specific competencies through which potential employees would provide the most value to their geospatial endeavors. The group engaged in vigorous discussion on this topic and provided the following list of critical competencies:

- Research design expertise
- Sophisticated understanding of how to set research objectives
- Experience with big data approaches
- Statistical training
- Computing sophistication
- Leadership skills in combination with technical background

These competencies identified by New Mexico professionals echo research findings at the national level, which indicate that general skills in research and leadership are just as important to post-PhD career success as specific geographical and technical skills.[6] The New Mexico Joint Doctoral Program in Geography has been explicitly designed to address these competencies. Its core curriculum emphasizes the development of multiple integrated skill sets and underscores the critical importance of merging theoretical development with practical applications that can be translated to agency and industry contexts.

3.2.3 Academic Context: Geography in Higher Education

Although the New Mexico Joint Doctoral Program in Geography is based on a unique and innovative design, it will provide the same quality of direct training for the next generation of academic leaders as any existing or traditional Geography PhD program. As the overall labor need for graduates with geographical training has increased, institutions of higher education have seen increasing enrollment in geography programs even as other fields and overall numbers have declined.[7] This robust enrollment has supported the addition of new degree programs in Geography across the country at all levels,[8] which in turn has supported strong academic placement rates for graduates with PhDs in

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[6] Solem, Michael, Ivan Cheung, and M. Beth Schlemper (2008) Skills in Professional Geography: An Assessment of Workforce Needs and Expectations. *The Professional Geographer*, 60(3): 356–373. Monk, Janice J., Kenneth E. Foote, and M. Beth Schlemper (2012) Graduate Education in U.S. Geography: Students' Career Aspirations and Faculty Perspectives. *Annals of the Association of American Geographers* 102(6): 1432–1449.

[7] This trend can be expected to continue, based on the emerging importance of geography education at the K-12 level, as indicated by exploding numbers of high school students taking the AP Human Geography exam and the American Association of Geographers (AAG)'s recent announcement that it is proposing that the College Board add an AP exam in Geographic Information Science and Technology.

[8] Murphy, Alexander B. (2007) Geography's Place in Higher Education in the United States. *Journal of Geography in Higher Education* 31(1): 121–141

Geography. Indeed, a recent nationwide survey of social science doctorate recipients' post-degree career paths showed that almost three quarters of PhD-holding geographers were entering the academic ranks, primarily at the faculty level.[9]

This same survey noted, however, that the nature of the geography professoriate is changing, as geography professors are increasingly encouraged to participate in university-industry research partnerships and to engage in "interdisciplinary research in response to societal problems – often of global scope" as a central element of the research enterprise (p.185). This evolving higher-education context, therefore, necessitates an evolution of PhD-level geography education. Not only must we broaden the diversity of student recruitment to escape the traditional narrowness and elitism of academia, but we must also broaden and diversify PhD curricula to better equip students with a variety of geographical and general skills needed to succeed in the academic workplace.[10] One of the first tasks of the program's Joint Steering Committee will be to develop a proactive plan for diversity and broadening participation. We envision taking a leadership role in addressing the need to diversity the discipline, not just in New Mexico but nationally as well.

The New Mexico Joint Doctoral Program in Geography is designed with this fundamental re-orientation in mind. Through its interdisciplinary structure and practice- and competency-based curriculum, it is responsive to recent shifts in higher education. It will also help meet the need for academic leaders who are capable of thinking creatively and integratively about the kind of geospatial training that supports a sophisticated workforce. At the same time, it is responsive to recent calls that PhD programs broaden students' career paths beyond the academic workplace.[11] As nationwide trends indicate, "PhD holders are viewed as good candidates for staffing the complex knowledge environments that increasingly characterize social institutions."[12] By attending to the critical importance of practical training and professional development,[13] the proposed joint program will thus prepare students for a broad suite of professional careers in higher education, business, government, and the non-profit sector.

3.3 Evidence of Student Demand

The target student population for the New Mexico Joint Doctoral Program includes individuals who are already in New Mexico as well as students who migrate from outside the region to take advantage of the joint program's unique

[9] Rudd, Elizabeth and Maresi Nerad (2015) Career preparation in PHD programs: results of a national survey of early career geographers. *GeoJournal* 80: 181-186.
[10] Boyle, Mark, Kenneth E. Foote, and Mary Gilmartin (2015) Rethinking the PhD in geography: overview and introduction. *GeoJournal* 80:159-168. See also Monk et al 2012 and Solem et al 2008.
[11] Monk, Janice (2015) Changing doctoral education: the case of US geography. *GeoJournal* 80:187-191.
[12] Rudd and Nerad, p.185.
[13] Adams, John S. (2015) Reality therapy for geography PhD programs. *GeoJournal* 80: 169-174.

characteristics. We expect a mix of students who intend to pursue traditional academic paths toward teaching and research careers with those who are oriented toward future employment as resource managers, professional scientists, geospatial innovators, and policy analysts. The program is designed to support all of these paths through its focus on advanced training in integrative research skills, and we expect to recruit widely, both from undergraduate and master's programs in Geography and related fields, as well as from national laboratories, government agencies, consulting firms, or private businesses whose employees would benefit advanced graduate training. The innovative nature of our joint program will provide a recruiting advantage, as will the unique aspects of existing geography programs at both UNM and NMSU. UNM, for example, has the only Geography program in the nation with a concentration in geography, environment, and law, while NMSU is nationally prominent in the area of geography education.

3.3.1 Student demand from the MS Geography program at UNM

To characterize student demand from existing academic programs, we first analyzed the career trajectories of our own MS Geography graduates. Historically over the previous two decades, we have placed only about one master's graduate per year in a PhD program, while the majority of students have gone into government employment, as shown in Table 3.1. Some of these students might have applied for a PhD program in New Mexico if one were available; several reported that they would have pursued a PhD, but could not do so because of their need to stay in New Mexico.

Table 3.1 First post-degree employment placement: MS Geography grads, 1998-2013

First Post-Master's Employment	Placement Rates*
Government	
Federal Agency	18%
National Research Lab	8%
State Government	6%
Local Government	4%
Industry/Consulting	15%
Education	
University Research Facility	10%
College/Post-Secondary Teaching	6%
K-12 Teaching	2%
Entered a PhD Program	13%
Other/Retired/Unknown	17%

*Out of 126 total MS degree recipients.

One cannot assume, however that the historical 13% rate of UNM graduates' post-MS entry into PhD Geography programs will persist once the New Mexico Joint Doctoral Program in Geography is introduced. These historical data are insufficient to predict future trends because the Department of GES at UNM has undergone radical change in the last five years. With the addition of new

programs and certificates and a 150% growth in faculty size since 2006, we have seen a significant increase in the quality of our master's program. Since our most recent students are likely to be more representative of the department's future MS graduates, we have separately surveyed the current cohort to determine their career plans. These survey data show that almost a third of our current MS students consider it "very likely" that they will pursue a PhD in Geography (see Table 3.2). Two thirds of the current cohort consider it desirable to live in New Mexico after completing the Master's degree (see Table 3.3); and one fourth of UNM's current MS Geography students stated they would be "very likely" to apply to a UNM-based PhD program in Geography, if one were offered (see Table 3.4). These new data indicate that we can expect a robust application rate from existing UNM Geography students to the New Mexico Joint Doctoral Program in Geography.

Table 3.2 Survey results: Please rank how likely you are to pursue the following options after completing your MS in Geography at UNM (19 total respondents)

	Very likely	Likely	Neither likely nor unlikely	Unlikely	Very unlikely
Enter a PhD program in Geography	21.1% 4	21.1% 4	10.5% 2	15.8% 3	31.6% 6
Enter a PhD program in another field	31.6% 6	26.3% 5	10.5% 2	21.1% 4	10.5% 2
Enter a Master's program in another field	47.4% 9	21.1% 4	10.5% 2	15.8% 3	5.3% 1
Pursue professional position with a government agency	10.5% 2	5.3% 1	10.5% 2	47.4% 9	26.3% 5
Pursue professional position with a private company	5.3% 1	10.5% 2	26.3% 5	31.6% 6	26.3% 5
Establish your own business as an entrepreneur	31.6% 6	21.1% 4	31.6% 6	5.3% 1	10.5% 2

Table 3.3 Survey results: Please rank the desirability of the following locations in terms of where you would consider living after you complete your MS in Geography at UNM (20 total respondents)

	Very undesirable	Undesirable	No opinion	Desirable	Very desirable
Albuquerque, NM	5.3% 1	15.8% 3	10.5% 2	36.8% 7	31.6% 6
Elsewhere in New Mexico	21.1% 4	15.8% 3	21.1% 4	42.1% 8	0.0% 0
Elsewhere in the Southwest	5.3%% 1	21.1% 4	36.8% 7	26.3% 5	15.8% 3
Elsewhere in the United States	5.3% 1	15.8% 3	5.3% 1	42.1% 8	31.6% 6
Elsewhere in North America	10.5% 2	10.5% 2	26.3% 5	36.8% 7	21.1% 4
Outside North America	15.0% 3	15.0% 3	15.0% 3	25.0% 5	30.0% 6

Table 3.4 Survey results: If UNM's Department of Geography currently offered a PhD program, how likely would you be to apply for admission following completion of your MS in Geography? (20 total respondents)

	Very likely	Likely	Neither likely nor unlikely	Unlikely	Very unlikely
Respondents	30.0% 6	10.0% 2	15.0% 3	20.0% 4	25.0% 5

3.3.2 Student demand from other academic programs at UNM

The University of New Mexico has also recently developed a collaboration with the Universidad Central de Ecuador (UCE), in which more than one hundred faculty members from that institution will enroll at UNM to earn PhD degrees over the next five years. A visit to UCE in summer 2014 revealed that many of these faculty members are seeking a PhD that focuses on environment, development, and sustainability. The Latin American and Iberian Studies Institute agrees with our estimate that 2-3 students per annual 30-person cohort would seek to enter the New Mexico Joint Doctoral Program in Geography. (In the first year of the program, 3 UCE faculty have enrolled in GES via a Geography concentration available under the Latin American Studies degree program, with two of them explicitly noting that the would have enrolled directly in GES if a PhD program were available.) Because this mass-enrollment of UCE faculty comes in response to new Ecuadorian legislation aimed at transforming the country's higher education system, we expect that the collaborative model will soon be expanded to other universities in Ecuador that are facing the same imperatives of advancing their faculty's education. In time, other countries in

Latin America may go through similar transformation, which could bring dozens of students through our joint PhD program over the next two decades.

In addition, UNM's Department of Geography & Environmental Studies has seen increased graduate course enrollment from students in related disciplines, especially Biology and Anthropology. It is clear from conversation with these students that the addition of doctoral-level training in geospatial methods will contribute to their own graduate work, and that the New Mexico Joint Doctoral Program in Geography may induce those with geospatial interests to stay in the state for PhD training rather than looking elsewhere for suitable PhD programs.

3.3.3 Student demand from academic geography programs in the region

In 2015, we conducted a survey of all peer institutions (for both UNM and NMSU) that have Geography departments, along with all Geography departments within the Southwest region of the American Association of Geographers (SWAAG). Survey results confirmed that we should expect robust student demand from existing academic geography programs within the region. In the last five years, 36% of 221 students in the sample who received a Master's in Geography went on to get a PhD. The institutions in our sample that currently offer PhD programs in Geography reported that 29% of their PhD graduates in the last five years had already completed a lesser degree from that same institution. This indicates that although we should expect significant demand from our own Master's graduates, the bulk of our students are likely to enter the New Mexico Joint Doctoral Program in Geography after completing Master's level programs at other institutions. (See Appendix I for survey details.)

These same PhD-granting institutions in our sample also reported that 62% of their entering PhD students are returning after taking one or more years away from academic study. This high number suggests that enrollment numbers will likely depend on the program's ability to appeal to students engaged in professional pursuits. In this regard, we expect that our unique program design will be successful in drawing both recent master's graduates and working professionals to New Mexico from throughout the region. After receiving the PhD, we expect that a minimum of 20% of our graduates will stay in New Mexico, as is the average reported by the PhD-granting institutions in our survey.

3.3.4 Student demand from programs elsewhere in the U.S. and other countries

Data collected by the American Association of Geographers show that Geography PhD program enrollments have been rising steadily in the first years of the twenty-first century, with an overall increase of 10 percent.[14] Enrollments in undergraduate and master's-level geography programs, however, are rising even faster, indicating that the nationwide trend toward increased PhD program enrollment will continue. By offering a unique joint program with a focus on integrative human-environment dynamics, the New Mexico Joint Doctoral Program in Geography will be poised to draw students from across the U.S. and other countries to New Mexico.

[14] Murphy 2007.

3.3.5 Student demand from government agencies and private industry

In addition to the predictable demand for PhD training as the terminal destination of those already engaged in undergraduate and master's work in Geography and related fields, we expect significant enrollment from highly qualified individuals at university research facilities, national research laboratories, consulting firms, and governmental agencies in New Mexico. As noted above, many of these individuals are somewhat immobile given their existing employment, but they would like to further their education and job effectiveness by studying for a PhD in geography. Other individuals will be drawn to the program for the opportunities it offers to merge advanced research training with entrepreneurial practice and innovation.

Our 2015 focus group with representatives of New Mexico's geospatial industry revealed not only that many employers are seeking employees with doctoral-level training and qualifications (as described in section above on "Justification for Employment Need") but also that many of them know people in their own organizations who desire PhD education in Geography. These focus-group participants confirmed that a program focused on integrative dynamics would be most valuable in terms of providing a combination of quantitative, qualitative, and advanced research skills. They encouraged us to take the needs of part-time students seriously and to focus on paths to employment. The core curriculum design reflects this influence, as the third required course is explicitly focused on professional development, leading students to design and implement research in their chosen career focus area.

3.3.6 Student demand related to Innovate ABQ initiative

UNM has begun investing in its commitment to support economic development activities in the City of Albuquerque and throughout Bernalillo County by building a district for research and innovation within the city. The Innovate ABQ project – to be located at Central and Broadway – will serve as the core site to catalyze for this district. We anticipate that UNM Geography Masters and PhD students will both be drawn to Innovate ABQ as a research site, and will find their geospatial abilities in high demand by those collaborative projects that will be centered around the Innovate ABQ campus. Importantly, we anticipate that the presence of UNM Geography graduate students at Innovate ABQ will serve as a "living promotion" for our graduate programs, and will serve to bring students into the New Mexico Joint Doctoral Program who might not have otherwise considered doctoral level studies at UNM.

3.4 Evidence of Demand for Program Graduates

The U.S. Bureau of Labor projects that employment of geographers will grow 35 percent from 2010 to 2020, compared to 14 percent for all occupations. The Department of Labor also points to the emergence of geospatial technology as a field in high demand with enormous employment growth. In 2006, the National Research Council (NRC) published the results of a study that broadly assessed the field of mapping sciences in the U.S. In their report, titled *Beyond Mapping: Meeting National Needs Through Enhanced Geographic Information Science,*

the following recommendations (among others) were offered to justify advanced degree programs in Geographic Information Science (GIScience):

> The country's colleges and universities must become more flexible if they hope to keep pace with the GIScience industry and with government programs (p.4)…Devising institutional arrangements that favor robust GIS/GIScience and funds necessary to sustain it will yield large dividends in the form of ready employment for undergraduates and advanced degree graduates (p.5)…To meet the need for trained GIS/GIScience professionals as well as an informed citizenry, education programs in GIScience should be implemented at all levels of education (K-20 with special attention at K-16) in the United States. These programs should cut across traditional disciplinary borders and employ the latest technologies. (p.5-6)

Michael Phoenix of Environmental Systems Research Institute (developers of the ArcGIS product line) similarly estimates that "the shortfall in producing individuals with an advanced level of GIS education is around 3,000 to 4,000 [annually] in the U.S. alone" (Phoenix, 2007, p.13). The Assistant Secretary for Labor and Training in the U.S. Department of Labor reports that, "87 percent of geospatial product and service providers...had difficulty filling positions requiring geospatial technology skills" (DeRocco, 2004, p.2).

Geography is in a different position from a number of other disciplines because the demand for trained geographers exceeds the supply. Awareness of the potential supply-demand imbalance was first reported in the mid-1990s and was one of the impetuses behind the National Research Council's 1997 *Rediscovering Geography* report (National Research Council 1997). Three years later Dr. Philip Suckling showed that, just within academia, there were more open positions than new geography PhDs (Suckling 2000). As the revolution in geospatial technologies gains momentum, the demand for geographic expertise continues to grow. Investment in geographical training and research is clearly critical if the possibilities of the geospatial technology revolution are to be realized.

Our own advisory board for the Department of Geography and Environmental Studies has identified a wide range of potential employers in New Mexico for graduates with advanced training in Geography. Based on board members' own professional networks and knowledge of regional employment needs in Albuquerque and beyond, they see great potential for UNM Geography grads to make an impact throughout the state. Table 3.5 summarizes the many employment categories and employers where the GES Advisory Board believes MS and PhD graduates would be welcomed as employees.

Table 3.5 Potential employment categories and employers in New Mexico

Employer Category	Agency/Example
Federal Government	Forest Service Bureau of Land Managements National Park Service NASA NOAA CIA USGS Census Bureau FEMA Department of Transportation Homeland Security
National Laboratories	Sandia Los Alamos
State and Local Governments	Planning Departments State Engineer's Office Parks and Recreation Council of Governments Department of Transportation
Education	Public and Private Universities Public and Private Colleges Community Colleges Technical Colleges K — 12 Schools
Utilities	PNM Gas Company of New Mexico
Consulting	GIS Remote Sensing Mapping Environmental Analysis Market Analysis Location Analysis Research Polling Mining
Retail	Market Analysis Location Analysis
Other	Non-profit Organizations Film Industry

Developed 2013 by the Advisory Board for UNM Geography and Environmental Studies

3.6 Needs Assessment

See Appendix F for Department of Labor analysis of the nationwide need for increased geospatial education and training. No similar report has yet been formally published for New Mexico, although the New Mexico Geographic Information Council (NMGIC) recently conducted a statewide survey of employers to assess the need for new geospatial training and educational opportunities. This "Pathways" survey was completed in late 2015 and is now available as a draft white paper as Appendix Z.

3.7 Workforce Development

Although a Bachelor's degree is the entry-level education for many of the occupations within the expanding geospatial employment sector, higher-level degrees are typical for holders of advanced positions, with a PhD most common at the level of research management, agency/firm leadership, and any scientific/academic position in higher education. Thus, the program provides workforce development for employees in many geospatial and environment-related positions in New Mexico. Large employers in New Mexico who typically require graduate degrees for advanced positions include Sandia and Los Alamos Laboratories, the University of New Mexico, and federal and state governmental agencies.

3.8 Research Grants Development

Creation of the New Mexico Joint Doctoral Program in Geography will significantly increase the ability of both institutions to generate external funding through sponsored research. By engaging with doctoral students who are training to undertake sophisticated multi-year research programs, program faculty will be able to demonstrate and rely on significantly augmented research capacity. This increased capacity, coupled with the fact that both UNM and NMSU are Hispanic-Serving Institutions can be expected to lead to significant competitive advantage in external grant competitions. An increase in sponsored research will return significant F&A to both universities

3.9 Methods for Establishing Demand for the Program

Given that the state of New Mexico does not currently have a PhD program in Geography, there are no existing surveys of student demand for this type of program. To establish initial predictions, we began by consulting our own advisory board to brainstorm whether New Mexico would benefit from the addition of an in-state PhD program in Geography. Table 5 was generated from that initial conversation, held in 2013. After working with our NMSU colleagues to develop a preliminary draft of the program structure and curriculum, we then conducted used several additional methods to determine demand.

- We reviewed the employment placements of our own MS graduates over the previous 15 years, focusing specifically on rates of enrollment in PhD programs. Although we did not survey alumni directly, we relied on the institutional knowledge of two long-serving full professors to construct an anecdotal record of successful MS students who did NOT go on to PhD programs because they considered themselves place-bound in New Mexico.
- We then surveyed all of the geography departments at peer institutions of UNM and NMSU, as well as all geography departments who are members of the Southwest Division of the American Association of Geographers. This survey asked department chairs (or grad program directors) to characterize the demand from within their own undergrad and master's programs for additional geography education. We also asked them to provide enrollment rates and student characteristics as a proxy for the general trends we might

experience in the New Mexico Joint Doctoral Program in Geography. Additional information about this survey, along with summary data, is provided in Appendix H.

- We conducted a focus group and followup interviews with agency and industry representatives from across the state, many of them participants in the New Mexico Geographic Information Council (NMGIC) to get a better sense for both employment need and student demand that might come from NMGIC members and their professional colleagues working in geospatial fields. Additional information about this focus group, including a list of participants, is provided in Appendix G.
- Finally, we surveyed our own current cohort of MS Geography students to gauge overall interest in PhD study and to determine the potential application and enrollment demand that might be generated by our own successful Master's program. More information about this survey is provided in the Appendix I.

3.10 Duplication

There currently is no PhD program at any public or private institution of higher education in New Mexico. A number of institutions of higher education offer doctoral programs in Geography in surrounding states (Table 3.6), but none of these are accessible to New Mexico student via the WICHE professional student exchange or WICHE regional graduate program. Even when compared with neighboring regional institutions, the New Mexico Joint Doctoral Program in Geography will offer a unique programmatic focus within the Southwest Region.

Table 3.6 Geography PhD programs in the Southwest Region

State	University	Faculty Size	Total PhD Students, In Residence	Total PhD Students, Graduated	Program Specializations
Arizona	U. Arizona	27	48	7	Broad Geography
	Arizona State U.	41	141 (all grads)	15	Broad Geography
Colorado	U. of Colorado Boulder	23	59	11	Broad Geography
	U. Denver	15	6	2	Broad Geography
Idaho	U. Idaho*	10	11	1	Physical Geog, Development, Remote Sensing, GIS
Nevada	U. Nevada, Reno	13	18	3	Remote Sensing, GIS Mountains, Deserts
Texas	Texas A&M	24	31	6	Human-Environment Interaction, Geog Education
	Texas State U.	34	57	11	GIS, Geography Education, Environmental Geography
	U. Texas Austin	16	28	8	Broad Geography
Utah	U. Utah	16	18	4	Urban, Economic, GIS

(Data Source: AAG's Guide to Geography Departments in the Americas, 2014-15)

4. INTER-INSTITUTIONAL COLLABORATION AND COOPERATION

4.1 Overview

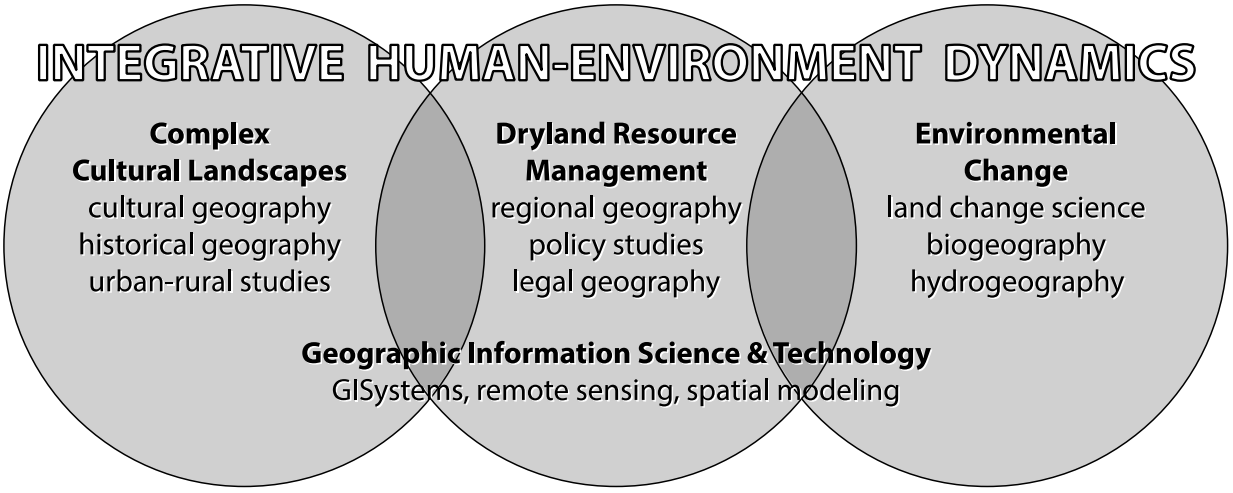
The New Mexico Joint Doctoral Program in Geography is designed as a fully collaborative and cooperative program between the geography faculties at the University of New Mexico and New Mexico State University. As described in the section on "Joint Program Delivery," the curriculum and administrative structure are intended to include both institutions as equal partners in the development and delivery of the joint program. All specific agreements concerning institutional interactions are detailed in the Memorandum of Understanding, attached as Appendix V.

4.2 Leveraging Existing Strengths at UNM and NMSU

The existing graduate programs at UNM and NMSU focus on human-environment dynamics from a variety of perspectives, with strong master's curricula and research programs that explore the changing human and physical environments of our world at multiple scales. The New Mexico Joint Doctoral Program in Geography will build on complementary strengths through a collaborative program that focuses on integrative human-environment dynamics in four primary areas: environmental change, aridlands resource management, complex cultural landscapes, and GIS&T. The joint doctoral program will leverage existing teaching strengths in a variety of theoretical and methodological areas, including both qualitative and quantitative methods. By building from existing strengths and seeking opportunities to direct scholarly inquiry toward matters of pressing regional interest, the joint doctoral program will provide significant benefits to New Mexico through its mission to prepare the next generation of resource managers, policy thinkers, geospatial innovators, professional scientists, and academic leaders who solve complex contemporary problems in dynamic environments.

As shown in the figure below, the existing combined strengths from UNM's Department of Geography and Environmental Studies and NMSU's Department of Geography have a synergistic nexus in interdisciplinary studies of human-environment dynamics, an area of scholarly inquiry that is driving current research agendas in this era of rapid environmental change. Our joint doctoral program will lay the foundation for a new generation of scholars and practitioners who are trained to understand human-environment interactions through interdisciplinary perspectives that consider not only environmental phenomena but also the human phenomena governed by knowledge production, transition regimes, resilience structures, and governance issues. In New Mexico and the Southwest region more broadly, these perspectives will be critical to developing and managing sustainable approaches to water, land, energy and other environmental resources for the future.

Our current programs are based in the expertise represented in the conceptual diagram below. The joint program will continue each program's growth in these strength areas by focusing on their intersection in human-environment dynamics as the foundation for an outstanding PhD education in Geography.



4.3 Agreements for Collaboration and Cooperation

The New Mexico Joint Doctoral Program in Geography has been developed through collaborative discussion between UNM and NMSU over the last several years. Conversation about a potential joint program was first initiated between the two department chairs in 2011-2012, and a small committee of departmental representatives from both institutions was then tasked with developing preliminary agreements and administrative structures in 2012-2013. Development of different aspects of the program proceeded throughout 2013-2014, based on communication between the two department chairs and within the two individual faculties. In fall 2014, we held a meeting of the two joint faculties to ensure that the joint program's basic structure and focus was in line with faculty expectations and commitments at both institutions. In spring 2015, we followed with an intensive two-day retreat, at which both faculties engaged in detailed strategic and logistical planning to support final development of the proposal document. This highly constructive and collaborative meeting engendered significant consensus across both faculties, which was carried into three cross-institutional working groups that collaborated distantly to evaluate both institutions' existing courses and finalize the proposed curriculum. The success of these joint efforts in 2015 provides a very positive view of the potential for further collaboration in program delivery.

The attached Memorandum of Understanding outlines the agreements that have been brokered at these various planning stages. The MOU document has been agreed by both faculties and vetted by administrative personnel at both institutions.

4.4 Procedure for Submission of the Joint Program Proposal

Separate proposals for the New Mexico Joint Doctoral Program in Geography will be submitted concurrently at both UNM and NMSU. Although the program description in these two proposals is substantially identical, the proposal documents follow different formats (as required by the two institutions' different procedures for review and approval) and emphasize the impact on each institution's individual finances, students, and existing academic programs. If approved at UNM and NMSU, these two proposals will then proceed through the state-level review jointly, along with the Memorandum of Understanding attached as Appendix V.

5. CLIENTELE AND PROJECTED ENROLLMENTS

5.1 Overview

Between the growing number of students who are attracted to an integrative approach to human/environment relations in as empirically rich a setting as New Mexico, and those students who are otherwise tied to New Mexico but have had to leave to pursue PhD studies, the Joint Doctoral Program in Geography will be able to attract a steady stream of students. We will uphold the quality of the program through a combination of rigorous admissions standards and procedures. We will implement a targeted recruitment plan that is designed to ensure a vibrant student body by (a) attracting and serving talented New Mexico residents who currently have to forgo doctoral education in Geography or move outside the state and (b) attracting outstanding new students to New Mexico.

5.2 Clientele

The New Mexico Joint Doctoral Program in Geography will draw its students from several discrete populations. Most obviously, the Program will attract a very specific, but increasingly common type of PhD candidate. As we have observed in the course of developing our Masters program over the past decade, there is a growing population of students whose academic trajectories are deeply engaged in human-environment dynamics, who are eager to rigorously delve into the research and theoretical insights that geography has to offer, yet who are also concerned with the applied ramifications of their research. For these students, the New Mexico Joint Doctoral Program in Geography would provide a unique opportunity.

Within New Mexico, we have a substantial body of Masters-level students at both UNM and NMSU who would like to continue their research in New Mexico in preparation for either academic, scientific, or policy related careers. At present, these students have no choice but to leave New Mexico to pursue a PhD. There is also steady demand for doctoral level education from professionals at Sandia and Los Alamos National Labs and similar organizations who would like to pursue a PhD degree for professional advancement. While these institutions have long been a source for Masters students at UNM, we have had to turn students seeking PhD's away.

By actively focusing learning and research in the areas of environmental change, dryland resource management, and complex cultural landscapes we will provide a set of foci that have already proven to be very attractive for out-of-state students. Moreover, the multicultural, high-desert setting of the partner institutions provides a powerful draw for students who are engaged in questions of human-environment dynamics, offering a rich and often under explored set of research sites upon which to build a subsequent career as a professional academic. Unlike most doctoral programs in Geography, the Program will also

emphasize preparation for non-academic career paths, and is thus expected to draw students from around the U.S. who are interested in using the in-depth study and research of a PhD program as a means of either beginning or furthering existing careers as resource managers, policy thinkers, geospatial innovators, or professional scientists.

5.3 Admissions Requirements

To be admitted to the New Mexico Joint Doctoral Program in Geography, applicants must have a master's degree in Geography or a related field, with demonstrated professional research capacity as a fundamental expectation. GPA and GRE scores must be submitted but will not individually determine whether an applicant will be admitted. International students are expected to demonstrate proficiency in English through the TOEFL or a phone interview. All candidates will submit three letters of reference and a letter of intent that explains the student's purpose in undertaking graduate work, details the student's research interests, and identifies a desired advisor at the primary (home) institution as well as a primary sponsor at the partner institution.

5.4 Admissions Expectations to be Published for Applicant Consideration

The most competitive applicants to the New Mexico Joint Doctoral Program in Geography will show evidence of having a thesis completed or in progress in geography or related discipline. In addition, special attention will be paid to following elements of the application:

- GRE scores and grades: We will not admit or deny applicants on the basis of GRE or GPR scores; rather, we will aim to consider the applicant as a whole. For guidance, our average GRE score is expected to be around 300 combined (or 1200 combined verbal and quantitative on the old scale).
- Statement: applicants' Statements should consist of an essay describing past experiences relevant to the joint doctoral program and should indicate a proposed research topic in integrative human-environment dynamics. Applicants will be strongly encouraged to contact faculty with whom they share research interests, and they should explicitly identify which faculty members at each institution they would desire as sponsors in the joint program. Strong essays that provide an argument for why an applicant seeks graduate study in our program, making reference to specific faculty expertise, will be favored.
- Letters of recommendation: Letters of recommendation will be encouraged to be provided from academic referees, rather than previous employers. Letters from supervisors at workplaces involving issues relating directly to a student's planned PhD course of study will also be welcomed.

5.5 Recruitment

Recruitment for the New Mexico Joint Doctoral Program in Geography will focus on three different sets of potential PhD students, each with its own set of strategies for attracting top candidates.

The first population for targeted recruitment will be potential students who already have ties to New Mexico, including graduate students from the partner institutions, professionals at major National Labs, personnel at geography-intensive organizations and businesses in New Mexico, and students from Central University of Ecuador (UCE) who are enrolling at UNM as part of an institutional partnership to increase the number of UCE faculty holding PhD credentials. (See Section 3 for a more detailed discussion of the student demand likely to come from this program.) This communication will take place through direct contact with larger institutions, a careful attention to programmatic website design and content, presence at regional conferences, and a continual effort to target outstanding undergraduate and masters students from departments across the two partner campuses, including Geography, Anthropology, Chicano Studies, American Studies, Biology, Community and Regional Planning, and the like. Funding packages will be offered to the most outstanding candidates in an effort to combat "brain drain" away from New Mexico.

The second population we will focus upon for recruitment is Masters level graduates of geography programs outside of New Mexico who may not be familiar with the unique offerings of the Program. Recruitment of these students will focus on outreach and inducement. Outreach will take the form of an active presence at both national (Association of American Geographers) and regional (Southwest Association of American Geographers) conferences. This presence will include information and promotional tables, and hosting a regular annual party. Inducement will take the form of competitive PhD funding packages that are structured such as to create equal incentives for students to choose to primarily study at UNM and/or NMSU. Once sufficient faculty resources are developed to ensure the sustainable delivery of PhD level curriculum, we will allocate any additional programmatic resources to expanding the number and attractiveness of these packages so as to ensure UNM's competitiveness in attracting outstanding PhD students.

Finally, we will focus on communicating the specialties and opportunities provided by the New Mexico Joint Doctoral Program in Geography to those students without a conventional background in Geography, but for whom the New Mexico Joint Doctoral Program in Geography would be an ideal fit for their intellectual and professional development. In particular, we will seek to attract students from academic fields that will enable us to recruit graduate cohorts that more closely reflect the population of New Mexico as a whole. Accordingly UNM will begin to have a regular presence at such trans-disciplinary conferences as the Native American and Indigenous Studies Association, and the National Association for Chicano and Chicana Studies, including hosting an informational table. And as with students from more conventional Geography backgrounds, we will use and expand the use of competitive funding packages to attract top candidates.

Once the program is well established based on enrollment from these initial target populations, we envision undertaking a detailed analysis of the potential for expansion through targeted recruitment of international students.

5.6 Projected Enrollment

Once the New Mexico Joint Doctoral Program in Geography is well established, we anticipate having over 20 PhD students enrolled across the two universities, with 4+ PhD degrees being granted each year. It will take 4 to 5 years to establish the program, however, and we anticipate admitting 5 or fewer students into the program each year. Therefore, it will take at least 4 years before we have 20 PhD students in residence, and not all of these students will be full time.

Table 5.1: Six-Year Enrollment Projection for UNM Students

	New Students		Returning Students		Total Headcount		Student Credit Hrs
Timing	Fulltime	PartTime	Fulltime	PartTime	Fulltime	PartTime	
Year 1	2	1	0	0	2	1	**45**
Year 2	2	1	2	1	4	2	**90**
Year 3	2	1	4	2	6	3	**135**
Year 4	2	1	6	3	8	4	**180**
Year 5	2	1	8	4	10	5	**225**
Year 6	2	1	8	5	10	6	**234**

The following assumptions were used in estimating enrollment and student credit-hour generation at UNM:

1. We assume that five students per year will enroll in the New Mexico Joint Doctoral Program in Geography, with 3/5 of these students based at UNM and 2/5 based at NMSU on average.
2. Full-time enrollment is estimated at 9 credit hours per semester, or 18 credits per year, although we acknowledge that actual credit hours may vary widely among individual students, depending on their program stage/progress.
3. Part-time enrollment is estimated at 4.5 credit hours per semester (since some students will enroll in 3 credits and others will enroll in 6 credits while attending part-time), or 9 credits per year.
4. Full-time students are expected to complete the program in five years and are not counted as returning for a sixth year. .
5. Part-time students are expected to complete the program in an 8-yr average.
6. Although some students based at UNM will take courses offered by NMSU (thus generating tuition dollars at UNM but generating student credit-hours at NMSU for purposes of the funding formula), we assume that cross-enrollments in the joint program will be more or less offsetting between the two institutions. Therefore, the estimates for student credit hour generation at UNM do not reflect any adjustments related to cross enrollment.

6. INSTITUTIONAL READINESS FOR THE PROGRAM

6.1 Overview

While departmental resources at UNM –including faculty, staffing, and space – are currently at or near maximum capacity, careful management and the modest addition of resources in each category over time will allow the Department of Geography and Environmental Studies to expand its institutional readiness for the PhD program as enrollments grow. Specifically, the Department has planned for the phased addition of new faculty, new TA lines, a new staff position, and expanded facility space over the first six years of the program so as to meet our expanded programmatic load with expanded capacity.

6.2 Faculty Size

As shown in Table 6.1, there are 57 geography programs in the United States that grant a PhD in Geography. The average-size PhD program has 16.5 faculty members, 29 PhD students in residence, and graduates 4.4 PhD students per year. The average PhD program in the western half of the United States is not significantly different from the country as a whole.

Table 6.1 PhD Programs in Geography mean faculty, enrollments and degrees granted

Category	N	Mean # of Faculty	Mean PhD Students in Residence	Mean Annual PhD Degrees Granted
All Programs	57	16.5	29	4.4
Western Programs	24	16.9	32	4.0
Established Post 1880	19	15.3	22	4.6
Established Post 1996	14	14.7	23	4.7
Established Post 2006	6	13.5	15	.2

Source: Guide to Geography Programs in the Americas, 1980-2012.

As mentioned above, The Department of Geography and Environmental Studies at UNM currently has 13 tenure and tenure track faculty members, and the Department of Geography at NMSU has 5 tenure-track faculty members, providing a combined total of 18 faculty members. (Each department currently also has one visiting faculty member.) Although this is above the national average of 16.5 faculty members for all programs in the U.S. that offer a PhD in geography, we expect that we will need to add a minimum of one additional faculty line at UNM to teach necessary courses and to provide adequate teaching, mentoring, and research capacity for a complex doctoral program that requires significant faculty coordination across two institutions. Indeed, the University of California Santa Barbara/San Diego State University joint PhD program – the only other U.S. joint doctoral program in Geography – has a total of 39 faculty between the two campuses, graduating an average of 4.8 PhD's per year over the past five years.

6.3 Impact on Current Workloads for Faculty

Geography and Environmental Studies faculty at UNM are currently carrying standard workloads for faculty in research-intensive departments that support undergraduate and master's-level graduate programs. The New Mexico Joint Doctoral Program in Geography is expected to increase existing faculty workloads in the areas of advising, mentoring, research supervision, and course development. The program will therefore require two primary forms of additional support: [1] Additional instructional capacity will be needed to support the launch of new courses as well as research-related course releases for some faculty. [2] Additional support resources will be needed to compensate for the increase of faculty time devoted to advising, mentoring, and supervision. These needs will be met through the funding of new GA lines and a new staff position, respectively.

The attached course rotation for 2015-2022 (Appendix L) shows projected course assignments for GES faculty over the next seven years. During this time, we expect to maintain existing graduate course offerings at their current frequencies to support the MS program, and we project that we will begin phasing in PhD-specific offerings as early as Fall 2018. At the same time, we expect continued growth in our undergraduate program, which will require increasing the frequency of some of our required undergraduate courses over time (e.g. GEOG195, GEOG471, and 100-level online courses that meet General Education "core" requirements). Although some of this growth will be eventually be absorbed by assigning advanced PhD students to teach undergrad courses, it is critical that we meet increased need for teaching capacity in GIScience with an additional tenure-track line.

This planned expansion is fully described in the most recent GES hiring plan (see Appendix M) and has received a commitment of support from the Dean of Arts & Sciences (see Appendix U).

6.4 Impact on Current Workloads for Staff

UNM's Department of Geography & Environmental Studies currently has two staff positions:

1. Our *Network Tech* position is funded by course fees to support the operation and maintenance of the Spatial Computing Lab, the Physical Geography equipment checkout facility, the grad student office computers, and other instructional facilities. Because this is a fairly new position in GES, significant workload is now dedicated to the creation and implementation of improved networking systems that improve security and better support instructional needs. In the next two years, however, this "startup" workload will begin to ease somewhat. At that time, this position will be able to absorb some additional workload related to the expansion of the curriculum and grad/undergrad student populations. Depending on how the new joint doctoral program's engagement with distance learning technology evolves

over time, it is possible that tech-support workload would increase beyond the capacity of a single position. At this time, however, we are confident that the existing Network Tech position will be sufficient to support the program launch without an excessive increase in workload.

2. Our *Department Administrator*, on the other hand, is already carrying a maximum workload to support our research-active faculty and growing master's program. Because it is not feasible to add any additional workload to this position, a second staff position will be needed to support the joint doctoral program.

6.5 Required Resources

6.5.1 Faculty Lines

As shown in our most recent hiring plan (Appendix M), we expect to add one net tenure-track faculty line to support an expanded range of courses for the UNM-based PhD students in the New Mexico Joint Doctoral Program in Geography. (We additionally intend to (a) convert a Visiting Professor to an Instructor who can support a separate geospatial entrepreneurship online program, and (b) replace an Environmental Studies professor who has just gone on leave with the intention of departing UNM.) The new hire will also contribute to the undergraduate curriculum, allowing us to increase the frequency of some courses, to expand the enrollment caps in others, and to resurrect some courses in our catalog that have not been taught regularly due to recent retirements that were not directly replaced.

6.5.2 Staff Lines

A program coordinator will be required to provide administrative support in the areas of student registration (admissions, enrollment, and transcription), student advising (re committee formation, program of study, and career planning), and student/faculty research support (for grantwriting, for conference travel, and for publications). This program coordinator will be housed at UNM but will provide support to all doctoral students across both campuses. Because the program coordinator will require specialized expertise in research support, it will not be an entry-level position.

6.5.3 GA/TA Lines

A minimum of six additional GA lines (3.0FTE) is requested at UNM, both to provide consistent recruitment packages for prospective students and also to provide relief for current faculty teaching workloads. As shown in the projected course rotation, we propose phasing in the six TAs over the first three years of the program. They will be assigned primarily to cover lab sections for the GIS&T courses or to support large-enrollment intro-level courses. This teaching support will improve the GES undergraduate curriculum while also allowing faculty to devote increased time to grant writing, research, and advising and mentoring of doctoral students.

GES currently has five recurring TA lines (2.5FTE) that are critical to the recruitment of competitive MS students, along with a variable number of externally-funded RA and PA packages (see Table 7.2 for exact numbers). We will reallocate three of these existing lines (1.5FTE) over the first three years to support PhD students instead of MS students. This will bring the total number of fixed TA packages for PhD students to nine (4.5 FTE), allowing us to offer three-year packages to three students per year. This matches our generalized projection for student enrollments at UNM in the program's early years, and will be augmented by the availability of externally funded RA packages. Grant-funded RA positions will be used (1) to support PhD students who have already completed their three-year funding packages, (2) to maintain current levels of MS recruitment, and (3) to support students whose professional interests are better matched with research than with teaching.

6.5.4 Faculty and Staff Development Services

The New Mexico Joint Doctoral Program in Geography will require minimal investment in faculty support beyond the standard services typically offered to new faculty in the Department of Geography & Environmental Studies, e.g. robust startup packages, conference travel funds, and campus-wide training opportunities for junior faculty. The department's anticipated increase in externally-funded research activity, however, will necessitate that staff are trained in research support activities. UNM already provides ample opportunity for this kind of training, which does not incur costs for existing staff.

6.5.5 Technology, Media, Equipment and Instructional Supplies

As discussed in the section on curriculum, effective delivery of this joint program will hinge on our ability to offer numerous courses to doctoral students at both campuses simultaneously. We will therefore need to significantly expand our engagement with distance learning resources. We intend to develop this new capacity in a phased manner, as explained in the section on Quality of Program ("Instructional Models"), relying first on a variety of existing resources and then building toward the development of specific equipment and technology resources that are tailored to support the program as it matures.

Due to the rapid pace of technological change, it is hard to predict the exact technologies that we will be using in 2018 and beyond. In general, however, we plan to use existing technologies and facilities at both UNM and NMSU in our pilot-phase testing, and we will work with Extended Learning as we develop a long-term strategy for the program's use of distance learning technologies. For the next few years, we expect that our pilot-phase testing will take advantage of existing technologies that support a few basic structural models:

1. Videoconferencing: At the most basic level, some of our classes will take advantage of the simple ability to connect two or more physical spaces via videolink. Both UNM and NMSU currently provide dedicated classroom spaces that are capable of videoconferencing links, and both institutions use Adobe Connect. At NMSU, the AdobeConnect software integrates with the campus Learning Management System, Canvas, which has been renewed for

at least the next 5 years. Although this software has suboptimal performance in low-bandwidth environments, we are confident that both UNM and NMSU provide the necessary facilities and support to make this a reasonable option for courses that would need to take advantage of videoconferencing as a pedagogical tool in the short term.

2. ITV: Although ITV is no longer a primary model for distance learning, its successor technologies are still relevant under the original model: where a "parent" class is offered at the home institution and is synchronously broadcast to facilities in other physical locations where students gather to interact with the parent class and instructor from a distance (e.g. in ITV facilities at branch campuses and community colleges). Both UNM and NMSU have ITV classrooms that can still be used for this purposes, although the structure we have envisioned would necessitate our use of these facilities for a videoconferencing arrangement, rather than a true ITV broadcast model.
3. Broadcast to desktop: This ITV successor technology allows not only for broadcast to existing physical facilities in other specific locations but also for broadcast directly to individual desktops, so that both instructor and students can be in any location but still participate in direct video links that facilitate teaching and learning in an enhanced digital environment. UNM is currently using Zoom cloud-based software for this purpose, and its successful implementation by Project ECHO (HSC) shows that it works well in low bandwidth environments.
4. LMS-based systems: Although UNM and NMSU do not currently use the same LMS software, we expect that LMS-based systems at each institution (Canvas-based Adobe Connect at NMSU and Blackboard Collaborate at UNM) will be relevant for distance learners in individual courses.

Although it is possible that UNM's Department of Geography & Environmental Studies might eventually consider developing its own in-house facility to support distance-learning needs within the joint PhD program, we do not envision that development of costly new in-house classroom facilities is a prerequisite for establishing a healthy program. In fact, we believe that UNM's existing plans to expand distance-learning options across campus are likely to "stay ahead" of program needs, providing relevant technical expertise, pedagogical support, and facilities planning to support a robust expansion of distance offerings over time.

6.5.6 Library Resources

The New Mexico Joint Doctoral Program in Geography can be launched without requiring the acquisition of significant new library collections. Since the proposed program's areas of research and teaching specialization overlap with existing specializations on both faculties, the two universities' library collections are substantially sufficient with regard to the breadth of content related to human-environment dynamics and Geographic Information Science & Technology. Future additions of new faculty may require increased collection depth in specific areas of specialization, but we do not anticipate that such needs would depart from the normal collection adjustments that typically occur when new faculty members arrive at UNM.

The addition of a PhD program will necessitate the addition of new methodological courses, however, which may require some additional library materials. Specifically, we anticipate that faculty and students will need access to materials focused on integrative research, mixed qualitative-quantitative methods, and the integration of theory and praxis in research design. Since these are generic methodological topics and are not specific to Geography & Environmental Studies, it is possible that relevant and sufficient materials are already contained in UNM's library collection. We will therefore rely on the library impact statement to clarify any need for additional acquisitions in this regard.

6.5.7 Additional and Renovated Space

Our primary space needs to support the program include: upgraded infrastructure for the Spatial Computing Lab (for instruction) and the GEM Lab (for research), additional office and research space for three new faculty members and one new staff person, and a renovation of our graduate student office space.

- Upgraded Space: The 23-seat Spatial Computing Lab is used for classroom courses in cartography and geovisualization, remote sensing and image analysis, and geographic information systems and technologies. The 6-seat GIScience for Environmental Management (GEM) Laboratory is a dedicated research facility that supports both faculty and student projects in GIS and remote sensing data processing and analysis. The GEM lab currently hosts 6 research computers, a dedicated server infrastructure that supports 40TB of Raid 5 data storage and a shared high performance data processing server, and multiple software licenses. These two labs offer a good foundation for computing needs within the proposed PhD program, but significant repairs and updates to both electrical and IT infrastructure will be required before the program launches. Existing CAT-5 wiring needs to be upgraded to CAT-6, and electrical infrastructure needs to be brought up to code.
- New Space: New offices and research spaces will be required to support our three additional faculty members and their scholarly projects. At present, we are in conversation with the designers of the new Physics, Astronomy, and Interdisciplinary Sciences (PAIS) Building, who have explicitly included GES in their preliminary space plan. The current conceptual design for PAIS includes a research cluster area that could support two faculty-led research groups. If this building is indeed constructed as currently envisioned in these early plans, the space set aside for GES will help support our faculty growth, minimizing the need for excessive expansion within our current home, Bandelier Hall. It is likely, however, that we will need to seek at least three new offices: for the third faculty member, for his/her research group, and for the new staff Program Administrator. This will be pursued through the Real Estate office at the appropriate time.
- Renovated Space: Our current graduate office suite in Bandelier East (rooms 107, 109, 111, and 111A) is in serious disrepair and must be renovated before the New Mexico Joint Doctoral Program in Geography launches. To serve the

expanded ranks of our TAs, RAs, and editorial and project assistants, the space must be reconfigured, refurnished, and infrastructurally improved. A proposal was recently submitted to GPSA to renovate this space as a "Graduate Research Commons" with a dedicated computing facility, collaborative research/meeting space, and office facility with individual desks. Although the likelihood of GPSA funding is unknown, we plan to continue seeking funding for this project to ensure that it is complete before the PhD program launches.

6.6 Use of External Facilities

Delivery of the New Mexico Joint Doctoral Program in Geography will necessarily include the use of facilities at New Mexico State University, since students will be able to take courses at either institution. Agreements regarding the two institutions' shared commitment to this program are included in the Memorandum of Understanding. Although there is some additional possibility that joint meetings of the UNM and NMSU faculties and doctoral students may take advantage of facilities external to either department, there are no current agreements in place in this regard.

7. PROJECTED COST OF THE PROGRAM

7.1 New Costs

As described in Section 6, "Institutional Readiness for the Program," most of the resources needed for the New Mexico Joint Doctoral Program in Geography are already in place. Startup costs will be required to address a few pressing facilities issues, but most of the costs of the program will be recurring costs associated with the addition of faculty, staff, GA/TA lines, student recruitment funds, and a slight increase to the department operating budget. Table 7.1 shows a projection of these costs over the first six years, broken down by category.

Table 7.1 Projected New Costs, First Six Years (existing personnel/resources not included)

Category/Item	Year 1[15]	Year 2	Year 3	Year 4	Year 5	Year 6
Faculty: Three Expansion Lines[16]						
Open-Rank Hire: Geographic Information Science (search to be conducted before program begins)						
Faculty search	$3,000					
Startup package	$30,000					
Salary	$85,000	$86,700	$88,434	$90,203	$92,007	$93,847
Fringe Benefits	$30,260	$30,865	$31,483	$32,112	$32,754	$33,409
Staff: Program Coordinator Line[16]						
Grade 10 Midpoint	$42,494	$43,344	$44,211	$45,095	$45,997	$46,917
Fringe Benefits	$15,128	$15,430	$15,739	$16,054	$16,375	$16,702
Student Funding: Stipend/Benefits for Six New GA/TA Lines (3.0FTE)[17]						
Funded by A&S:1.5FTE	$42,116	$65,467	$67,829	$70,269	$73,096	$75,713
Funded separately: 1.5FTE		$21,822	$67,829	$70,269	$73,096	$75,713
Other						
CAT-6 Wiring upgrade, BAE	$25,000					
Cooling System, BAE106	$12,000					
Targeted Recruitment[18]	$2,500	$2,600	$2,704	$2,812	$2,925	$3,042
Operations Increase[19]	$2,500	$2,600	$2,704	$2,812	$2,925	$3,042
TOTAL	**$289,998**	**$268,828**	**$320,933**	**$329,626**	**$339,175**	**$348,385**

7.2 New Revenue

New revenue is expected from a variety of sources. As described below, some of this new revenue is already committed, while other sources are either projected or are still in development.

[15] Assumes AY2018-19 as Year 1.
[16] Faculty and Staff salary projections assume 2% annual cost-of-living increase.
[17] GA/TA funding package amounts are projected from current minimum stipends/benefits, with percentage increases described in Appendix R. A&S funding will be used to add two lines in the first year (1.0FTE) and a third line (0.5FTE) in the second year. Non-A&S funding will be sought to add three additional lines (1.5FTE): one in the second year and two more in the third year.
[18] Cost of flying top applicants to UNM for "recruitment weekend," includes 4% inflation increase.
[19] Required to cover travel costs for program coordinator and designated faculty to attend annual meetings of the program's Joint Steering Committee. Includes 4% annual inflation increase.

7.2.1 A&S Commitments

The College of Arts & Sciences has committed to expand the GES faculty size by one tenure-track line, add one staff line, and fund three GA/TA lines (1.5 FTE) of the six required. See Appendix U for the dean's commitment letter.

7.2.2 F&A Increases

Because of the broad and interdisciplinary nature of scholarship in Geography, there is high variability in individual scholars' external funding productivity. In general, GES faculty members who work in sub-fields aligned with the humanities or social sciences (e.g. Brulotte, Carr, Duvall, Hadjilambrinos, Lane, Milstein, Smith,) are expected to generate significantly less external funding than those who work in the GIS&T-related subfields (e.g. Freundschuh, Lin, Lippitt, Lippitt, Warner).

Before 2008, GES did not have a faculty member focused on GIS&T and was therefore a small producer in terms of F&A. With the hire of Paul Zandbergen in 2007, however, the department's grants activity immediately began to increase, generating important F&A revenues as well as funding lines for multiple student RAs (see Table 7.2). Dr. Zandbergen's subsequent leave from UNM (beginning in early 2012) had a quick depressive effect on F&A revenues that was not recovered until after the hire of Dr. Chris Lippitt in 2012-2013 and of Dr. Caitlin Lippitt in 2014-2015.

Table 7.2 Historical Grants Activity in GES (2007-2015)

	New Awards	Total Grant Spending	GA Lines Funded	Total F&A Generation	F&A Returned to GES Dept
FY08	1	$97,402	4	$17,153	$1,503
FY09	3	$99,672	3	$25,215	$3,877
FY10	3	$145,145	5	$38,407	$2,041
FY11	3	$123,045	4	$38,101	$4,506
FY12	2	$156,690	4	$49,869	$7,705
FY13	1	$34,562	0	$5,480	$767
FY14	0	$10,865	0	$0	$0
FY15	2	$145,768	3	$41,051	$5,988

The figures shown above for FY15 represent the minimum GES grants activity expected in any future year, given current faculty size and composition. We project considerable growth in external funding productivity over the next five years, based on (a) the recent addition of three new faculty members in Environmental Studies who have active sponsored-research agendas, (b) the pending addition of one new faculty member in GIS&T, who will be expected to demonstrate significant research productivity, and (c) the addition of a PhD program that provides significantly increased capacity to engage in sponsored research. Table 7.3 provides a conservative projection of these increased revenues, with assumptions as shown in the bullets points below.

Table 7.3 Projected Grants Activity in GES, 2016-2024

	New Awards	Total Grant Spending	GA Lines Funded	Total F&A Generation	F&A Returned to GES Dept
FY16	3	$160,000	5	$40,000	$4,800
FY17	3	$160,000	5	$40,000	$4,800
FY18	3	$200,000	6	$50,000	$6,000
FY19	6	$300,000	9	$75,000	$9,000
FY20	6	$330,000	10	$82,500	$9,900
FY21	6	$363,000	11	$90,750	$10,890
FY22	6	$381,150	11	$95,288	$11,435
FY23	6	$400,208	11	$100,052	$12,006
FY24	6	$420,218	11	$105,054	$12,607

- F&A generation is projected as 25% of total grant expenditures, the historical average for GES during the time period shown in Table 7.2. This is a conservative projection, given UNM's standard rate for indirect costs of 51%.
- The portion of F&A revenue returned to the department is projected as 12% of total F&A generated, which is the historical average for GES during the time period shown in Table 7.2. As this is slightly less than the 14% generally expected (based on a 35% return of all F&A from OVPR to A&S, and a 40% split from college to department), it is also a conservative projection.
- FY16: Projections for FY16 show a small increase, based on grants currently in progress.
- FY17: We assume that FY17 will be roughly equivalent to FY16. We hired a new Assistant Professor in August 2016 (Lin) and added three faculty by internal transfer (Smith, Brulotte, Milstein) between January and August 2017, but did not predict that any of them would land new grants until the following year. FY16 sponsored research activities were therefore conservatively projected to continue into FY17 at the same levels.
- FY18: We project that external funding will grow by about 25% in FY18 when the new personnel begin to lands their first grants. Existing faculty members' sponsored research activities are again conservatively projected to hold steady at levels similar to the prior year.
- FY19: We project a 50% increase in sponsored research in FY19, due to the increasing maturity of the new hires and their transition to research-intensive expectations within GES.
- FY20: We project a 10% increase in FY20 due to the addition of an open-rank hire with expertise in water-related GIS&T research. (See Hiring Plan for details, appendix M.) We expect that the water-related hire will be a mature researcher who transfers external funding to UNM immediately upon arrival.
- FY21: We project another 10% increase in FY21 due to a general increase in the department's capacity to undertake sponsored research, based on addition of the new joint PhD program.
- FY22 and beyond: For purposes of budget projection beyond FY21, we assume a small 5% increase per year in sponsored research funding.
- These figures show total F&A returned to GES and do not substract any amount "split" with individual PIs. GES has historically split these revenues 50/50 with the researchers who generate them. If this split were to continue, revenues available to the department would be only one half what is shown above. Because this split may be renegotiated, however, and because this is a very conservative projection, we are showing the full amount returned to the department.

New F&A revenues will be used not only to seed new faculty research activities but also to support the PhD program in the areas of student recruitment, conference travel support, and professional development activities. Of the new costs shown in Table 7.1, new revenues from F&A will be used to cover all non-facilities items currently listed in the category of "Other" and may also be used to fund 1.5FTE in student funding, depending on whether direct grant funding sources.

7.2.3 Course Fees

The unique delivery of core courses GEOG601 and GEOG602 will require the UNM instructor and students to travel once per semester to Las Cruces for a joint meeting with the students/instructor from NMSU, as described in Section 2 on "Program Description and Purpose." (Students from NMSU will also travel to Albuquerque once per semester, and the funding for that travel will be handled separately by the Department of Geography at NMSU.) Funding for these costs at UNM will be covered through student course fees (estimated roughly at $75 per student in each of these two courses) and are not included in Table 7.1 above. Other course-specific fees are similarly excluded from the budget shown, e.g. our $30 standard fee for graduate courses taught in the Spatial Computing Lab.

Table 7.4 Six-Year Projection of New Tuition Revenue at UNM[20]

Timeline	In-State Students[21]		Out-of-State Students[4]		Total Tuition
	SCH	Tuition	SCH	Tuition	
Year 1	30	$8,094.68	15	$13,664.43	**$21,759.11**
Year 2	60	$16,513.15	30	$27,875.44	**$44,388.59**
Year 3	75	$21,054.27	60	$56,865.90	**$77,920.17**
Year 4	90	$25,770.43	90	$87,004.83	**$112,775.26**
Year 5	105	$30,666.81	120	$118,326.57	**$148,993.38**
Year 6	108	$32,173.86	126	$126,727.76	**$158,901.62**

7.2.4 Tuition Revenue

Based on the projected enrollments outlined in Section 5, "Clientele and Projected Enrollments," we anticipate that the New Mexico Joint Doctoral Program in Geography will generate tuition revenues as shown in Table 7.4. Please note that this table shows direct tuition dollars generated. It does not

[20] See Table 5.1 for original assumptions about student credit-hour (SCH) generation at UNM.
[21] Assumption is that 2/3 of entering students in the first two years will be in-state students, with 1/3 from out of state. In the third and subsequent years, we assume that this proportion will reverse and that 2/3 of new students will come from outside New Mexico, while 1/3 will be drawn from locations within the state.
[22] Tuition projections start from the published tuition rates in 2015-2016 and apply a 2% increase per year. Year 1 in this table is assumed to be 2018-2019, thus starting with the following rates ($269.82/SCH for in-state students and $910.96/SCH for out-of-state students). See Appendix P for full six-year projection.

include mandatory fees, and it does not project the extent to which these tuition revenues may influence the state funding formula that determines UNM's I&G allocation on an annual basis. Given that this formula changes based on decisions at the state level and is therefore impossible to predict from the departmental level, we have determined that it is more instructive to provide a straightforward projection of total tuition generated, rather than an estimate of formula-based returns to UNM.

We have *not* projected any specific increases in undergraduate enrollments, although we expect to see substantial increases in these revenues. Due to the addition of new faculty members and PhD-level GAs who are capable of serving as instructors in their final years, we expect to expand our undergraduate curriculum by adding a number of additional courses. Although these courses will not be part of the joint PhD program, the additional tuition revenues they generate will of course be attributable directly to that program.

7.3 Overview of Financial Projections, First Six Years

The New Mexico Joint Doctoral Program in Geography will take advantage of existing resources in UNM's Department of Geography & Environmental Studies (e.g. computing facilities, faculty, and staff) while simultaneously augmenting some existing revenue streams that are actually external to the PhD program itself (e.g. by contributing to ongoing enrollment expansion at the undergraduate level). Rather than providing a budget projection that includes all of these interlinked departmental finances, however, we have instead projected only the new costs and revenues/commitments that are related to the PhD program itself.

As shown in Table 7.5, we expect that all new costs can be offset through a combination of college-level funding reallocation and by department-level F&A generation. The College of Arts & Sciences has already committed to provide funding for the search, startup, and salary expenses for the new faculty, staff, and GA lines described above and shown in Table 7.1 As described in the commitment memo by A&S Dean Mark Peceny (Appendix U), this funding will be generated through a reallocation of existing A&S resources; no new funding is required by the college or department. The department will additionally commit F&A funds for all new operational and recruitment costs, as described above, and will either use departmental F&A funds or seek external funding sources for (a) facilities upgrades and (b) additional GA lines to augment those provided by A&S, as shown in separate row in Table 7.1 that denotes addition of GA lines beyond those funded by A&S.

Table 7.5 shows that we expect the program to generate small amounts of new revenue in each of its first six years, as the combination of new A&S allocations to the department and the generation of new F&A will slightly exceed projected program costs.

Table 7.5 Six-Year Projection of Program Finances

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Projected New Costs						
Startup	$70,000	$0	$0	$0	$0	$0
Recurring	$219,998	$266,828	$320,933	$329,626	$339,175	$348,385
Total	**$289,998**	**$268,828**	**$320,933**	**$329,626**	**$339,175**	**$348,385**
Projected New Revenues						
A&S reallocation	$247,998	$241,806	$247,696	$253,733	$260,229	$266,589
F&A generation	$75,000	$82,500	$90,750	$95,288	$100,052	$105,054
Total	**$322,998**	**$324,306**	**$338,446**	**$349.021**	**$360,281**	**$371,643**
Projected Balances						
Revenue minus cost	**$33,000**	**$55,478**	**$17,513**	**$19,394**	**$21,106**	**$23,258**

Table 7.6 shows the overall financial impact to UNM in terms of program balances and tuition revenue. Please note that tuition revenues are shown here as part of the broader financial impact to UNM but are not included in the analysis of program finances in Table 7.5, because there is no direct link between tuition revenue and departmental funding.

Table 7.6 Six-Year Projection of Financial Impact to UNM

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Program balances	$33,000	$55,478	$17,513	$19,394	$21,106	$23,258
Tuition generated	$21,759	$44,389	$77,920	$112,775	$148,993	$158,902
Total	**$54,759**	**$99,866**	**$95,433**	**$132,169**	**$170,100**	**$182,160**

These are modest revenues, and we acknowledge that they depend largely on the A&S commitment to reallocate college funding in support of this new program. Although other UNM revenue streams could potentially be augmented by this program (e.g. increased undergraduate enrollments, as described above), the broader value of the New Mexico Joint Doctoral Program in Geography lies mainly in its ability to build research capacity in the state. By adding a top-quality program that provides integrative research training and conducts research on complex environmental and geospatial questions in partnership with numerous New Mexico entities, the program will provide its primary benefits to the state of New Mexico. The specific financial impacts of this widely distributed benefit are not accounted for in this document.

8. QUALITY OF THE PROGRAM

8.1 Overview

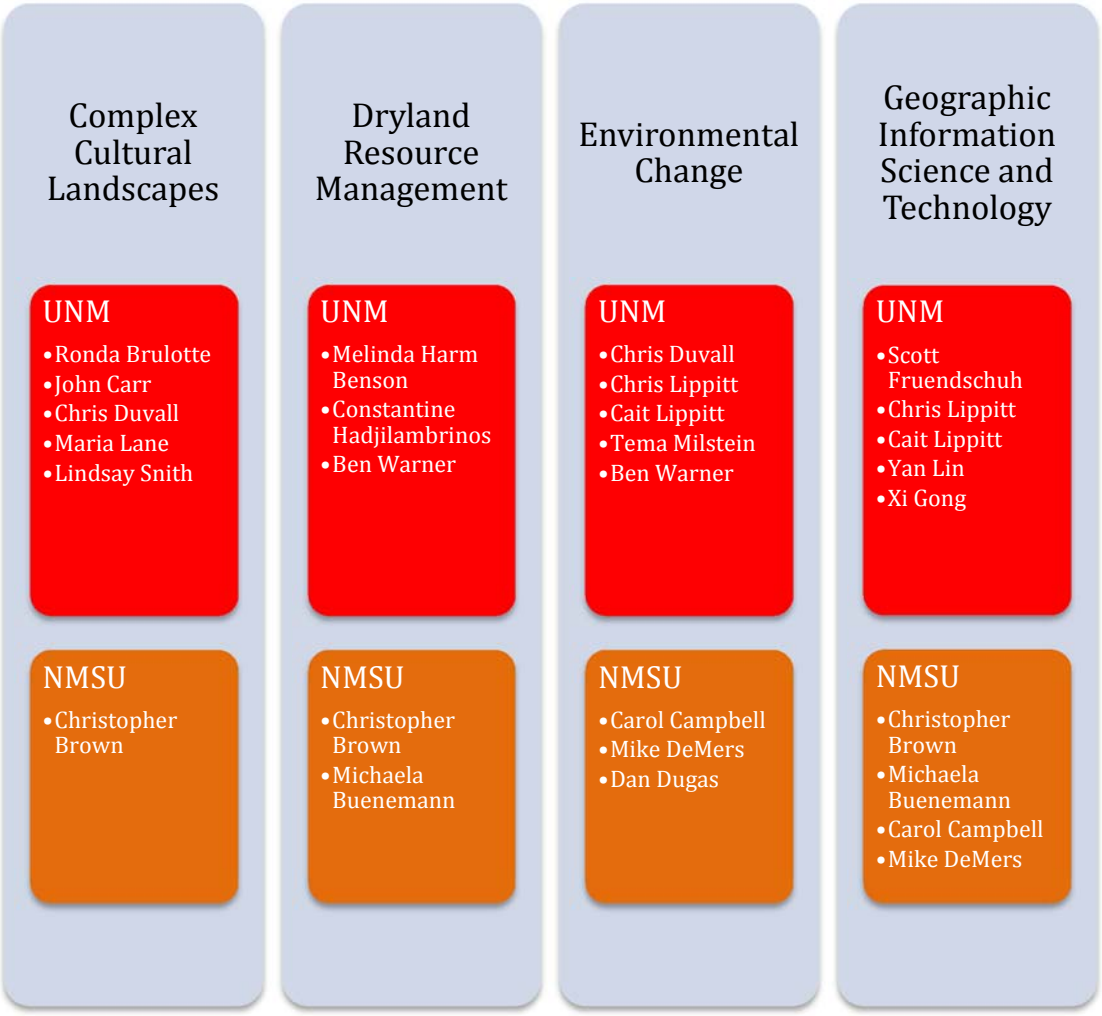
From its earliest conception, the New Mexico Joint Doctoral Program in Geography has been designed to capitalize on existing program and faculty expertise at both UNM and NMSU, in order to offer a rich, multi-campus educational experience based on an innovative integrative instructional model to highly qualified students, and animated by a robust set of programmatic goals. Due to the program's inherent focus on integrative graduate student learning that bridges applied and theoretical approaches, this instructional model will incorporate a rich set of experiences outside the classroom by design. Because the program has been structured around existing resources at both universities, the need for additional support services will be greatly reduced. Even so, in order to both attract top-quality graduate students and to support faculty as they take on the additional work inherent to a PhD program, the Joint Doctoral Program will need to be augmented by additional student recruitment and support packages, most of which will be Teaching Assistant lines.

8.2 Existing Program and Faculty Expertise at UNM

A joint PhD program capitalizes on the combined strengths of both geography departments, creating a synergy between the UNM faculty's broad expertise in environmental studies (natural resource management, policy, law, conservation, history) and in Geographic Information Science & Technology or GIS&T (GIS, remote sensing, geovisualization, spatial cognition, modeling), and NMSU's broad expertise in physical geography (biogeography, land change science, geomorphology, water, arid lands) and applications of GIS&T (education, resource management). Figure 8.1 on the following page shows how the combined strengths of the two faculties directly animate programmatic foci and thus ensure the quality of the program.

UNM's Department of Geography and Environmental Studies currently offers a Masters of Science with two concentrations: Environmental Studies and Geographic Information Science. The Department also offers a one-year graduate certificate in Law, Environment, and Geography, as well as a "shared credit" undergraduate/graduate degree program with Economics by which a student may earn an undergraduate minor in Geography, an undergraduate major in Economics, and a MS in Geography in five years. Amongst other resources, the Department of Geography and Environmental Studies has a 23-seat teaching lab, and a 6-seat graduate research lab.

Figure 8.1 Combined Geography Faculties, UNM and NMSU



8.3 UNM Core Faculty[23]

Melinda Harm Benson, Associate Professor: Received her J.D. from the University of Idaho in 1998. She conducts research on environmental governance regimes — how we conceptualize, employ and protect the natural world. She is a leading scholar in the area of legal geography and has made influential contributions to a conceptual rethinking of ideas like sustainability and resilience. She has published numerous high-impact articles and is now co-authoring a book titled *The End of Sustainability* (forthcoming from with University Press of Kansas). NOTE: Dr. Benson has just gone on leave, in anticipation of leaving UNM. Our hiring plan calls for a replacement hire in Environmental Studies.

[23] Refer to Appendix N for updated CVs for all core UNM faculty.

Ronda Brulotte, Associate Professor: Received her PhD in Anthropology from the University of Texas in 2006. She conducts research on tourism, critical heritage studies, materialism, and food systems. She recently completed a Fulbright Scholarship in Mexico investigating the sociologically complex field of production, marketing, and connoisseurship surrounding Oaxacan mezcal as it circulates in the global market. She is the author of *Between Art and Artifact: Archaeological Replicas and Cultural Production in Oaxaca, Mexico* (University of Texas Press) and the co-editor of *Edible Identities: Food as Cultural Heritage* (Ashgate). Dr. Brulotte also serves as the Associate Director for Academic Programs of UNM's Latin American and Iberian Institute.

John Carr, Associate Professor: Received his PhD in Geography from the University of Washington in 2007 and his J.D. from the University of Texas-Austin School of Law in 1993. His research interests include urban geography, globalization and post colonialism, legal geography, critical theory, public space and culture, and activist research methods. He is a university-wide leader in innovative pedagogy who was awarded UNM's top teaching award for pre-tenure faculty in 2013. In 2016, he is the recipient of research and teaching fellowships at the University of Tasmania in Hobart, Australia and Canterbury University in Christchurch, New Zealand. His research on geocoded data privacy and ethics has been supported by the National Science Foundation

Chris Duvall, Associate Professor: Received his PhD in Geography from the University of Wisconsin Madison in 2006. He is a biogeographer who studies the historical and contemporary distribution patterns of humans, plants, animals, and the environmental conceptions that link them together. Dr. Duvall's most recent research focuses on the Transatlantic exchange of environmental knowledge and practice, with a particular focus on the role of West Africa. He is the author of the 2015 book *Cannabis* (Reaktion books), which traces the global origin and spread of cannabis from both a biological and cultural perspective.

Scott Freundschuh, Professor: Received his PhD in Geography in 1992 from the State University of New York at Buffalo. His research focuses on cognitive science and spatial cognition as it relates to types of spatial knowledge and their structures, geographic scale, and spatial concept development and understanding. He is an active and influential scholar at the national level and served previously as a program director at the National Science Foundation. He is currently executive editor of the journal *Cartography and Geographic Information Science*, Vice President of the Coalition of Geospatial Organizations (COGO), and the Executive Director of CAGIS.

Xi Gong, Visiting Assistant Professor: Received his PhD in Geographic Information Science from Texas State University in 2016. He specializes in the spatial analysis of environmental health and has conducted a variety of studies that use data-mining techniques to examine the correlations between air pollution and health risks. NOTE: This position is not counted as one of our "core" 13 tenure-track faculty positions, but our hiring plan calls for converting

this visiting position to a continuing Instructor position, primarily to add GIScience teaching capacity and to support our planned development of an online program in Geospatial Entrepreneurship.

Constantine Hadjilambrinos, Associate Professor: Received his PhD in Urban Affairs and Public Policy from the University of Delaware 1993. He conducts research in energy resources, environmental policy, and the relationship between science, technology, and society. Dr. Hadjilambrinos is an expert on European energy policy and has held both academic and professional positions in the U.S. and abroad. Before coming to UNM, he served as the Head of Renewable Energy Policy for the New Mexico Public Regulation Commission.

Maria Lane, Associate Professor: Received her PhD in Geography from the University of Texas at Austin in 2006. She is a historical geographer who studies the scientific, legal, and political processes that influence decisions about natural resource management. An award-winning teacher at UNM, Dr. Lane employs numerous graduate students in a variety of scholarly positions, including editorial fellowships for the journal *Historical Geography*, for which she serves as editor. Dr. Lane is the author of a 2011 book *Geographies of Mars* (University of Chicago Press) that explores early thinking about natural resources on the planet Mars, and is currently writing a book about water management in New Mexico titled *Fluid Geographies* (under contract with University of Chicago Press).

Yan Lin, Assistant Professor: Received her PhD in Geographic Information Science from Texas State University in 2014. Her research and teaching specialize in health geography, spatial epidemiology, health disparities and the links between population, environment, and health. Dr. Lin has published a number of papers investigating disparities in rates of cancer diagnosis and mortality, using advanced techniques for spatial analysis of large data-sets. She collaborates actively with public health practitioners.

Caitlin Lippitt, Assistant Professor: Received her PhD from the joint program at San Diego State University and the University of California, Santa Barbara in 2013. Her research is focused on leveraging remotely sensed data to identify land cover change at multiple scales for monitoring and managing disturbance in semi-arid and arid environments. She collaborates actively with biologists and has significant research expertise in the study of landscape disturbance effects, including drought, wildfire, and invasive species

Christopher Lippitt, Associate Professor: Received his PhD from the joint program at San Diego State University and the University of California, Santa Barbara in 2010. His research is in developing methods and theory to improve the effectiveness of remote sensing and GIS technologies when applied to time-sensitive problems like disaster response, and to understand the dynamics and feedback effects within the human-environment relationship. Dr. Lippitt has a very active sponsored research program, with major grants from the National

Science Foundation and the New Mexico Department of Transportation. He is co-editor of the 2015 book *Time-Sensitive Remote Sensing* (Springer Press).

Tema Milstein, Associate Professor: Received her PhD in Communications from the University of Washington in 2007. Her research focuses on environmental communication, environmental meaning systems, nature tourism, and transformative ecopedagogy. Her recent honors include a Fulbright research award in New Zealand, a research fellow award at University of Tasmania, a grant with the U.S. Fish & Wildlife Service, and recognition by UNM as the 2015-2017 Presidential Teaching Fellow. She is editor of the book *Environmental Communication Pedagogy and Practice*, published by Routledge, and has conducted research in a wide variety of fieldsites including New Zealand, the Pacific Northwest, and Iceland.

Lindsay Smith, Assistant Professor: Received her PhD in Anthropology from Harvard University in 2008. Her interdisciplinary research focuses on migration and borderlands, drawing on expertise that spans ethnography, science and technology studies, spatial science, and medical anthropology. She is the author of *Subversive Genes: Making DNA and Human Rights in Argentina*, which is now under publication consideration with Stanford University Press. Dr. Smith manages an active sponsored-research program, using grants from the National Science Foundation and the Wenner-Gren Foundation to support extensive ethnographic fieldwork in Latin America.

Ben Warner, Assistant Professor: Received his PhD in Sustainable Development from Arizona State University in 2014. His research focuses on rural and agrarian development, environmental change adaptation, vulnerability and risk, water resources management, and sustainability education assessment & policy. Dr. Warner has published numerous journal articles focused on adaptation strategies developed by smallholder farmers and rural communities, both in Central America and the United States. His research has been funded by major grants from the National Science Foundation and the United States Department of Agriculture.

8.4 UNM Affiliated Faculty

In addition to the permanent faculty listed above, UNM's Department of Geography and Environmental Studies has close relationships with a number of scholars and researchers outside the department. The following UNM-based affiliated faculty members collaborate with GES faculty on research initiatives, offer cross-listed courses, serve on graduate student committees or otherwise participate in the scholarly life of the department.

- **Daniel D. Arreola** (Arizona State University, School of Geographical Sciences & Planning) Expertise: cultural landscapes, place-making, Mexican-American borderlands

- **Karl Benedict** (UNM College of University Libraries and Learning Sciences) Expertise: information architecture, spatial data management
- **Bob Berrens** (UNM Department of Economics, Water Resources Program) Expertise: environmental economics, water resources
- **David Correia** (UNM Department of American Studies) Expertise: environmental politics, law and violence, critical human geography, New Mexico and the U.S. Southwest
- **Jeff Erbig** (UNM Department of History) Expertise: historical GIS, history of cartography, Latin America
- **Fred Gibbs** (UNM Department of History) Expertise: interactive mapping + urban ecologies, historical GIS, food systems, public health
- **Moises Gonzalez** (UNM Community & Regional Planning Program) Expertise: spatial planning, GIS
- **Laura Harjo** (UNM Community & Regional Planning Program) Expertise: community development, GIS
- **Anne Jakle** (UNM EPSCOR Project Associate Director) Expertise: energy policy, resource management
- **Marcy Litvak** (UNM Department of Biology) Expertise: ecosystem ecology, effects of climate variability and disturbance
- **Bruce Milne** (UNM Department of Biology, Sustainability Studies Program) Expertise: ecoculture, environmental communication, environmental meaning systems, ecological identity, nature tourism, transformative ecopedagogy
- **William Pockman** (UNM Department of Biology) Expertise: ecosystem ecology, plant distributions, climate change response
- **Caroline Scruggs** (UNM Community & Regional Planning Program) Expertise: environmental policy, public health, sustainable development
- **Mark Stone** (UNM Department of Civil Engineering) Expertise: environmental flows, fluvial geomorphology, ecosystem services
- **Jennifer Thacher** (UNM Department of Economics) Expertise: environmental economics, survey valuation
- **Marygold Walsh-Dilley** (UNM Honors College) Expertise: sociology of development, food and agricultural systems, indigenous politics

8.4 Existing Program and Facilities at NMSU

NMSU's Department of Geography currently offers a Masters of Applied Geography as well as a Graduate Minor in Geographic Information Science and Technology. Amongst other resources, the Department of Geography and Environmental Studies has a 30 seat teaching lab, and a 10 seat research lab.

8.5 NMSU Core Faculty

Christopher Brown, Associate Professor: Received his PhD in Geography from San Diego State University/UC Santa Barbara in 1998. His research focuses on US-Mexico border environmental and water resource policy, specifically examining the political ecology of binational watersheds along the border and

how various institutions have coalesced to advance such policy efforts amidst relevant barriers or impediments.

Michaela Buenemann, Associate Professor: Received her PhD in Geography from the University of Oklahoma in 2007. Her research focuses on the integration of remote sensing, geographic information systems, and spatial modeling to assess the spatio-temporal dynamics of coupled human-environment systems, primarily land changes in dryland environments.

Carol Campbell, Associate Professor: Received her PhD in Geography from the University of California, Los Angeles in 2005. Her avian biogeographic research is couched in niche theory, employing remote sensing techniques for land cover quantification and change detection, and to explain responses of bird communities to biotic conditions.

Mike DeMers, Professor: Received his PhD in Geography from the University of Kansas in 1985. He conducts research in land classification, evaluation, and change analysis, and in geodesign, geogame technologies, and immersive virtual worlds as ways of both exploring geography, especially GIS&T, and creating new tools for both learning and practicing geography.

Dan Dugas, Assistant Professor: Received his PhD in Geography from the University of Oregon in 1993. His research focus is on spatial analysis of dune fields, interpretation and mapping of soils patterns for road engineering, landslide mapping, geomorphic aspects of landscape ecology, geomorphological soils mapping, analysis of spatial influences of arroyo channels on ant nesting patterns, and various geoarcheological consulting tasks.

Bob Czerniak, Professor Emeritus: Received his PhD in Geography from the University of Colorado, Boulder in 1979. He conducts research in land use, community development, urban geography and transportation planning.

8.6 Admissions Standards

The admissions standards for the New Mexico Joint Doctoral Program in Geography are comparable to similar programs, while also specifically tailored to ensure that PhD program students are both drawn to and capable of pursuing a graduate degree that is focused on integrative approaches to human/environment dynamics.

As with our peer institutions (see Table 8.1 below) the joint PhD program will require successful applicants to have a Masters Degree in a relevant field or profession, and provide letters of recommendation, academic transcripts, and a letter of intent. We will also require at least a "B" GPA for prior graduate work and at least a 150 on both Verbal and Quantitative portions of the GRE – barring extraordinary circumstances.

Beyond these requirements, we will ensure the quality of the New Mexico Joint Doctoral Program in Geography by implementing admissions standards and procedures that are designed to ensure a proper fit between students and the program resources and design.

At the time of application, potential students will identify a desired primary advisor and will apply formally to that professor's home institution. After an administrative check to ensure that candidates meet minimum requirements, the home institution will conduct a first round of admissions review and forward acceptable applications to the secondary campus. The second round of review will determine whether there is at least one sponsor at the secondary campus and will evaluate the applicants' overall fit with faculty expertise and research strengths. The final decision on admission of candidates to the program will be made by a joint review committee, and the final decision for funding will be made at the home institution, based on the funding availability and service loads of that institution's faculty.

Throughout this process, serious consideration will only be given to candidates who express an interest in integrative, multi-methodology approaches to human/environment dynamics. This focus will help ensure that faculty are able to focus on students who have been drawn to, and are served by the program's foci. And by developing cohorts who share this integrative focus, the program's quality and reputation will be continually reinforced.

Table 8.1 Admission requirements for peer Institutions in the Southwest

University	Masters Degree	GRE Scores	Transcripts	Letters of Recommendation	Letters of Intent	GPA
University of Arizona	Yes	Yes	Yes	Three	Yes	B average
Arizona State	Yes	158 Verbal 147 Quant	Yes	Three	Yes	3.0
University of Colorado	Yes	162 Verbal 159 Quant	Yes	Three	Yes	3.71
University of Denver	Yes	153 Verbal 144 Quant	Yes	Three	Yes	3.5
University of Idaho	Yes	270 Combined	Yes	Three	Yes	2.8
Texas A&M	Yes	300 Combined	Yes	Three	Yes	3.0
Texas State	Yes	270 Combined	Yes	Three	Yes	3.5
University of Texas	Yes	320 Combined	Yes	Three	Yes	3.5

8.7 Instructional Models

As discussed in earlier sections, the program will use a hybrid instructional model that combines both face-to-face courses, educational experiences shared by students based at both campuses, and distance learning options for students

on both campuses. Because our existing undergraduate and graduate programs currently rely heavily on face-to-face instruction, we will need to develop our engagement with distance learning technologies and pedagogies significantly. We intend to increase this capacity in a phased manner, as shown below, relying first on a variety of existing resources and then building toward the development of specific equipment and technology resources that are tailored to support the program as it matures.

- **Phase 1, Pilot Courses**: In the years before we admit our first cohort of doctoral students, we will pilot various approaches to grad-level distance learning through our existing UNM courses, making them available to grad students throughout New Mexico under the cross-enrollment policy. We will select these initial pilot courses based on instructor interest and distance education competency. The pilot courses will be developed with the support of New Media and Extended Learning (NMEL) at UNM and Academic Technology and Instructional Innovation and Quality (IIQ) at NMSU, with the goal of developing faculty expertise and comfort with a variety of distance-education activities and approaches that are suitable for graduate-level courses. Because our long-term objective is to develop distance courses suitable for PhD-level students, we will focus in the pilot phase on enabling robust seminar-style interaction and intensive discussion that mimics face-to-face interaction as much as possible. To this end, we expect to use videoconferencing software and classroom facilities that already exist on the UNM campus, following the lead of programmatic development that is already underway through Extended University.
- **Phase 2, Core Courses**: When the program launches, we will offer a small subset of key courses to distance learners at NMSU, including at a minimum the first-year core courses for PhD students. As discussed in the curriculum section above, we have already determined that we will offer GEOG601 and GEOG602 in novel cross-campus formats that include one face-to-face meeting per semester on each campus, which will be coordinated with a field experience in either Albuquerque or Las Cruces. We will supplement these face-to-face meetings throughout the semester with distance learning techniques that proved successful in the pilot phase. In developing these courses, we will work intensively with Extended University to identify software, equipment, and facilities that will enable us to deliver these courses in robust formats that enhance our unique joint program.
- **Phase 3, Early Expansion Courses**: After the first cohort begins, we will continue to develop distance-learning options across the joint-program curriculum. We will select these courses based both on instructor interest/ability as well as on the programmatic need to provide distance-capable courses to joint-program students in all three core program areas: human geography, physical geography, and GIS&T. In this phase, we will continue to identify successful strategies for PhD-level distance learning and will explore the potential for using distance learning technologies even for field-based courses, which we currently envision as being solely "native" offerings at the two individual campuses. Relevant support units at both UNM

and NMSU will be critical in this effort, helping us conceptualize, pilot, and implement various distance-learning strategies beyond those that are currently considered standard.

- **Phase 4, Late Expansion Courses**: Once the program is considered "mature," with a full enrollment of at least four cohorts and at least one student completed, UNM and NMSU faculty will engage in strategic planning for facilities, technology, and equipment resources needed to deliver a joint program that best supports student success in achieving the program's learning outcomes across the two campuses. Although we expect that the University of New Mexico will have by that time significantly expanded its own facilities and resources to support distance learning, it is also possible that we will consider a facilities augmentation within GES to support distance-capable delivery of additional courses. If we have been successful in adding numerous courses to the roster of those available to distance learners, it is possible we could cross the 50% threshold that triggers designation as a distance program. In that case, we would work with Extended University officials to declare and report on our distance-learning capacities for purposes of accreditation.

8.8 Impact on existing master's program

The creation of the joint PhD program will put short-term pressure on the existing MS Geography program at UNM by increasing advisement loads on faculty until staffing is increased and by reducing the availability of GA packages to MS students until sponsored research grows enough to offset the diversion of internally-funded GA lines from the MS program to the PhD. Program. That said, however, the overall long-term benefits to the existing master's program outweighs these costs. Specifically, experience from other PhD programs in Geography has established that the co-presence of doctoral and master's-level students in shared educational settings tremendously enriches the educational experience of MS students. In addition to bringing new ideas, experiences, and knowledge to the program, PhD students inevitably "raise the bar" for all students, helping promote a culture of inquiry and excellence.

8.9 Student Experience Beyond the Classroom

Because it has been designed around integrative approaches to geography – and particularly approaches to human-environment dynamics that bridge theory and application – graduate student experience beyond the classroom will be a defining characteristic of the joint New Mexico Joint Doctoral Program in Geography. Indeed, all PhD candidates in the program will be expected to base their original dissertation research upon active, applied, real-world issues. And in order to do so, faculty will actively assist students in the program to find, connect with, and potentially work for a host of stakeholders in New Mexico and beyond in the process of conducting their research. Accordingly, students' work in the field will blur many of the traditional lines between dissertation research, internships, and service learning. In the process of preparing students for such engaged, integrative research, the faculty will draw upon existing relations with

such stakeholders as the U.S. Forest Service, the National Park Service, the Bureau of Land Management, the US and New Mexico Departments of Transportation, the New Mexico Department of Health, the Environmental Protection Agency, and a variety of municipal organizations throughout New Mexico, while forging new relationships with a broad spectrum of organizations and actors in the Southwest.

8.9 Support for Student Success

8.9.1 Support Services

Because the program has been structured around existing resources at both universities, most student support services are already in place as part of the normal departmental services – including advising, professional development, IT support, research training, and research/conference travel. That said, UNM's Department of Geography and Environmental Studies will need some specialized curricular additions – such as GEOG603 "Professional Geographic Practice" and GEOG590 "Qualitative Methods – in order to meet the professional development and research training needs of PhD students. Our vision for the program includes the following basic support services to ensure student success.

- Advising: Advising will be handled by existing and future faculty as part of the regular allocation of service roles, with support from a dedicated staff person who will work with students to facilitate interactions across the two institutions and faculties.
- Professional development: Professional development will occur both informally as part of the traditional advisor/advisee relationship, and formally through GEOG603 "Professional Geographic Practice." GEOG603 will be only one of three required core courses for the PhD program. It will prepare PhD level students to enter the professional realm, whether as full time academics, researchers, policymakers and/or other types of geographic professionals. Accordingly, it will provide students an opportunity to develop the range of skills expected of geographic professionals in a variety of contexts, with a focus on "core competencies" which are required across professional contexts – including oral communication, written communication, and visual presentation. We will also develop extra-curricular professional development seminars to address the specific needs of individual student cohorts.
- IT Support: The department currently has a 23-seat teaching lab, and a 6-seat graduate research lab, both of which are maintained by a full-time network tech and lab manager. This staff position is supported with student course fees and is assigned primarily to provide student IT support. In addition, we will work closely with UNM Extended Learning to ensure that our distance-capable classes are supported with proper technology facilities.
- Research Training: A prerequisite for graduating from the New Mexico Joint Doctoral Program in Geography is demonstrated competency in both quantitative and qualitative research methodologies. Accordingly,

a full suite of both qualitative and quantitative research methodology courses will be available to all students. Moreover, every student's PhD advisor is charged with ensuring that he/she receives sufficient research training as part of the design of his or her graduate program of studies. Beyond in-class training, the PhD dissertation is designed to provide each student substantial practical experience in developing and using qualitative and quantitative research methodologies. Furthermore, we anticipate that many students will choose to integrate their own dissertation research with externally funded research initiatives in which they will participate as paid research assistants to GES faculty. This dovetailing of student-led and faculty-led research work will provide extensive experience in collaboration, working in teams, and developing project management skills.

- Research and Conference Travel: The joint program will provide a regular, competitive funding source for PhD students to travel to conduct research and engage in conference presentation. When budgets have permitted, GES has in the past supported MS students' travel to the American Association of Geographers conference and to the Southwest American Association of Geographers conference on a limited basis. With the addition of a PhD program, however, we will seek new institutional and externally-funded travel resources to make conference attendance a standard part of the PhD-student experience, given its critical importance both for research scholarship and for professional development. In addition, we will use increased F&A revenues to provide internal support for student research projects.

8.9.2 Financial Packages

The proposed New Mexico Joint Doctoral Program in Geography will aggressively support student success through student recruitment and employment. The design of the PhD program is premised on two principles:

1. The success of the program will depend on competitive funding packages to recruit high-caliber students, and
2. The program will actively seek to develop student cohorts that reflect the emerging American majority.

Accordingly, a set of new Graduate Assistantship lines will be developed at both universities – and standardized across both campuses – in order to aggressively attract highly competitive, diverse student cohorts. This effort will be complimented by travel funding to bring top prospects to visit UNM each year. In order to recruit a diverse range of qualified students who would not otherwise consider PhD studies at UNM, or even a PhD in Geography, the program will also send a faculty member to regularly promote the New Mexico Joint Doctoral Program in Geography at relevant conferences such the National Association of African American Studies & Affiliates Conference (which encompasses the National Association of Hispanic and Latino Studies, the National Association of Native American Studies, and the National Association of Asian Studies).

8.10 Assessment of Program Goals for Student Learning

The primary objective of our teaching and mentoring is to produce graduates who are well prepared for professional careers within and beyond the academy. Broadly, we intend for all students to graduate with:

A. Broad capability in the discipline of geography, with a critical understanding of how specific areas of theoretical, methodological, and practical expertise relate to scholarship in other areas of the discipline;
B. Advanced competency in the design and implementation of original and significant basic and applied research;
C. Professional knowledge skills in communication, teaching, and mentorship.

We expect students to achieve these specific learning outcomes by the time they reach degree completion:

A.1. Students will discuss the historical development of geographic thought and critically evaluate contemporary philosophical approaches in geography

A.2 Students will demonstrate expertise in concepts, methods, and trends in three chosen specialty areas as well as in synthesizing multi-variable human-environment interactions

B.1 Students will design and conduct independent research for answering relevant geographic questions using appropriate quantitative and/or qualitative methods

C.1 Students will make original and significant scholarly contributions and communicate them effectively orally and in writing both to the scientific community and the general public

C.2 Students will demonstrate professional knowledge and skills that will allow them to enter careers in academia, government agencies, or the private sector

A detailed plan for assessment of these outcomes – including assessment measures, assessment procedures, and schedules for evaluation of assessment data/results – is included as Appendix E.

8.11 Accreditation

UNM is institutionally accredited by the Higher Learning Commission of the North Central Association and has approval to offer any degree program appropriate to UNM's mission. There are no specific accreditation or licensure requirements associated with doctoral programs in Geography.

9. ASSESSMENT OF OPERATIONS AND IMPACT

The New Mexico Joint Doctoral Program in Geography will be structured around an ongoing assessment of the operations and impact of the program.

9.1 Assessment of Programmatic Impact

The Joint Steering committee will be convened annually to perform continuous assessment of programmatic impact. The basis for annual assessment of operations and impact by the internal review committee will include:

- Student achievement of learning outcomes, as assessed in our formal program assessment (Appendix E).
- Cumulative data on PhD students' scholarly activities, including but not limited to:
    - Scholarly presentations
    - Publications
    - Other research products, including but not limited to grant applications.
- A qualitative progress report by the PhD program director on current PhD student progress towards degrees.
- Graduation rates.
- Results of an annual survey of PhD program graduates to evaluate
    - Subsequent career placement
    - Subsequent academic and professional activities, including publications

9.2 Assessment of Operations

The staff member in charge of program support will prepare an annual operational report for the program, including a report on past and projected costs and revenues from the program – based on such data as student credit hours, percentage of faculty teaching load, and hard expenses and income. The Joint Steering committee will evaluate that report at their annual meeting to determine if any administrative changes or refinements are needed.

9.3 External Review

After five years of programmatic operation, and every five years thereafter, the program will solicit an external review of programmatic operations and impact. The New Mexico Joint Doctoral Program in Geography will also be assessed within the regular cycle of Academic Program review at each institution.

10. ADMINISTRATIVE RESPONSIBILITY FOR THE PROGRAM AND INSTITUTIONAL COMMITMENT

The New Mexico Joint Doctoral Program in Geography will be administered by the faculties of both the Department of Geography and Environmental Studies at UNM and the Department of Geography at NMSU. While the faculties of both departments will share in the administration of the program, the Program Coordinator at UNM (a staff position) and the Graduate Program Directors at each campus will have special roles in administrating the program. The delegation of administrative responsibilities is designed to provide each program a maximum amount of flexibility as the two departments grow and evolve, while creating a joint decision making structure for matters that impact the ongoing functioning of the joint program.

10.1 Management structure

The New Mexico Joint Doctoral Program in Geography will be managed by the Doctoral Program Steering Committee (Steering Committee), and the Steering Committee will be responsible for screening applications; making admissions decisions; reviewing and advising curriculum; handling conflicts, grievances, and appeals that cannot be resolved within the student's research committee; and maintaining communication between both institutions on relevant issues as they arise. Composition of the Committee will reflect representation of faculty from both institutions, specifically including, at a minimum, the graduate program director and at least one additional faculty member from each department. Committee membership may change annually, based on teaching assignments, interest, sabbatical leave, and other fluctuations of effort among faculty members. Meetings of the Steering Committee may occur as face-to-face meetings or via Skype or other Web-assisted technologies.

10.2 Program curriculum

Each department maintains full responsibility for its own course offerings, but both departments commit to coordinate changes that would affect the program as a whole. Specifically, a three-week notice and comment period is required for any addition, removal or modification of doctoral-level courses in either university's catalog, during which input to proposed changes are accepted from the institution not making the change. Some courses will be offered at UNM, some will be offered at NMSU, and some will be offered at distance. All proposed changes to curriculum at UNM are contingent on Faculty Senate approval notwithstanding the joint design of program

10.3 Transfer of credit policies

The New Mexico Joint Doctoral Program in Geography relies on the state's newly developed "cross enrollment" protocol, which allows students to register seamlessly for graduate courses at multiple New Mexico institutions of higher

education, in cases where a course is not offered at the home institution. Under this program, tuition is paid to the home campus, but any special fees are paid to the host institution. Student credit hours are awarded to the host institution that is actually delivering the course. This protocol will allow students in the New Mexico Joint Doctoral Program in Geography to take courses at either UNM or NMSU (as long as courses taken at the host institution are not offered at the home institution), thus facilitating the creation of a totally joint curriculum. In the event that a student desires to switch advisors within the Joint Doctoral Program, thus necessitating a change in the home institution, the registrars of the two institutions will work together to facilitate an advisor change without any prejudice against the student's standing or progress.

10.4 Admissions and Financial arrangements

At the time of application, potential students will identify a desired primary advisor and will apply formally to that professor's home institution. After an administrative check to ensure that candidates meet minimum requirements, the point of contact at that home institution will route all relevant materials to a joint review committee composed of faculty from both institutions that will make admissions decisions.

Payment of application fees will be handled via the intake portal at the home institution, and students that are admitted to and enroll in the program will handle all financial matters related to tuition, fees, financial aid, and stipend/salaries associated with graduate assistantships through the home institution. Only in the event that a student desires to switch advisers that would involve a change in the home institution would the two institutions need to discuss any cross-institutional interactions on financial matters involving student support.

As noted elsewhere, the funding for the joint program coordinator will be provided by UNM, and both institutions will benefit from and be served by this staff person. Although UNM faculty will have the primary responsibility for screening, hiring, and managing this staff person, NMSU faculty will provide input into these processes. Specifically, UNM will select finalists for the staff position and invite comment from NMSU before making any final decision. The UNM department chair will be the direct supervisor, but the Steering Committee will be asked to provide input to the official annual review process.

10.5 Faculty hiring

Each department maintains full responsibility for its own faculty hiring, but both departments commit to communicate about any searches for faculty that would be expected to participate in the joint doctoral program. Specifically, we agree that the institution planning the faculty search will provide a three-week notice and comment period to the partner institution before finalizing and posting a faculty job advertisement unless prohibited by the timeline necessary to conduct a successful hire. We also agree that upon successful completion of a faculty

search, the institution conducting the hire will notify the partner institution in a timely manner of the search results, and will initiate a discussion about the role of the new faculty member in the joint doctoral program.

10.6 Responsibility for advising students

Successful applicants to the program will research potential advisors prior to applying, establish a relationship with a likely advisor, and speak to this relationship in their application materials. During the application review process, the review committee will interact with likely advisors, ask them to review the file, and ask for a commitment to be interim advisor if the applicant is admitted to the program. The interim advisor will assist the student in assembling and finalizing a joint doctoral committee, preparing and submitting an appropriate program of study, and conducting the first semester diagnostic interview. Primary responsibility for advising rests with the joint doctoral committee chair at the home institution; the program coordinator will assist as needed.

10.7 Faculty supervision of dissertations

Upon enrollment of the student in the program, the interim advisor at the home institution will work with the student and faculty at both institutions to develop a joint doctoral committee, which will necessarily include two faculty members from each institution and one external member. We expect the external member will typically be a faculty member who is from the home institution but outside the home department. Eligibility to serve on doctoral committees is defined in the graduate catalogs at UNM and NMSU, and each institution will therefore follow its own procedures for evaluating graduate committees and qualifying "graduate" faculty. The committee formation described above is in accord with both universities' existing requirements for committee formation.

The committee structure we propose is meant primarily to ensure that students engage with faculty from both institutions, and this will also provide the broadest umbrella for advising possible to guide the student in developing their program of study and research proposal, preparing for their qualifying exams and proposal defense, and dealing with any issues that arise in their time in the program. The joint doctoral committee discussed in the previous section will be responsible for all facets of supervising dissertation research, including:

- developing the preliminary research proposal and external funding proposals (where applicable),
- developing expertise needed to conduct the proposed research,
- preparing for comprehensive and oral exams,
- preparing for the final research proposal defense,
- conducting needed field and laboratory analysis,
- preparing for the final defense of the dissertation, and
- writing and revising the articles or other written documents that will summarize the research completed and comprise the finished product of the dissertation process.

Primary responsibility for supervising the dissertation rests with the home institution due to the primacy of the joint doctoral committee chair, but we envision a fully joint supervisory structure that ensures dissertations will be completed to meet standards at both institutions. Meetings of the joint doctoral committee will be handled both through face-to-face meetings and the use of interactive teleconferencing tools that both institutions currently support.

10.8 Program Assessment

The Steering Committee composed of faculty from both institutions will be tasked with conducting regular reviews of student learning and program quality in three distinct phases: entrance interviews, annual student reviews, and exit surveys. In general, this assessment structure is designed to evaluate both employment placement and the quality of student research products. Each academic year, the Steering Committee will synthesize the results these assessments and will share them with the entire program faculty (across both institutions). A joint faculty meeting will then be held to discuss the assessment outcomes for purposes of guiding improvements to the program or affirming successes. This "internal" review will be conducted on an annual basis, with an external review commissioned after 5 years. The New Mexico Joint Doctoral Program in Geography will additionally be assessed within the regular cycle of Academic Program Review at each institution.

10.9 Institutional Commitment

The Dean of the College of Arts & Sciences has expressed a strong commitment to the development of the New Mexico Joint Doctoral Program in Geography. (See Appendix U for his letter of support detailing specific financial commitments.) Prior to submission to the NMHED and NMGDC, documentation from the Provost's Office will also be included to indicate the institution's priority for this program.

11. APPENDICES

Curriculum Forms and Documentation

A. Proposed UNM catalog language for degree program
B. Form B curriculum proposals for program-related new courses
C. Catalog course descriptions for all existing UNM courses in proposed program curriculum
D. Sample syllabi for grad-level UNM courses, existing and proposed
E. Learning assessment plan

Documentation of Employment Need and Student Demand

F. U.S. Department of Labor documentation
    1. High Growth Industry Profile: Geospatial Technology, 2007
    2. High Growth Job Training Initiative: Geospatial Technology, 2005
    3. Geospatial Management Competency Model, 2012
G. Documentation of focus group with NM geospatial industry reps
H. Survey of Geography departments at UNM-peer, NMSU-peer and other regional institutions
I. Survey of current graduate students in Geography, UNM
J. List of potential employers
K. List of similar programs, Southwest region

Department of Geography & Environmental Studies Documentation

L. Seven-year projected course rotation for all undergraduate and graduate courses in GES
M. GES five-year hiring plan, 2015-2020
N. Recent CVs for all UNM faculty
O. Table of 6-year projected graduate program cost estimates and resources
P. Calculation worksheet for tuition revenue projections
Q. Calculation worksheet for sponsored research revenue projections
R. Calculation worksheet for graduate assistantship cost projections
S. List of advisory board members

Agreements

T. Authorization to proceed with proposal, Office of the Provost
U. Commitment letter from Dean Peceny, UNM College of Arts & Sciences
V. Memorandum of Understanding between UNM and NMSU
W. Graduate Level Cross Enrollment Agreements Among Universities in New Mexico, draft 2015

Letters of Support

X. Letters from external partners and stakeholders
    1. Sarah Bednarz, President, American Association of Geographers
    2. Michael Solem, Director of Educational Programs, AAG
    3. Christopher Brown, Geography Department Head, NMSU
    4. Craig Allen, Station Leader, USGS Jemez Mountains Field Station
    5. Pete McCormick, Associate Dean of Arts & Sciences and Director of Environmental Studies, Fort Lewis College
Y. Letters from other units at the University of New Mexico
    1. College of Arts & Sciences, Tom Turner, Associate Dean, Research
    2. Department of Anthropology, Les Field, Chair
    3. Department of Biology, William Pockman, Chair
    4. Community & Regional Planning, Renia Ehrenfeucht, Chair
    5. Department of Civil Engineering, Mahmoud Taha, Chair
    6. Department of Earth & Planetary Sciences, Laura Crossey, Chair
    7. Department of Economics, Janie Chermak, Chair
    8. Extended University, Debby Knotts
    9. Latin American and Iberian Institute, Susan Tiano, Director
    10. R.W. Johnson Center for Health Policy, Gabriel Sanchez, Director
    11. Water Resources Program, Robert Berrens, Director

New Mexico Context

Z. Formal needs assessment: New Mexico Pathways survey report
AA. Forthcoming: Letters of support from NM institutions of higher ed