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An Overview

Some Key Achievements of the Faculty of Forestry, University of Toronto

The contribution of the Faculty has been to innovate in forestry education and forest science research and to engage with issues of concern at the level of global society.

In 1997, we introduced the first professional Master in Forest Conservation degree in Canada (M.F.C.). The curriculum of this landmark program broadened the interdisciplinary, social and communication dimensions of forestry education. Our M.F.C. graduates are employed in the broader forest sector: government, ENGOs, consulting and the forest industry. In 2014, the M.F.C. program received accreditation from the Canadian Accreditation Board.

We continue to grow and develop our urban forestry legacy. It was Faculty member Dr. Eric Jorgensen who first introduced and defined the “urban forest” in the 1960’s. Our research on invasive species control contributes to better understanding of the ecosystem services and values represented by all forests, particularly the urban forest, and we help municipalities bring scientific understanding to their problem solving.

Our research in forest ecology and restoration has furthered understanding of biodiversity conservation, forest productivity and mitigation and adaptation in the light of negative effects of forest stressors such as climate change. In 2014, an Industrial Research Chair in Biochar and Ecosystem Restoration was established, the first of its kind.

In the 2000s, the Faculty pioneered research in nano-biotechnology, bio-composites and bio-nanocomposites. Through the conversion of forest waste products into bio-based green chemicals and bio-nano-materials including plastics, lightweight composites, carbon fibre and foams, we explore more sustainable practices, and increase forest sector efficiencies.

Forest sustainability is the integrating theme of our teaching and research. We predict a future in which decision-making about the emerging bio-economy will need to be informed by more research associated with forest sustainability. Additional research areas in which the Faculty excels include forest economics, forest management planning, forest and wildland fire management and wildlife ecology.

Today, and historically, the Faculty is active in international collaboration and research. Some of the countries include China, India, Bangladesh, Nepal, Brazil, Chile, Portugal, Spain, Malaysia, Panama, Dominica, Mexico, Ghana, D.R. Congo, USA, UK, France, Germany, Sweden and Finland.

We are a close-knit community of staff, students, research fellows, professors and professional associates from diverse backgrounds. Our faculty members and students are economists, political
ecologists, biologists, foresters, entomologists, engineers, writers, botanists, mathematicians and chemists (to name a few).

The diversity of our students is high, reflecting the high number of international students attracted to the Faculty, but also reflecting our diverse membership with respect to gender. For example, 21 women and eight men are enrolled in the M.F.C program this year, a trend which anticipates new types of leadership values in forestry’s future.

1.0 Introduction and Context

The Faculty of Forestry, the oldest such institution in Canada, continues to provide leadership in resolving the urgent and long term challenges of our society and the environment. Since 1907, the Faculty has been committed to making a difference to societal well-being. In line with the University’s Vision 2030 mandate, we are committed to strengthening our academic excellence by continuing to improve student expectations, by providing innovative and relevant graduate and undergraduate programs, by excelling on all fronts of teaching and research and by reaching out globally to address and define forestry- and environment- related policy. We do so by working with government and non-government institutions.

In July 2012, the University administration appointed a dean for a five year term. Terms of reference were to transform the Faculty of Forestry into a fiscally sustainable unit wherein Forestry can thrive, grow and excel in all academic aspects.

This Cyclical Review is an opportunity to report on the milestones that the Faculty has achieved since 2009. It also provides an opportunity for our faculty, students and staff to reflect on their achievements. More importantly, it is a time to reflect on the future challenges facing Forestry, especially the urgent needs of global society, which include solutions to climate change, the advancement of our First Nations and Aboriginal peoples and their forest communities, the stresses associated with increasing urbanization and innovations in forest product manufacturing. As one of our supporters, Phillipe Morgan, president of Pro Silva, stated “We are at a point in time when the role of forests and the need for forest conservation, at a global scale, is recognized as being critical for future resilience and sustainability of ecosystems and society” (Appendix 1).

The consultation process used to develop this self-study involved seeking input from students, faculty and staff. The town hall meetings, and follow-up, designed for engaging students in this process, are discussed in Section 2.4.4. Faculty and staff were involved through meetings to discuss the approach to the self-study process. They were involved in the reviewing and the writing of the draft reports. The self-study process and this report reflect the advice of the Faculty’s Advisory Committee. The Faculty’s partners and alumni were consulted through discussions to obtain letters
of endorsement and the M.F.C. employer survey, among other conversations and discussions with the Dean and other Faculty members.

A brief recent history of the Faculty is helpful in understanding the context of the 2016 Cyclical Review. In 2006, the University introduced a new budget formula which allowed smaller units to maintain a base budget and grow organically. The latter was to be accomplished by generating new revenue to sustain the unit’s future growth. To this end, the Faculty of Forestry has made significant efforts over the past four years to improve the Faculty’s fiscal sustainability and, at the same time, grow student enrolment.

Prior to 2012, a decanal review was conducted by an external review committee. The review team members, Professors Bare and Saddler, stated that the quality of the Faculty of Forestry was “unassailable” and noted their support for Forestry’s strategic goal to contribute to the “greening” of the economy and efforts to be a global player in conservation and biomaterial science. Surprisingly, however, the review was interrupted by a revised Terms of Reference to focus on possible reorganization options and appropriate leadership to implement a new structure (Appendix 2).

The issues raised by these events have been seriously considered within the Faculty and during this self-study, and the outcomes of these deliberations are discussed in detail in Section 5.3 of this report, entitled “Financial Sustainability”. In that section, the opportunities available to Forestry to increase its revenue and to develop a “self-paying” budget model, with a focus on moving the Faculty towards a long term fiscal sustainability, are highlighted. The Faculty of Forestry has focused on graduate programs since the mid-1990s; however, undergraduate enrolment in forestry courses and programs, taught by Forestry, but offered through other units, has steadily increased. These offerings present additional opportunities to grow significantly, including options such as the “1+1 program” or double degree programs are being explored by the hosting division. Many examples of the success of similar 1+1 (grad), 2+2 and double degree programs are evident in Forestry programs at the University of British Columbia and Laval.

In 2010, an interim dean was appointed by the University administration for an initial one year term, which stretched over two years, to continue to transform Forestry’s fiscal sustainability. While a significant effort was made by the Faculty and the administration during this period, no agreement was reached in securing a sustainable future organizational structure to host the programs currently offered by the Faculty.

During this time, Forestry has continued to provide leadership in new and emerging areas of education and research, with a focus on urgent global issues. The Faculty successfully transformed the traditional model of forestry education into a new interdisciplinary model. The latter embraces a unique and innovative interdisciplinary approach in which there is social, ecological and bio-
economic convergence to address wide ranging issues related to human health, social justice and
trepreneurial career development. This has been accomplished without compromising the
competencies required to practice professional forestry as evidenced by the accreditation of the
Faculty’s landmark Master of Forest Conservation Program by the Canadian Forestry Accreditation
Board.

Modern forestry education is a broad-based enterprise that requires two elements to prosper: the
perspectives of forestry scientists and practitioners and collaboration with other disciplines
dedicated to various aspects of forestry education. Interdisciplinarity is valued as an approach to
investigating long term solutions to emerging global challenges such as climate change, ecological
management and the demands of the new bio-economy. To accomplish these ambitious goals, the
Faculty of Forestry has designed unique and innovative educational and research programs in Forest
Conservation, Climate Change and Forest Bio-economy, Forest Biomaterials Science, Ecological
Management and Urban Forestry (http://www.forestry.utoronto.ca/).

Our pioneering professional Master of Forest Conservation (M.F.C.) program is one of the first
anywhere to identify the opportunity to develop a leading professional educational program in
forestry. This flagship program helps our graduates develop unique knowledge and competencies
for conserving the world’s forests. It enriches their in-class and in-field experiences with insights on
public interests in forests and the integration of forest conservation, human health, the livelihood of
First Nations and Aboriginal peoples. Two of our undergraduate programs, Forest Conservation and
Forest Biomaterials Science, are offered through the Faculty of Arts and Sciences (FAS). One of the
Faculty’s more recently-introduced certificate programs, Renewable Resource Engineering, is
offered through the Faculty of Applied Science and Engineering (FASE). The Faculty of Forestry
currently has three graduate programs: Professional Master of Forest Conservation (M.F.C.), Master
of Science in Forestry (M.Sc.F.) and Doctor of Philosophy (Ph.D.).

Associated with the academic excellence of Forestry graduates are prospects for their career
development. One avenue open to Forestry graduates is the forest industry. Following a protracted
and unprecedented recession beginning in 2004, the traditional forest products industry in Canada is
transforming to incorporate the bio-refinery industry that is now projecting to add 60,000 new jobs
over the next 10 years (http://www.fpac.ca/forestry-jobs/). The political and social recognition that
climate change, clean water, boreal forests, urban sustainability, green technology are urgent
national and global priorities are the key elements driving this optimism in the forest products
industry.

The University of Toronto’s Forestry graduates diverse and innovative career paths are illustrated by
the responses of employers to a recent questionnaire (Section 2.4.5) and the testimonials of
students (Appendix 3). In the context of their high employability, graduates of the Faculty of
Forestry have changed the conversation about forest policy. In this review, we examine the
contributions of our graduates, particularly the Master of Forest Conservation alumni, who are prominent in the Ontario and Canadian forest policy network. Their education has given them the knowledge to be highly-valued employees in government, industry, forestry associations and non-profit and environmental non-governmental organizations.

2.0 Programs

Our collaborative and interdisciplinary approach to education and research, which is informed by social and environmental issues, cultivates the knowledge and competencies required of today’s forestry graduates and professionals. We prepare graduates to make their career mark in global contexts. Our expectation is that Forestry graduates will be positioned to make transformative contributions, often through knowledge translation, which will help society deal with the challenges of our times. A brief summary of the Faculty’s offering is as follows:

i. The Master of Forest Conservation (M.F.C.) is Canada’s first and leading interdisciplinary, career-driven and professionally-oriented graduate program in forest conservation, ecological management, policy and governance. Enrollment in the M.F.C. program has increased steadily over time and is projected to increase substantially in coming years (Figure 1: actual enrollment is shown for 2012-2016 and projections for 2016-2021). Our ratio of acceptance to applicants (offer rate), the key measure of the attractiveness of a program, has also decreased over time.
ii. Our M.Sc.F. and Ph.D. programs provide innovative, integrative, multi-disciplinary, research-intensive graduate education. Many of our graduate students come with backgrounds other than forestry and many of our research themes are uniquely designed to embrace inter-disciplinary approaches, with forests as a solution. Enrolment in the research stream graduate programs is growing (Figure 2), especially on a per professor basis (given that the Faculty complement has decreased over time), and is projected to increase further.

Source: Faculty of Forestry
iii. Two undergraduate programs and 17 undergraduate courses in transformative and innovative forestry disciplines are offered through the faculties of Arts and Science, Engineering, the University of Toronto at Mississauga and the University of Toronto at Scarborough. Enrollment in FOR courses and interdivisional teaching has grown considerably over time and (Figure 3) and again, this growth is even more pronounced on a per-professor basis.
2.1 Objectives: Consistency of all Faculty Programs with the University’s Mission and Forestry’s Academic Objectives

The University of Toronto is among the highest ranking public universities in the world; one of President Meric Gertler’s aims is to enhance the University’s global ranking even further. Universities are evaluated on the basis of multiple criteria to determine their global ranking and the Faculty of Forestry has identified areas where the University has significant opportunity to enhance its ranking. Specifically, we are focusing on our strengths to position ourselves as high achievers in the following areas: 1) unparalleled student experience and enrichment; 2) stellar research programs that are world class in terms of tackling global issues, as indicated by the high quality scholarship of our students and our professors; and 3) international involvement in Asia, Africa, North America, South America and Europe through our expertise in managing resources for a greener, cleaner and sustainable world. Associated with these priorities are the Faculty’s ability to attract significant and highly competitive research funds from national and international stakeholders and the achievements of faculty members in winning national and international awards.
The Faculty’s programs not only draw international students from around the globe but, importantly, our research programs also show the strength of our research collaborations, with 40 per cent of our published papers including other national and international partners (Section 4.3). We believe these are strong markers of our international engagement and recognition.

Over the years the Faculty has made significant efforts to improve our undergraduate and graduate student experience by providing class sizes that allows students to interact closely with professors and instructors both inside and outside the classroom. We continue to balance student experience and class enrolment by carefully monitoring the caps set by individual instructors in relevant senior level courses. The quality of our doctoral programs is being enhanced by reducing the time for completion below the University’s average. The Faculty is seeking increased funding from industry partners with the objective of developing joint research programs that relate to solving real life problems, thereby providing students with unique learning opportunities. These issues are discussed more fully in later sections.

The Faculty has many new initiatives to develop international and collaborative research programs with internationally high-ranking universities. For example, in Brazil we have established student exchange and research programs jointly funded by stakeholders including governments, NGOs and the private sector; namely Ford Brazil, Braskem, Embrapra, University of Sao Paulo, State University of Sao Paulo, University of Sao Carlos and the University of Campinas. In India we have a pilot joint program for doctoral student training that is designed to transform India’s graduate education. In Europe we have established strong research and student-exchange links through EU Framework funding supported by Canadian funding agencies. In China, we are very active in student and faculty exchange programs through a number of bi-lateral agreements.

The Faculty of Forestry has taken particular steps to increase high quality international students in our graduate programs. We have signed agreements with Brazilian, Mexican, Indian, Chinese and Swedish universities to engage in our recruitment process. Most recently, we have expanded our priorities to the United States and Singapore. At present about 15 percent of Forestry’s graduate students are from outside Canada. The Faculty has an aggressive plan to increase international enrolment to 25 per cent over the next three years. Some of the challenges the Faculty is facing in this recruitment process are the language skills required by the students who are exceptional in merit and are not from urban areas. Recently, the Faculty proposed a pilot project for English language training in line with the Faculty of Applied Science and Engineering pilot program. The approval of the pilot project would allow the Faculty to reach out to more students with academic excellence in Forestry schools in China, Brazil, Chile and Korea.
In another project, the Faculty is in discussions with two universities in China with regards to the opportunities for collaborating in “1+1 programs”: that is, programs of joint study between the Chinese institution and the University of Toronto (Appendix 5). The Faculty is hopeful that the University will help facilitate such international inter-university collaboration. This is further discussed in Section 6. The University wishes to encourage international partnerships and collaborations, including international collaborative programs for undergraduate and graduate students, and this direction supports Forestry’s objectives to increase the number of international graduate students.

The Faculty believes that the strategies discussed above dovetail with the University’s objectives. President Gertler described these to be objectives that “strengthen and deepen key international partnerships by means of a well-defined strategic focus” (see http://threepriorities.utoronto.ca/).

Associated with the Faculty’s planning priorities, which are in line with the University’s objectives, is our mission to continue to recruit even more female students in our professional and research streams. It is striking to note that our female students now form the majority of our graduate cohort (Figure 4). This trend is encouraging for the Faculty as we seek to grow more diversity in all facets of our program offerings.

**Figure 4**

**Percentage of Females Enrolled in Faculty of Forestry Programs from 2009 to 2015**

Source: Faculty of Forestry
Historically, urban forestry has been a strong asset of the Faculty of Forestry, and continues to be so today. Strategically, the Faculty of Forestry is taking a proactive role in providing education aimed at urban social, environmental and economic solutions. This work again supports President Gertler’s objective to “leverage our urban locations more fully, for the mutual benefit of University and City” and within the global context. Forestry has pioneered urban forestry and green infrastructure in educational and research programs. The Faculty is motivated to influence policy development aimed at making Toronto one of the greenest and most sustainable global cities, and also to promote its thriving and world-leading research programs in green infrastructure and green transportation. Forestry students have created urban start-up companies that create employment and career opportunities that otherwise would not exist. For example, one such company, Urban Forest Innovations Inc., undertakes “detailed structural analysis of the urban forest resource, as well as in-depth management cost/benefit analysis to support improved decision-making and sustainable management” (see http://urbanforestinnovations.com/services/urban-forestry/).

2.2 Admission Requirements for all Forestry Programs: Appropriateness of Admission Requirements to the Learning Outcomes of the Programs

The undergraduate degree programs offered by the Faculty of Forestry are:

* Forest Biomaterials Science, B.Sc., Hons.: Major, Minor
* Forest Conservation (Science), B.Sc., Hons.: Specialist, Major, Minor
* Forest Conservation (Arts), B.A., Hons.: Specialist, Major, Minor

*offered through the Faculty of Arts and Science;

i. Undergraduate Programs

The Faculty of Forestry has high admission standards that follow or exceed the requirements of the University of Toronto. Undergraduate admissions are governed by the Faculty of Arts and Science: (see http://www.artsci.utoronto.ca/futurestudents/admissions/guidance/faqs).

As shown in Figure 5, the applications, offers and registrations have increased for undergraduate applicants to the Faculty of Arts and Science (and Appendix 4).
The grade level admissions in the Faculty of Forestry undergraduate programs are in shown in Figure 6 (and Appendix 4). The data indicate that the averages of undergraduate students entering Forestry programs (through the Faculty of Arts and Science) are relatively stable and high with the (department) average consistently above 85 per cent.
The Forestry undergraduate applicants must first be admitted to the Faculty of Arts and Science. Once admitted, students who have completed at least 4.0 undergraduate courses are eligible to enroll in Forestry undergraduate programs.

The Forest Biomaterials Science Major and Minor (Science programs) enhance experiential learning through research projects and the availability of our state-of-the-art research facilities, interaction with industry, and small class sizes. They also promote direct interaction between the students and participating wood products companies through field trips to their facilities and support of student projects based on industry issues. The programs are interdisciplinary and the details about learning outcomes are discussed in Section 2.3.6.

The Forest Biomaterials Science programs may be strengthened by an accompanying major or minor(s) in Biology (major, minor), Biochemistry (major), Forest Conservation (major, minor), Chemistry (major, minor), Environmental Chemistry (minor), Materials Chemistry (minor) or Environment & Science (major, minor). This program has unlimited enrolment and no specific admission requirements. All students who have completed at least 4.0 undergraduate courses are eligible to enroll.

Figure 6

Undergraduate Grade Level Admissions

Source: Standardized Data
The Forest Conservation Science Specialist, Major, Minor programs and the Forest Conservation Arts Specialist, Major and Minor programs prepare students for the critically important role of recognizing the cultural, social and environmental role of forests, as well as the traditional economic values of forests. These programs combine traditional ecological and other sciences with social sciences and humanities. Forest conservationists increasingly focus on complex, emerging social and community issues, such as aboriginal rights and land tenure, protected areas, preservation of urban green space, and the use of forests and forest products for carbon sequestration. More description of the differences between these programs and their learning outcomes are described in Section 2.3.6.

ii. Professional Master of Forest Conservation Program (M.F.C.)

The minimum requirements for the course-intensive 16 month Master of Forest Conservation (M.F.C.) program are an appropriate bachelor’s degree from a recognized university with an average in each of the final two years of at least mid-B. The M.F.C. program is intended for students with a strong undergraduate background in ecology, environmental sciences, forestry, natural sciences, biology, physical geography, geology, agricultural science, or relevant social sciences. Students from other disciplines will be considered by the Faculty, but may be advised to take appropriate background courses prior to admission. Additional documentation must be submitted to the Faculty with the completed application form, including transcripts, three references, a letter of interest in the M.F.C. program, and a resumé.

All graduate units at the University of Toronto are required to meet the minimum admission standards of the School of Graduate Studies (SGS). Units can choose to set higher standards than those of SGS. In Forestry’s case, for the M.F.C. program, we have also done this. Forestry requires an average of mid-B in each of the final two years of study in the undergraduate program, whereas the SGS requirement is a mid-B in the final year of study.

The primary objective of the M.F.C. program is to enable graduates to make a difference. They will do so by entering into professions responsible for the policies and practices that have a profound impact on all living organisms and on the sustainability of human social and economic systems; work that is crucial to society and the planet’s health.

The M.F.C. program is accredited by the Canadian Forestry Accreditation Board. Accreditation by an external body ensures that Forestry students graduate with the competencies required to practice professional forestry.

M.F.C. students study all aspects of forest conservation, including sustainable forest management, urban forestry, forest economics, forest governance and policy, conservation biology, silviculture, and current issues in forest conservation in Canada and around the world. M.F.C. graduates learn to
feel confident in their knowledge of forestry and conservation issues and methods and in their ability to think analytically, write and speak clearly and convincingly about complex issues and ideas, work effectively in groups of people with sometimes disparate views, and critically assess and apply information.

iii. Research Programs: Master of Science in Forestry (M.Sc.F.), Doctor of Philosophy in Forestry (Ph.D.)

At the outset, it is important to clarify that the application process adopted by the Faculty of Forestry for research-stream programs (M.Sc.F. and Ph.D.) differed from that of many other university divisions. Historically, Forestry research supervisors pre-screened students before they proceeded to a formal graduate application. This fact led in past years to an artificially high offer rate (the ratio of admitted students to applicants). Over the past three years, the Faculty has made some changes in its recruitment approach, which has decreased our offer rate.

Applicants for graduate programs are admitted under the General Regulations of the School of Graduate Studies (see http://www.sgs.utoronto.ca/calendar/Pages/Programs/Forestry.aspx). Forestry has set a higher standard for admission to the Ph.D. program (as compared with the School of Graduate Studies (SGS) regulations). We admit to the Ph.D. on the basis of an A- average in the Master’s whereas the SGS regulation is for a B+ average in the Master’s program.

Applications that meet the minimum admission requirements are reviewed by an admissions and awards committee for decisions. The committee consists of five graduate faculty members and is chaired by the Graduate Coordinator at the Faculty of Forestry.

In 2011, the argument was made by the previous University administration that the Faculty’s offer rate was higher than the university average, however, our high rate was an artifact of the Faculty’s admission policy to screen applicants through interviews with interested research professors prior to an application. Unfortunately, this high offer rate was used as justification by the previous administration to reduce Forestry’s graduate student government funding allocation (i.e., BIUs) by 35 per cent for master-level FTEs (i.e., budgetary academic allocation). This decision adversely affected the Faculty’s fiscal situation from 2011-2012 because it resulted in a 15 per cent overall revenue reduction for the Faculty. During the last four years, the Faculty is slowly transitioning from its conventional recruitment process to the university-wide adopted system. Today, the Faculty’s offer rates to graduate student applicants is below 60 per cent (Figure 5), which indicates that the Faculty’s student offer rate is stronger than in many other divisions.
Consequently, there is no valid reason that the Faculty continues to be barred from receiving government funds (i.e., BIUs), especially given that the domestic program has experienced 40 per cent growth in the meantime, as shown in Figures 1 and 2. The University administration has recently restored a portion of the government funding.

The minimum requirement for the research-stream Master of Science in Forestry (M.Sc.F.) program is for applicants to have an appropriate bachelor's degree from a recognized university, with a final-year average of at least mid-B. A minimum of B+ is required for the collaborative program with Environmental Studies. Additional documentation must be submitted to the department with a completed application form, including transcripts, three references, a letter of intent, a resumé, and a writing sample.

Applicants are admitted to the four-year Doctor of Philosophy (Ph.D.) program via one of three routes. The first is with an appropriate master's degree from a recognized university with at least an A- standing, in a discipline appropriate to the intended field of doctoral study and research. The second is direct entry in exceptional circumstances, where there is an extraordinarily strong applicant with an appropriate bachelor's degree from a recognized university. The third is, under certain specific conditions, for outstanding M.Sc.F. students to be considered by the end of their first
year in the M.Sc.F. program for transfer to the Ph.D. program. In all cases, the applicants must submit additional documentation to the Faculty with a completed application form, including transcripts, three references, a letter of intent, a resumé, and a writing sample.

The learning outcomes for M.Sc.F. and Ph.D. students are associated with the focused research they conduct under the supervision or co-supervision of Faculty members. Faculty members’ research is interdisciplinary and typically applied in nature, distilling the utility and impact of discoveries and enabling partnerships with the public, private and non-profit sectors.

Successful candidates come from a variety of backgrounds including biology, botany, ecology, economics, environmental studies, engineering, forestry, agriculture, mathematical and computer science, physical and social sciences, and zoology. The students’ research programs are developed to reflect their individual strengths and research interests. The research interests of Faculty members include (but are not limited to):

- Forest conservation biology and wildlife ecology
- Forest biosphere science
- Invasive species and threats to forest health
- Environmental sustainability of managed forests
- Fire and ecosystem management
- Sustainable development and economics
- Forest Policy and other interests related to the governance of forests
- Social and cultural ecology of forest ecosystems
- Urban forestry
- Forest Bio-materials Science
- Bio-energy

The objectives of the M.Sc.F. and Ph.D. programs are to provide high level education and training in broader forestry research and to encourage critical analytical thought processes. In the M.Sc.F. program, students will become acquainted with forest research methods as applied to the sustainable management and conservation of forests, forest product engineering sciences and the social impact of forests in Canada and globally. They will also acquire in-depth familiarity with a body of knowledge and literature relevant to their specific area of research.

Among the learning outcomes for the Ph.D. program are the integration of advanced instruction from several relevant fields of study, and competence in interpreting the data or literature from these fields at a level appropriate to the advanced research being undertaken. The capacity to design and conduct independent research and to make innovative contributions to the body of knowledge in the area of specialization is another learning outcome, as is the ability to communicate scientific knowledge and expertise at an appropriate level, orally, in writing.
and through use of new media of communication. The ability to demonstrate leadership and to translate research into real-life opportunities and solutions are desired learning outcomes.

2.3 Curriculum and Program Delivery

Curriculum development and control is exercised by four standing committees of Faculty Council: Executive Committee, Graduate Education Committee, Graduate Admissions and Awards Committee and the Undergraduate Education Committee. The powers and duties of these committees within Forestry’s organizational structure and governance are described in Appendix 6.

The Forestry programs and courses are described in www.forestry.utoronto.ca/index.php/courses/?pg.grp=programs

www.forestry.utoronto.ca/index.php/undergraduate-programs/

2.3.1 Curriculum Reflects the Current State of the Forestry Discipline

The Faculty’s program offering has been transformed over the past 15 years. It is reflected both in our Faculty’s research as well as in curriculum development. For example, our professional graduate program (M.F.C.) has brought forward the much needed inclusion of forestry’s role in modern society, which includes social, ecological, economic, and the human dimensions. Most of our course offerings reflect those changes within our revised curriculum; today our Faculty is a reflection of our interdisciplinary curriculum approach. Our curriculum is built on the unique expertise of our faculty members and instructors. We have social components and forest bio-materials engineering expertise, in addition to our faculty expertise in urban forests, conservation, ecological restoration and management, and biodiversity. Another important change brought forward in our curriculum is experience-based learning:

1. In our undergraduate programs we offer the opportunity to work with researchers in their labs.
2. In the M.F.C., we include a mandatory internship and more exposure to applied statistics and ethical learning to address social and human dimensions, as well as understanding the government policy development.
3. In our research stream programs, we often integrate the expertise of stakeholders by including them as a part of the unit’s supervisory role. For example, a graduate student can spend a considerable amount of time doing research in a national or provincial lab on a specific research topic that is of national and global importance. In yet another example, our research-stream graduate students can now spend part of their time in an industry or non-profit organization under the co-supervision of an expert (governed by SGS supervisor quality assurance criteria) from that industry or NGO.
Our curriculum now reflects developments in the Faculty’s research areas such as urban forestry, ecological management, climate change, carbon sequestration and canopy modelling; bio-energy, bio-materials, mining land restoration, and the forest bio-economy; and social justice relevant to First Nations traditional lands. These research areas are enhancements to traditional curriculum offerings that focused mostly on up-stream forest management and wood science. The Faculty believes these new directions address societal challenges, while enhancing our graduates’ career opportunities and helping to create a new generation of research graduates that are more effectively translating their knowledge to forestry professionals and practitioners.

2.3.2 Appropriateness of the Program’s Structure, Curriculum and Length to its Learning Outcomes and Degree Level Expectations

i. Undergraduate Programs

The undergraduate degree programs offered by the Faculty of Forestry are:

*Forest Biomaterials Science, B.Sc., Hons.: Major, Minor
*Forest Conservation (Science), B.Sc., Hons.: Specialist, Major, Minor
*Forest Conservation (Arts), B.A., Hons.: Specialist, Major, Minor
**Renewable Resource Engineering Certificate

*offered through the Faculty of Arts and Science;

Forestry’s Undergraduate courses are offered through the Faculties of Arts and Science, Engineering, Architecture (St. George Campus), and the University of Toronto Mississauga (UTM) and the University of Toronto Scarborough (UTSC) campuses.

The Forestry’s undergraduate programs are also described in detail in the Faculty of Arts and Science 2015-2016 Calendar http://www.artsandscience.utoronto.ca/ofr/calendar/crs_for.htm.

The Faculty of Forestry’s undergraduate Forest Biomaterials Science programs prepare students for the new and exciting technologies that are transforming forest resources into biodegradable polymers, specialty chemicals and carbon neutral fuels. Students in this program acquire a thorough understanding of forest sustainability; the material science of wood and other forest-based materials; bio-conversion technologies related to forest and agricultural materials and optimal use and maintenance of natural fibre-based materials. The program is highly interdisciplinary, combining aspects of forestry, biology, chemistry, chemical and mechanical engineering and building sciences.

The major (requiring eight full courses) and minor (requiring four full courses) programs in Forest Biomaterials Science interest students who recognize the value of conserving the forest through good design, and the application and utilization of forest based products. Graduates from this program can pursue careers in private industry, research and government organizations where
knowledge of new and changing technologies will be required to lead the transformation from petro-chemical based industries to ones established on renewable biomaterials.

There is one required course in first year for all undergraduate programs, BIO120H1 Adaptation and Biodiversity. This course provides the principles and concepts of evolution and ecology related to the origins of adaptation and biodiversity and various perspectives using empirical and theoretical approaches. The topics covered in this course include genetic diversity, natural selection, speciation, physiological, population, and community ecology, maintenance of species diversity, conservation, species extinction, global environmental change, and invasion biology.

The Faculty of Forestry’s **undergraduate Forest Conservation programs** prepare students for the critically important role of managing forests for their immense cultural, social and environmental role as well as for traditional forest products, by combining traditional ecological (ecology, botany, zoology) and physical (soil science, hydrology) sciences with social sciences. Forest conservationists increasingly focus on complex, emerging social and community issues, such as aboriginal rights and land tenure, protected areas, preservation of urban green space, and the use of forests for carbon storage and sequestration.

Responsible stewardship of our forests and the changing focus from industrial timber production to forest conservation has greatly expanded the range of expertise necessary. Graduates can pursue a wide range of new career opportunities developing in private industry, government and non-government environmental organizations where forest conservationists increasingly work as members of multidisciplinary teams of environmental and resource managers. Graduates from forest conservation programs can also pursue graduate programs in a wide range of disciplines, including forest conservation, forestry, biology, environmental sciences and international development.

Students may take a Specialist 4-year degree leading to an Hons. B.Sc. degree in Forest Conservation Science or an Hons. B.A. degree in Forest Conservation Arts. The Science program concentrates on forest biology and ecology with electives in life and physical sciences. The Arts program focuses on social forestry, sustainable forest management, development of forest policies, forest economics and forest product trade, with electives in social sciences, while.

The Specialist programs (requiring 12 full courses) provide grounding in forest conservation with emphasis on breadth as well as research depth. These programs meet the needs of individuals who are considering graduate level education in forestry (M.F.C., M.Sc.F. or Ph.D.).

The major programs in Forest Conservation are intended to build on students’ interest in forestry and related issues. Students are advised to consider combining these programs with a major in
another related discipline such as environment, geography, biology, chemistry, urban studies or architecture.

A minor in Forest Conservation Science (Science program requiring four full courses) and a minor in Forest Conservation (Arts program requiring four full courses) are also available. Students are also advised to consider combining these programs with a minor in other related disciplines.

ii. Professional Master of Forest Conservation Program (M.F.C.)

All M.F.C. students are required to take a common core program of ten integrated 0.5 F.C.E. courses (including a biodiversity field camp at the Haliburton Forest, located in central Ontario and another field camp in the northern boreal forest in Mattawa), one international or urban forestry field camp course (0.5 FCE), and two elective courses in Forestry (1.0 FCE) or other graduate divisions of the University over a 16-month period. Additionally, all students must complete a practical internship during the summer semester in which they work on practical forest conservation projects, either in Canada or abroad. In their final semester, they must prepare and orally present a major research paper or management report, called the Capstone project, to faculty, staff and invited guests (1.0 FCE) (including their internal and external supervisors, [see below]). The course-work/program requirements for full-time, extended full-time, and part-time students are the same as that for full-time students.

The M.F.C. course outlines are shown in Appendix 7. The majority of the courses are presented in part through lectures. Most courses have an element of problem-oriented instruction through assignments; for example, Society and Forest Conservation (FOR3010) requires group work on solving problems and a presentation. There is a required course in first term called Analytical Methods in Forestry (FOR 3012), which covers GIS, statistics, professional ethics, conflict resolution and social science issues.

A significant amount of course material, however, is delivered through the field work courses which are mandatory (see in Section 2.3.4 (ii)). It is estimated that 60 per cent of the course delivery is by lectures and problem-oriented instruction through assignments and 40 per cent is by field work.

M.F.C. students and those in Forestry’s graduate research programs can choose to complete a Collaborative Program in Environmental Studies through the University of Toronto’s School of the Environment.

http://www.environment.utoronto.ca/Graduate/Programs/EnvironmentalStudiesCollaborativeProgram.aspx
iii. Research Programs: Master of Science in Forestry (M.Sc.F.), Doctor of Philosophy in Forestry (Ph.D.)

All students accepted into the research-oriented degree programs are required to take one 0.5 F.C.E. courses (Graduate Seminar). M.Sc.F. students are also required to take one elective course of 0.5 F.C.E., and prepare a research thesis. Ph.D. students are required to take three elective courses of 0.5 F.C.E. each and prepare a research thesis. All Ph.D. students also take a qualifying appraisal examination in months six to 16 of study.

The criteria used to evaluate the level of competence for Ph.D. candidates are monitored by committees comprising internal faculty, inter-divisional and/or external experts that meet at least yearly. The internal defense committee consists of supervisory committee members and one graduate Faculty external to the committee; the final external defense (senate) committees comprise members from internal and external divisions and a qualified individual external to the University. Here, there is broader emphasis on capturing and evaluating the fundamental knowledge development in the given area as a key component to confer a research stream graduate degree.

2.3.3 Evidence of Innovation or Creativity in the Content and/or Delivery of the Program Relative to Other Such Programs

i. Undergraduate Programs

Uniqueness of Forestry’s undergraduate offerings:

Our undergraduate course offerings provide enriching experiences for students because most of the courses are delivered with three approaches. First, course lectures are given by experienced instructors. Second, guest lectures are delivered by relevant experts from research, business, non-governmental organizations and other fields. Third, our undergraduate students receive exposure to concrete issues by practicums or field trips. The latter approach has become a popular pathway for introducing research training into our undergraduate curriculum. This is discussed in Section 2.3.5.

Forestry has also fostered an innovative curriculum in our undergraduate programs by offering new undergraduate courses that are more relevant to contemporary forestry issues. In our Forest Conservation B.A. and B.S. programs, for example, we integrate social science with natural science.

The Renewable Resource Engineering Certificate, introduced by the Faculty of Engineering as part of a long-term partnership plan between the Faculty of Applied Science and Engineering and the Faculty of Forestry and primarily taught by Forestry faculty, is an example of Forestry providing leadership in the multi-disciplinary engineering space. The forestry courses taught to undergraduate students prepare them for careers in building with new composite materials required by LEED
certification, in the packaging industry to find alternative biodegradable products, USDA certification and finding sustainable biofuels and bioenergy alternatives for the energy sector (Appendix 8).

The undergraduate courses we teach in Engineering include FOR 308, Discovering Wood and its Role in Societal Development, FOR 421 Green Urban Infrastructure: Sustainable City Forests, FOR 424 Innovation in Manufacturing of Sustainable Materials and FOR 425, Bio-energy and Bio-refinery Technologies. The enrolment in these courses meets the cap. This demonstrates a growing interest in the younger generation to learn about relevant forest issues and the larger environmental, economic and social factors associated with forestry. At this point in time, the senior level Forestry undergraduate course offerings consistently attract more than 50 students, which is above the average of the University’s senior level undergrad enrolment. The growth in undergraduate course enrollments is shown in Figure 3. The popularity of these senior courses is driven by the increased career opportunities worldwide in ecological management, urban infrastructure and green space, bio-energy, bio-manufacturing, bio-economy and policy development. These courses provide early stage research experience and real life case studies embedded in their course curriculum. For example, FOR 424 has a pilot facility experience where students participate in the demonstration of leading edge manufacturing processes.

Uniqueness of Forestry’s graduate offerings:

ii. Professional Master of Forest Conservation Program (MFC)

One of the unique elements of our M.F.C professional offering is a mandatory internship with exposure to real life challenges in the forest conservation. All students in their third term work with forestry stakeholders and professional partners (see Appendix 9) to experience on-the-ground problem solving and to enrich their knowledge beyond traditional forestry matters. For example, the Faculty collaborates with the Haida Gwaii Higher Educational Society (formerly known as the Queen Charlotte Islands) in British Columbia and the provincial Ministry of Forests, Lands and Natural Resource Operations for student course work and for M.F.C. internship placements.

Internships are typically for a three-month period between June and August. The students receive a pass or fail grade for their internship. The Internship typically provides the basis for the student’s major “capstone” research paper or conservation report, which is the final formal requirement of the M.F.C. program. The Faculty typically arranges internships in government, industry and ENGOs (i.e. environmental non-governmental organizations).

The internship is designed to provide students with practical experience in the day-to-day planning for forest conservation. All internships must meet the following criteria:

- Forest conservation issues must be identified, either by or in conjunction with the host organization.
• Solutions and implementation strategies for these issues are to be determined.
• The internship includes interaction with stakeholders, including forest managers, workers, landowners, scientists and planners.
• A final written report is submitted by the intern to the host organization.

Students are assigned two collaborating supervisors; one from the host organization and another from the Faculty. Co-supervision between the Faculty and the host organization ensures that both academic and practical goals are met. The Faculty supervisor helps the student prepare for the internship, serves as a liaison with the host supervisor during the internship, and supervises the student’s preparation of the final internship report. An important feature of this work experience is the self-evaluations done by the students and the host evaluations done by the employer.

The M.F.C. students appreciate the advantages offered by the Internship. One young woman who now works as a Manager in Pine Beetle Recovery for the British Columbia government observed:

“Upon entering the program, I was a young B.Sc. graduate who was looking for a career focused on environmental advocacy at some environmental non-profit. Although there is a time and a place for this type of advocacy, one of the things the program taught me is that balance is key. ... Invaluable experiences such as industry, government, and non-profit presentations, lectures and internship opportunities groomed me to pursue a professional career in sustainable management.”

Other M.F.C. graduates are impressed with the broad range of interests captured in the Internship:

“The diversity of the Faculty is reflected in the numerous internship opportunities available to students. For example, if students take interest in the social aspect of forestry, they can spend the summer in Brazil learning about the Kayapo people and how deforestation has affected the tribe’s culture. Or, if students are interested in urban forestry, they can intern in Toronto or other cities across Canada and work with scientists on projects ranging from biodiversity monitoring to invasive species control. Students can rest assured that there is an opportunity to gain hands on experience in any area of forestry that piques their interests.”

and

“The mandatory internship program involving community leaders, industry, government and NGOs are distinct from other programs because of the strong relationships the Faculty has developed with these diverse organizations. Through their internships, the students are exposed to diverse problem sets including policy formulation, industrial products such as bio-energy and bio-materials, climate change data base development, carbon storage database development, urban canopy inventory studies, and mining land restoration, among other knowledge areas.”
This custom-designed internship program, combined with international and domestic field camps and trips discussed below, situate our M.F.C. graduates in a unique position that is sought after by organizations that have come to recognize forest conservation education as an important asset in their employment criteria. Another benefit associated with the internship program is that M.F.C. graduates are often hired by the participating internship organizations (see Section 2.4.5.).

iii. Research Programs: Master of Science in Forestry (M.Sc.F.), Doctor of Philosophy in Forestry (Ph.D.)

The Faculty’s research programs, compared to programs in many other disciplines, have a broader array of learning experiences and opportunities for collaboration, resulting from the interdisciplinary nature of the Faculty’s curriculum. This is true not only with respect to their professors and the course work, but also with respect to their fellow students.

The breadth of experience has numerous innovative components associated with the interdisciplinary nature of the research programs. For example, a doctoral student studying the human health effects of native and non-native species in the urban environment is working with experts who are not only urban foresters but also public health specialists and city planners. Broadening the expertise and, at the same time, keeping the focus on the depth of the fundamental knowledge development of our research students are continuing challenges for our innovative programs. We have been able to find a balance, without compromising the rigour and depth needed, to earn a doctoral or master degree that conforms to the University of Toronto’s reputation as a world class university. We are immensely successful in driving and adopting those innovative changes. A direct effect of this innovation is that our graduates are not only sought by forestry sectors but by a diversity of employers including automotive manufacturers and oil and gas companies. Some of our research graduates are highly entrepreneurial and make their own jobs by creating start-up companies and other businesses, including consulting.

Another innovative aspect of our program, for the research stream and the M.F.C. program, is the leadership training received by our students who are exposed to problem solving that, in addition to a strong knowledge base, also requires personal skills and the ability to lead a group. For example, the M.F.C. students are required to do individual and group presentations in most of their courses.

2.3.4 Opportunities for Student Learning Beyond the Classroom

i. Undergraduate Programs

The Faculty has made significant efforts to link classroom teaching to real life situations. Many of the undergraduate courses combine field trips, guest lectures and hands-on practicums that enrich
students with knowledge otherwise unavailable. In FOR 300H1, Forest Products in Sustainable Forestry, and FOR423H1, Sustainable Materials Design and Manufacturing, students are exposed to experiential learning. For example, FOR 424 students from engineering are exposed to industrial scale demonstrations of forest based fibre and lignin processed into lightweight composite products for the green building and the green transportation industry.

ii. Professional Master of Forest Conservation Program (M.F.C.)

Each M.F.C. student has the opportunity to attend an international field course to gain a global perspective on forest conservation issues. Field courses are typically two to three weeks long and are offered early in the summer semester. International field courses have been conducted in China, Malaysia, Brazil, Denmark, Spain, Mexico, Nepal and Costa Rica, to name a few. The country for the international field course is carefully selected in order to expose the students to urgent forest-related global issues within a cultural context that optimizes the learning experience. In many cases, countries are selected in which professors have particular expertise.

A lower cost Urban Forestry Field Course, visiting locations throughout Ontario and Quebec, and the northern United States, is also offered to M.F.C. students in the summer semester. The urban field course program exposes students to on-the-ground issues by visiting selected Canadian and American sites that demonstrate the challenges facing the urban forestry community. The importance to forestry professionals of open communication, leadership and networking in the urban forest context is emphasized.

In term one, there is one week of field work in September spent in the 100,000 acre/40,000 hectare Haliburton Forest and Wildlife Reserve for the M.F.C. course on Biodiversity of Forest Organisms (FOR3001). Students undertake an intensive program of biodiversity sampling and learn about forest operations such as tree marking and sawmilling. The spectacular Haliburton Forest is located in the Great Lakes- St. Lawrence forest and is one of the Faculty’s major research partners ( see http://www.haliburtonforest.com/).

In February, in the second term, M.F.C. students experience the annual mandatory three-four day field trip to Mattawa, in the transition zone between the Great Lakes-St. Lawrence and northern boreal forests, which is led by the Canadian Institute of Forestry (CIF) and the Canadian Ecology Centre. Faculty and students work with professional foresters on silvicultural systems and forestry operations. Both the CIF and Haliburton Forest take M.F.C. interns every year.

Field courses give students full immersion into forest conservation and management issues. International courses also give students an opportunity to gain experience in a different culture — valuable skills for those aspiring to a career with international organizations.
iii. Research Programs: Master of Science in Forestry (M.Sc.F.), Doctor of Philosophy in Forestry (Ph.D.)

Research graduate students may also join the international and urban forestry field courses. Research students are now working more and more outside the academic setting because their research programs are becoming increasingly relevant to fundamental problem solving. Students are often spending a part of their time in government and industry (forestry and non-forestry) research labs and in other countries.

2.3.5 Opportunities for Student Research Experience

i. Undergraduate Programs

Opportunities for students to gain research experience have expanded from the professional M.F.C. and graduate research programs to undergraduate programs. Each year undergraduate students in senior classes (300 and 400 levels) are exposed to practicums that are directly related to graduate research. For example, FOR 424, Innovation in Manufacturing of Sustainable Materials and FOR 425, Bio-energy and Bio-refinery Technologies, are courses that are oriented towards current research topics. One teaching/tutorial component of these courses is exposure to the Forestry laboratories where the research has been conducted on the relevant topic. Forestry graduate students explain and demonstrate their research objectives, approaches, methodologies and outcomes to undergrad students, who participate in a question-answer session followed by report writing. As a result of this approach, we have seen a steady increase in research-based projects by senior level students in partial fulfillment of their degree.

In yet another strategic move aimed at enriching the undergraduate experience beyond classroom learning, the Faculty of Forestry encourages faculty members to engage students in their respective research programs. As a result, the number of undergraduate research assistants engaged in research with our instructors and external partners has grown significantly in past three years. Another important milestone in drawing together undergraduates and research experience is beginning to be found in the increased number of publications. At the Faculty, the contribution of outstanding undergrad students are recognized by their inclusion in conferences and encouragement to be involved in peer reviewed publications. These emerging developments in the Faculty are shown in Figure 12, Section 3.3 of this report.

ii. Professional Master of Forest Conservation Program (M.F.C.)

For our professional master students, engagement in research is mandatory in the M.F.C. curriculum. FOR 3008HF is the final “capstone” project for the M.F.C program. It involves analyzing and preparing a formal report, typically based on the summer internship and in consultation with
the faculty and external supervisors. External examiners often play an important role in defining the project upon which a report is based. In December, students deliver a seminar presentation on their work (30 per cent of course grade), which includes an oral defense of the final written paper (60 per cent of course grade).

The capstone project is designed to provide students with an opportunity to carry out a project at a professional level. It also provides an opportunity to evaluate relevant literature in forest conservation, develop professional competencies, and develop critical research skills.

The array of topics explored by M.F.C. students is impressive (Appendix 10). The M.F.C. research projects are diverse. They focus on the local urban and global forestry issues, involve the social and natural sciences and require scientific and technical knowledge. A sampling of recent capstone research projects includes the following:

- Making forest conservation matter to urban communities at Ontario’s Royal Botanical Gardens
- An evaluation of coarse woody debris in the Rouge National Urban Park
- An assessment of habitat suitability in old growth and secondary retention areas on Haida Gwaii
- Modelling the influences of initial growth conditions to the forest yield of secondary mangrove forest in West Papua, Indonesia
- Local- and landscape-level habitat relationships of three small mammal species from understory trapping in mature, post-harvest mixed hardwood forests in south-central Ontario
- Restoring High Park’s black oak savannah from invasive plants: An educational workbook on dog-strangling vine (*Cynanchum rossicum*)
- Revisiting the limits of Ontario’s Forest Resources Inventory for predicting species composition: A study from the Chapleau Crown Game Preserve

iii. Research Programs: Master of Science in Forestry (M.Sc.F.), Doctor of Philosophy in Forestry (Ph.D.)

Research degree graduates are mandated to work on a research topic. For a research-based master (M.Sc.F.), their research is conducted under the supervision of a Graduate Faculty member for a minimum period of one year. Their research topics cover a broad range, reflecting the Faculty’s inter-disciplinary influence, and include the following recent graduate theses:

- Post-harvest mortality in SE Yukon following partial stand harvests
- Polypore fungus impacts on canopy physiology processes
- Effects of an acute spring heat event on canopy processes in a northern hardwoods forest
- Ground-penetrating radar as a tool for assessing rooting profiles
- Age-related crown thinning in tropical canopy trees
• The fifth pathway to forest transition in the Andes: modeling factors that influence smallholder tree planting
• Private environmental preference (PEP) in pollution reduction: structural equation modeling and cross-cultural approaches
• Economic impacts of forest stewardship council certification on international trade of forest products
• Modelling and optimizing the extraction of phenolic compounds from bark
• Climate-induced tree migration in southern Ontario: pathways and source populations

In the Faculty’s doctoral program, the thesis is the major focus of graduating students. A Ph.D. student typically spends three to four years conducting research under the supervision of a graduate faculty. This is timed with the completion of their mandatory research intensive course work. A sample of the dissertations for graduating doctoral students again displays the diversity and the relevance of the research topics to modern forestry and urgent global issues:

• Evaluating health and educational benefits of schoolyard trees
• Boreal forest feedbacks with climate and microclimate
• Boreal forest management impacts on albedo, snow cover, and soil greenhouse gas flux
• Evaluation and design of biochars for restoration on acid-generating mine tailings in Ontario
• Decay dynamics and methane emissions of coarse woody debris
• Outcomes and prospects for collaboration in two Aboriginal and Non-Aboriginal forest management negotiations in Ontario
• Economic analysis of world’s carbon markets
• Public forests, private governance: the role of government in forest certification in Canada
• Multi-cohort stand structural classification for boreal forest types: ground-and LiDAR based approaches
• What happens after establishment? Using Gypsy Moth to explore the indirect impacts of invasive species on native lepidopteran communities
• Effect of fiber morphology and mixing conditions on fiber characteristics in bio-fibre composites processing
• Nanocellulose reinforced composites
• Enzymatic modification of bark for PU application
• Evaluating the greenhouse gas mitigation potential and cost-competiveness of forest bioenergy systems in Ontario
• Ecophysiology and wood carbon content in tropical trees: a comparative study of island and mainland Neotropical species.

Doctoral students in the Faculty are increasingly exposed to unique research experiences, a trend that is in line with our interdisciplinary programs. There is careful emphasis on resolving real life
challenges by improving understanding and applying the fundamental principles of science, creativity and engineering where applicable. For example, research carried out by a doctoral student in the area of restoration ecology often also involves data collection in the field with the co-supervision of an external expert.

Important to the graduate student research experience are the Faculty’s state-of-the-art research laboratories housed in our research partners’ organizations. Students are being stationed at these facilities for various periods of time to gain an understanding of the fundamental challenges of devising real life solutions. For example, Ford Motor Company Canada has developed a key laboratory in Windsor that gives our students this critically important research exposure. Another example is the placement of research students in key national research laboratories such as Canadian Forest Service Research Laboratories (CFS) and provincial government research laboratories, primarily those associated with the Ontario Ministry of Natural Resources and Forestry.

In addition, the Faculty of Forestry has access to two very valuable field sites for research and instruction. The Haliburton Forest and Wildlife Reserve, mentioned above, is equipped with a field laboratory and bunkhouse. In addition to the September field course, mandatory for all Forestry graduate students, Haliburton Forest is also used as a base for significant Faculty research programs. The productive research relationship between the Faculty and Haliburton Forest, which also directly benefits students, is described by the owner and the general manager:

“Prof. Sean Thomas’ work on biochar has provided critical data to the emerging biochar sector. Thanks to his work we are in the process of building North America’s largest biochar production facility, which will produce over 10,000 tonnes annually. Of particular note is that Prof Thomas holds the first Canadian Research Chair in biochar and Ecosystem Engineering, a Chair we support. Prof. Sandy Smith’s work on insects and bees has been instrumental in assessing the impact of our apiaries on native bee populations around some of her findings. Prof. John Caspersen’s work on product recovery and hardwood silviculture has provided practical recommendations for the management of our harvesting operations and sawmill. Our silvicultural regime is designed largely around his growth-and-yield research.”

In another new research initiative, students are working with Greater Toronto Area urban forest groups to develop models for calculating the size and impact of tree canopies in urban municipalities such as Oakville, Markham and Toronto. The students are also directly involved in field research in those municipalities associated with running the pilot projects. The example of one such pilot project involves investigating the effects of urban green space and tree species selection on human health. These experiences are highly innovative and unique in nature.
The Faculty contains vibrant forest bio-energy and bio-refinery research programs, which are discussed later. Graduate students are exposed to a “one of a kind” research experience in which they can use the Faculty’s pilot research facilities to test their research hypothesis. This involves lab-scale research and also an authentic industrial context. These facilities have been constructed by faculty members over the past eight years.

The Faculty’s research facilities are discussed in Section 5.2. The Faculty has well equipped laboratories including a greenhouse, cold rooms, environmental chambers and field equipment storage.

2.3.6 Assessment of Learning: Appropriateness and Effectiveness of the Methods used for the Evaluation of Student Achievement of the Defined Learning Outcomes and Degree Level Expectations

i. Undergraduate Programs

Forest Biomaterials Science Major Program

The Forest Biomaterials science major program is multidisciplinary and combines aspects of forestry, biology, chemistry, biochemistry, economics, chemical and mechanical engineering and building science. Students require a thorough understanding of forest sustainability, material science of wood and other forest-based materials; biotechnology as related to bio-materials conversion to feed stock, energy and other value added products; and optimal use and maintenance of the materials. The program provides students with an appreciation for the materials science of wood and its anatomical, chemical, physical and environmental attributes that make it suitable for building materials and other products such as renewable fuels and feedstock for other chemicals and materials.

The Forest Biomaterials (major or minor) may be strengthened by accompanying major or minor(s) in biology, biochemistry, forest conservation, chemistry (environmental chemistry, materials chemistry) or environment and science. By the end of the program, students will have achieved competence in the following areas through course work, field and experimental work and industry interaction:

- Forest conservation and related ecological, social and economic aspects (Years one, two and three)
- Core background in related chemistry, material science and building science (Years one, two and three)
- Technological, political and economic feasibility of different bio-energy and bio-refinery options (Years three and four)
• Understanding of wood- and other bio-based products and processes (Years three and four)
• Appreciation for sustainable practices in processing and use of products (Years three and four)
• Ability to perform a life cycle analysis on products and processes (Years three and four)
• Ability to form an hypothesis and test it through a research project (Year four)
• Will have hands-on research and practical experience in experimental lab settings

This broad, interdisciplinary training will help fill the need for skilled technical works and managers in the wood products and especially composites and value-added sectors of the industry. As such, the program will particularly meet the needs of specialized forest products researchers and future graduate students. Students should consider combining the major program with a major in a related discipline such as biology, economics, architectural studies, chemistry, biochemistry or physics.

Forest Biomaterials Science Minor Program

The Forest Biomaterials science minor draws on a large number of disciplines in providing students with background on the attributes of wood and other forest biomaterials, and with methods of processing, manufacturing or otherwise using the materials in the most sustainable way. Specifically, the following learning outcomes are achieved:

• Students develop a basis of understanding of a field of interest that can be built on in subsequent years, such as forest conservation, materials science, business and entrepreneurship, chemical processing of biomaterials, architecture and building sciences (Years one, two and three)
• Students acquire specialized knowledge of the physical and chemical processing of biomass for multiple end uses (Years three and four)
• Will have hands-on research and practical experience in experimental lab settings

The above areas can be strengthened through accompanying majors/and or minors in biology, biochemistry, forest conservation, chemistry, environmental chemistry, materials chemistry, and environment and science among others.

Graduates from the Forest Biomaterials Science (Major and Minor) programs can pursue a wide range of new career opportunities developing in industry, research organizations, government and environmental and other non-governmental organizations where new opportunities for use of the forest resource are of interest. Graduates from forest biomaterials programs can also pursue graduate programs in a wide range of disciplines including forestry, wood sciences, and environmental sciences.
Forest Conservation Science Specialist Program

The specialist program provides a grounding in forest conservation with emphasis on breadth as well as research depth, and can particularly meet the needs of individuals who are considering graduate level education in forestry (M.F.C., M.Sc.F. or Ph.D.). It is broad-based and multidisciplinary program with emphasis on the sciences of forest biology and ecology as well as courses which explore historical and social aspects of the natural environment with an end to developing student appreciation for the cultural, social and environmental roles of forests. There is also emphasis on the implications of forest management for multiple benefits including revenue generation timber resources, biodiversity maintenance, ecological sustainability, watershed protection and protection of wildlife and their habitats. The specialist forest conservation program prepares students for the critically important global leadership roles in forest conservation and sustainable forest management by combining traditional ecological (biology, zoology) and physical (soil science, hydrology) sciences with social and environmental sciences. Students are expected to understand these interacting factors and to be able to analyze complex scenarios and recommend management options to meet specific forest conservation objectives.

These objectives are met progressively through the required and recommended courses:

- Develop a grounding in basic biological sciences, environmental issues and earth sciences or basic chemistry (Years one and two)
- Appreciate historical, social and cultural aspects of forest conservation (Years two, three and four)
- Develop depth of knowledge in issues of ecology, biodiversity, multiple benefits of forests and related disciplines (Years three and four)
- Develop ability in statistical analysis and modeling to predict and interpret effects (Years two, three and four)
- Develop ability to integrate knowledge and to recommend management options (Year four)
- Will have hands-on research and practical experience in experimental lab settings

Responsible stewardship of our forests and the changing focus from industrial timber production to forest conservation has greatly expanded the range of expertise necessary. Graduates can pursue a wide range of new career opportunities developing in private, government and environmental non-government organizations where forest conservationists increasingly work as members of multidisciplinary teams of environmental and resource managers.
Forest Conservation Science Major Program

The major science program provides understanding of forest conservation issues which can be strengthened by combining it with a major in another related discipline such as environment, geography, botany, zoology, chemistry, urban studies or architecture. It is a multi-disciplinary program which concentrates on forest biology and ecology with electives in life and physical sciences with an end to developing student appreciation for the social and environmental roles of forests and implications of forest management, for multiple benefits including generating timber resources, biodiversity maintenance and protection, ecological sustainability, watershed protection and protection of wildlife and their habitats. A special focus is placed on topics and issues in urban forests and their management for students who wish to pursue this avenue. The forest conservation major develops students’ understanding of forest conservation and sustainable forest management through ecological (biology, zoology) and physical (soil science, hydrology) sciences combined with social and environmental sciences.

Students are expected to understand these interacting factors and be able to analyze complex scenarios and recommend management options to meet specific forest conservation objectives, whether national, international or urban. These objectives are met progressively through the required and recommended courses:

- Develop understanding of basic biological sciences, environmental issues and earth sciences (Years one and two)
- Appreciate historical, social and cultural aspects of forest conservation (Years two, three and four)
- Develop depth of knowledge in issues of ecology, biodiversity, multiple benefits of forests and related disciplines (Years three and four)
- Develop the ability to integrate knowledge and to recommend management options (Year Four)
- Will have hands-on research and practical experience in experimental lab settings

Forest Conservation Science Minor Program

The minor program is designed to provide students with some knowledge of the scientific basis for forest conservation. This is provided through the recommended first year and required second year courses. More detailed understanding of the biological, environmental and social issues related to forest conservation can be developed through in-depth FOR courses required in third year and the integrative required course FOR 400 “Advanced Seminar in Forest Conservation”. Students can combine the forest conservation minor with minors and majors in other areas such as environment, geography, biology or chemistry.
Graduates of the Forest Conservation Science (Major and Minor) programs can pursue new career opportunities developing in industry, research organizations, government, non-governmental and environmental organizations where new opportunities for the use of the forest resource are emerging. Forest conservationists increasingly work as members of multi-disciplinary teams of environmental and resource managers.

**Forest Conservation Arts Specialist Program**

The Specialist arts program focuses on social and sustainable forest management, development of forest policies, forest economics and forest product trade, with electives in social sciences. It develops student appreciation for the cultural, social and environmental roles of forests and implications of forests and their management, from a social and cultural perspective. It is multi-disciplinary with breadth as well as research depth, in cultural and social aspects of forest conservation as well as ecological aspects. The forest conservation arts specialist prepares students for the critically important global leadership roles in complex, emerging social and community issues of forest conservation and sustainable forest management by developing understanding of aboriginal rights and land tenure, policy development, protection of wilderness parklands, preservation of urban green space, and the use of forests for carbon sequestration as well as some appreciation for the ecological and physical science aspects.

By the end of the program, students will have achieved competency in the following areas through course work, field and experimental work:

- Biological, ecological, social and economic aspects of forest conservation (Years one, two, three, and four)
- Ability to apply statistical and analytical methods for surveys and analysis of data (Year two)
- Appreciation for environmental benefits of forests and good forestry practices (Years one, two and three)
- Understanding of the cultural and social aspects of forest conservation, including historical perspective, aboriginal issues, human/nature conflicts (Years two, three and four)
- Knowledge of approaches to sustainable forest management and their limitations (Years two, three and four)
- Ability to form an hypothesis and test it through a research project or to integrate knowledge through a research paper (Year four)

**Forest Conservation Arts Major Program**

The major arts program provides an understanding of social aspect of forest conservation which can be strengthened by combining it with a major in another related discipline such as environment, sociology, geography, economics, political science, aboriginal studies, anthropology or urban studies. Students should develop an appreciation for issues related to communal forest
management, development of forest policies, forest economics and forest product trade. The program is designed to develop student appreciation for the cultural, social and environmental roles of forests and implications of forests and their management, from a social and cultural perspective.

The program meets these objectives through progressive required and recommended courses:

• Develops some understanding of the ecological (biology, zoology) aspects of forest conservation through required and recommended courses (Years one, two and three)
• Provides a basis of knowledge in social sciences and humanities through specified directed electives (Year two)
• Develops in-depth understanding of social and cultural issues related to forest conservation (Year three)
• Requires participation in the Advanced Seminar (FOR 400) course to integrate knowledge obtained in earlier years

**Forest Conservation Arts Minor Program**

Students in the minor program combine aspects of social sciences and humanities with forest conservation issues. In Year one the students select a course from a choice of anthropology, economics, environment, and geography courses.

In subsequent years students take courses to provide a grounding in the biological, social, cultural and environmental dimensions of forest conservation, usually (but not mandatory) including one of the capstone courses (FOR 400 Advanced Seminar in Forest Conservation or FOR 401 Research Paper or Thesis).

Students can combine the forest conservation minor with majors in other areas such as environment, geography, sociology, economics, political science, aboriginal studies, anthropology or urban studies.

The opportunities for graduates of the **Forest Conservation Arts Specialist, Major and Minor Programs** are similar to those in the Forest Conservation Science programs with respect to new careers developing in research and government and non-governmental environmental organizations. These opportunities include environmental and resource managers and policy analysts and planners, for example, working in forestry and natural resource issues concerning public and private land and urban and rural forests. The Specialist program, again, will suit the needs of individuals who are considering graduate level education in forestry.
ii. Professional Master of Forest Conservation Program (M.F.C)

The main framework for the assessment of learning is multifaceted. First, the M.F.C. course content is monitored through a Faculty program and curriculum committee. The committee’s oversight ensures that students have a comprehensive understanding of the biological and physical sciences, applied and social sciences aspect of forests and spanning a broad range of processes from plant physiology to community ecology and economics. The committee recommends changes, if needed, on the focus of the various courses as they relate to the required pertinent knowledge and rigour.

The stepwise design of the M.F.C. program is displayed in Figure 6. M.F.C. students are first introduced to the development of individual competencies in the first term. In the fall term of year one, M.F.C. students are required to study current issues, biodiversity (which includes the Haliburton Forest field camp), silvics and stand management and analytical methods, which includes statistics, GIS and ethics and professionalism modules. These foundational courses are followed by more advanced instruction in the second term: forest management planning, forest stresses, conservation biology, and society and forest conservation, are also taken in the second term. The elective course can be taken in any of the three terms: popular electives are Bioenergy and Biorefinery Technology (FOR1294), Urban Forest Conservation (1575) and Sustainable Forest Management and Certification (FOR1610). In the summer third term, MFC students work in their internship positions and attend the international and/or urban conservation field camps. The fourth term is taken up with the intensive capstone research project.
### Figure 8 M.F.C. Program Description

<table>
<thead>
<tr>
<th>Term</th>
<th>Course Number and Name</th>
<th>Credit Value</th>
<th>Lecture Hours</th>
<th>Contact Hours (lab, tutorial, workshops, sessions)</th>
<th>Lecture Hours per Term</th>
<th>Field Lab and Field Trip Hours per Term</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>FOR3000H CURR ISSUES FOR CONSERV</td>
<td>0.5</td>
<td>26</td>
<td></td>
<td>26</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>FOR3001H BIODIVER FOREST ORG</td>
<td>0.5</td>
<td>10</td>
<td>66</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>1</td>
<td>FOR3002H APPL FOREST ECOL &amp; SILVICULTURE</td>
<td>0.5</td>
<td>26</td>
<td></td>
<td>26</td>
<td>39+</td>
</tr>
<tr>
<td>1</td>
<td>FOR3003H ECONOMICS OF FOREST ECOSYSTEMS</td>
<td>0.5</td>
<td>34</td>
<td>12+</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>FOR3004H FOREST MANAGEMENT DECN SUPPORT</td>
<td>0.5</td>
<td>26</td>
<td></td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>FOR3006H CASE STUDY FOR MGT</td>
<td>0.5</td>
<td>30</td>
<td></td>
<td>9</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>FOR3007H INTERNSHIP IN FOREST CONSERVATION</td>
<td>0.5</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>320-480 (8 hours X 4 to 6 days)</td>
</tr>
<tr>
<td>4</td>
<td>FOR3008H CAPSTONE PROJECT FOREST CONSERVATION</td>
<td>0.5</td>
<td></td>
<td></td>
<td>30</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>FOR3009H FOREST CONSERVATION BIOLOGY</td>
<td>0.5</td>
<td>28</td>
<td>46</td>
<td>28</td>
<td>18</td>
</tr>
<tr>
<td>2</td>
<td>FOR3010H SOCIETY &amp; FOREST CONSERVATION</td>
<td>0.5</td>
<td>24</td>
<td>+1.5 hours per student</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>FOR3011H INTERNAT'L CONSERV CAMP</td>
<td>0.5</td>
<td>6 urban, 8 international</td>
<td>6 urban, 8 international</td>
<td>110 (11 days) urban, 120 (12 days) international</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>FOR3012H ANALYTICAL METHODS IN FOR</td>
<td>0.5</td>
<td>36</td>
<td></td>
<td></td>
<td>5+</td>
</tr>
<tr>
<td></td>
<td>Electives in any graduate course including mandatory field camp</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total Credits</strong></td>
<td><strong>7.5</strong></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
students integrate the individual competencies. Often the evaluations draw on information
gathered during field and lab exercises. The Faculty is interested in evaluating how M.F.C. students
apply this knowledge to the management of the forest, and emerging issues, which involves
developing critical thinking and analytical skills. This requires the students to make numerous
individual and group presentations on specific topics defined by the instructor. The presentations
are graded by the instructor, or an external examiner in the case of the capstone project.

iii. Research Programs: Master of Science in Forestry (M.Sc.F.), Doctor of Philosophy in Forestry
(Ph.D.)

The assessment of learning for research stream students was discussed in Section 2.3.2. Another
important factor to be considered in the assessment is student publications.

Although there are no written, measurable deliverables in research stream doctoral and master
degree accomplishment, most candidates are expected to publish in peer reviewed journals as proof
of the originality of their research program. The Faculty’s general expectation is that a research
master student will publish two peer reviewed publications or the equivalent (i.e., patents,
disclosures, policy documents). For a doctoral candidate, three or four peer reviewed journal papers
or the equivalent is the approach used to evaluate their successful outcomes.

2.4  Quality Indicators for Programs

2.4.1 Assessment of Programs Compared to International Comparators

The Journal of Forestry, November 2015, was dedicated to publishing the results of the Berkeley
Summit, which was a 2014 conference on forestry education hosted by the University of California-
Berkeley, College of Natural Resources. Sixty forestry education representatives, from the United
States, Canada and outside North America, were invited to attend eight facilitated working group
discussions. The agenda for the discussions was organized around the results of a pre-summit survey
by the prestigious Pinochet Institute.

The Faculty has reviewed the published results of the Berkeley Summit and concludes that our
programs are consistent with their recommendations. Forestry schools are reported to find it
daunting to prepare students to work with the conflicts associated with the problem solving that
engages the forestry profession. Our M.F.C. graduates are highly rated by employers for managing
and resolving conflict effectively (Section 2.4.5).

Distance learning is recommended to reduce costs and time-to-delivery. The Faculty has developed
online education courses and certificate programs as discussed in Section 2.3.2 (iv).
The Berkeley Summit identifies concerns about the various types of Professional Master degrees with questions about whether they supplement or substitute for undergraduate education, and the value of accreditation. Our pioneering M.F.C. program is almost 20 years old and has evolved successfully into an interdisciplinary degree while also being accredited in 2014 by the Canadian Forestry Accreditation Board. M.F.C. graduates are now eligible to become licensed professional foresters through the same process as students graduating with traditional forestry undergraduate degrees. It should be noted here that the Faculty also has a few students from our forest conservation undergraduate programs, and M.F.C. graduates from the pre-accredited program, who have successfully become licensed as Registered Professional Foresters through a special process of the Canadian Federation of Professional Foresters Associations called “CAP” (i.e., Credential Assessment for Foreign-Trained Applicants and Graduates of Non-Accredited Programs).

The Summit acknowledged that if the forestry curriculum is not broadened beyond traditional “extractive resource management”, forestry programs will lose out to general environmental sciences programs in the employment marketplace and fail to attract graduate students who reflect society’s demographics. The experience of the Faculty’s graduates support this viewpoint as reported in the endorsements from partners and supporters (Appendix 1), M.F.C employers survey (Section 2.4. 5), and the endorsements of Forestry alumni (Appendix 3).

M.F.C. graduates benefit from the Faculty’s network of diverse interests and partners. They also benefit from the exposure to new career possibilities. One forestry consultant observed:

“Nearly all of my post-U of T employment has come through the U of T network. So I can assume that the faculty’s reputation has helped open employer’s minds to hiring U of T grads. I have also seen some of the applied work of U of T faculty being used and referenced locally, specifically in relation to urban forestry.”

A federal government employee described his change of direction:

“Despite entering the program with no intention of pursuing a career in harvesting, I was interested in harvest residue based alternative energies ….led to working with Natural Resources Canada and FP Innovations as a researcher.”

An M.F.C. graduate working for an NGO described an array of career options:

“It is wonderful to see how influential the M.F.C. group is and the amazing projects they participate in, including: climate change mitigation activities, influencing provincial policy on air quality and forest resources, developing forest management plans, education youth and private landowners, urban forestry and tree maintenance, and invasive species management and planning.”
A city planner expressed satisfaction with the inter-disciplinary experience:

“I find myself feeling most grateful for the social science aspect of the M.F.C... understanding the needs and desires of people who live in and around forests, especially urban forests is essential to the success of the City’s urban forest conservation efforts.”

An M.F.C. graduate now enrolled in a doctoral program decided:

“...to pursue my passion in qualitative research relating to forest policy and stakeholder collaboration. I currently serve as the Program Assistant for the Sustainability Network, an environmental non-profit organization, overseeing a social network analysis project. “

The Summit concluded that achieving gender parity and reflecting minorities, as described in the American context, is necessary and should be viewed as a “requirement of the social contract” between forestry institutions and the public. The Faculty of Forestry supports these priorities. As reported earlier, the diversity of our students is high, and many of our students are female, as evidenced by 21 women and eight men enrolled in the 2016 M.F.C. program this year. The Faculty acknowledges that while attempts have been made to increase First Nations and Aboriginal content in the curriculum, it has been unsuccessful in attracting students from these communities. This is becoming more urgent in Canada because First Nations and Aboriginal communities need forestry expertise as they strive to assert their treaty and aboriginal rights over the resources in their traditional territories.

The Summit report raises a number of other important forestry education concerns including: doctoral programs “with little appreciation of or interest in the professional dimensions of forestry”, the shrinking pool of Ph.D.s from which forestry educators are recruited, and university budgets that penalize forestry programs which have smaller enrolments. These are issues that the Faculty continues to grapple with; the latter is discussed in Section 5.3.

2.4.2 Quality of Applicants and Admitted Students; Enrollment

It is notable that the applicant pool has increased significantly for Forestry’s programs. Figure 3 shows increases in the number of undergraduate students in interdivisional Forestry courses taught by Forestry faculty members. Additional enrollment information about Forestry undergraduates is shown in Appendix 4. As discussed earlier, we believe this growth is associated with the introduction of our new undergraduate courses. These are resonating with students who wish to study, and pursue careers, in areas that are relevant to the economic and environmental challenges confronting global society.

Since 2008-2009, the undergraduate programs experienced an increase of 15 per cent. In 2012, however, the Faculty's budget allocation for undergraduate teaching was reduced. The Faculty's undergraduate programs are governed by the Faculty of Arts and Science and the Faculty is provided...
with no additional resources for outreach and promotion to increase undergraduate enrolment (see Section 2.4.8.). The enrollment data for the Faculty of Arts and Science undergraduate programs were discussed earlier in Section 2.2.

Enrollment in our graduate programs has also grown. Figure 9 shows the trend in the M.F.C. program; information about the research graduate programs is shown in (Appendix 11). The projections for future growth in undergraduate and graduate enrolment are discussed in Sections 5.0 and 6.0 of this report.

**Figure 9**

![Applications, Offers, Registrations - Master of Forest Conservation](image)

Source: Standardized Data Set provided by the Vice-Provost

Additionally, in 2013-2014, the acceptance rate was 63.9 per cent for Master of Forest Conservation programs, 60 per cent for the M.Sc.F. program and 72.7 per cent for the doctoral program. These are comparable to the University of Toronto’s average for professional master programs and research master degrees and higher for doctoral programs (Appendix 11).

Aspects of the Faculty’s admission requirements were discussed in Section 2.2. The Faculty strives to attract high quality students and this is reflected in the higher minimum grades required for admission to our M.F.C. and graduate research programs.

Forestry attracts high quality students from almost all disciplines. For example, our doctoral program presently has 38 students, of which 12 students are from engineering, 10 from social sciences and humanities and 10 students from non-forestry science degrees. It is our observation
that our doctoral students identify themselves with forestry and are conducting innovative and applied forest science research.

The contributions of our doctoral students can be partially captured in their own words.

“I should add that my career success has also benefitted from the stellar international reputation the Faculty enjoys outside of Canada, especially in the developing world. My colleagues and collaborators in Switzerland and Cameroon know and follow the important research produced by its Faculty members; I think this gave me a respectful edge in the academic community in Europe too.” Dr. Julian M. Norghauer

“I moved back to Tanzania to lead the country program for International Center for Research in Agroforestry (ICRAF) where I still use most of the experience I gathered at UoF. I am also now working closely with the ZALF Institute in Germany where I will be the Research Fellow from July this year. In most cases I still consider the quality of Faculty at Forestry Department to be comparable and even higher that some of the international Professors I have interacted with over the last 4 years now at ICRAF. This general assessment is based on quality of scientific publications and presentations in lectures/conferences.” Dr. Anthony Kimaro

“I have benefitted greatly from the academic training I received while at the Faculty of Forestry. I ultimately published 14 peer-reviewed articles for my research there, which helped me secure a highly competitive two year post-doctoral fellowship from NSERC.....and have since moved on to a tenure track position at the University of Regina. The current academic job market is intensely competitive. My success to date in large part reflects the exceptional research experience and academic training I received while at the Faculty of Forestry.” Dr. Mark Vanderwel

The quality of students admitted to the Faculty programs is being enhanced by the diversity of these students. The high numbers of female and international students was discussed earlier in Section Two. The recruitment of high-achieving young women in Forestry programs, as shown in Figure 10, is particularly exciting for the advancement of young women in science and the potential for successful employment outcomes in a sector that was historically male dominated.
Drawing on the experience of female Forestry graduates (Appendix 3), it becomes apparent that they are successfully pursuing careers in numerous forestry-related areas. The following comments by female graduates of the Faculty describe their success in various career paths.

“The amount of exposure I received in 18 months to different government, industry and NGO leaders was incredible and has allowed me to start my career with a strong professional network. In the past several months I have encountered many Faculty alumni in Ontario, Manitoba and England that have been similarly helpful and supportive of my career.”

“I am now a Policy Advisor at the Ontario Ministry of Environment and Climate Change....The mandatory internship component allowed me to get entry level experience with a reputable company which helped me build my network and further strengthen my confidence as an environmental professional.”

“The softwood lumber trade dispute is a never ending issue between Canada and the USA. I also worked on another research project on sustainable management of uneven-aged hardwood forests in Ontario. Through working on these two projects, I published five refereed papers in the top forestry journal during my study at the Faculty of Forestry. ....Due to the relevance and excellence of my research to the important public

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**Figure 10**

*Female Enrollment in Faculty of Forestry Programs from 2008 to 2015*

Source: Faculty of Forestry
policies that affect sustainable forest management in Canada, Ontario Ministry of Natural Resources hired me as Trade Analyst even before I finished my Ph.D. In 2010, I received an Outstanding Doctoral Research Award from the International Union of Forest Research Organizations (IUFRO) in recognition of my outstanding scientific achievement in my doctoral research. These achievements would not have been possible without the excellent guidance from Prof. Kant.”

“Of particular value to me was my independent study course offered to me in my 4th year. Few undergraduate programs offer such an opportunity for self-directed research—research I still reference today—and supported by such dedicated faculty. ... Additionally, the technical and field courses offered to me as an undergraduate proved invaluable to me, and helped round out the more academic courses with on-the-ground technical experience. In addition to the solid foundation of the more traditional classroom-based foundational courses, the opportunity for field courses directly influenced my ability to obtain a job within the field. ...I have moved on to be the Natural Environment Specialist in charge of the Lower Don Watershed, where I am responsible for creating and implementing naturalization and restoration projects within the Lower Don, as well as coordinating capital projects aimed at protecting the unique and sensitive ravine habitats... Many of my colleagues also attended U of T Forestry prior to working at the City. Many other organizations we work with also employ U of T Forestry graduates. “

“After graduating, I obtained employment in the office of Ontario’s Minister of Natural Resources as a Policy Advisor. The opportunity to connect with Government and subsequently obtain employment was provided to me by one of my Faculty of Forestry professors. A year later, I accepted a position with Ontario’s Forest Industry Association (OFIA), where I succeeded another well respected M.F.C. graduate. I was not surprised to learn that another MFC graduate replaced me at the OFIA, when I recently made another career move to a major Eastern Canadian forest products company, EACOM Timber Corporation. It is my intention, in my current role, to work with the Faculty of Forestry to recruit summer students for my Company’s operations. Given my experience with the Faculty as a student, I hope to build a positive relationship between UofT Forestry and EACOM. “

Our international students come from the United States, China, India, Mexico and Brazil and these countries are expected to remain our target “markets” through 2021. International students bring perspective that is appreciated by all students and faculty:

“The diversity within enrolment at the faculty fundamentally trains students to learn to work together, and become valuable team players in multi-stakeholder environments. “

“I very much appreciated the diverse background of other students, which mimics the professional working environment where collaborative project efforts build on the strengths of group members.”
“Diversity adds an essential ingredient to the educational process (from the student perspective, more and more international students are accepted by the program; from the educational experience perspective, the students at the faculty were offered classroom learning experience, factory visits, attending conferences and meetings, field trips, webinar with other universities, etc.).”

Our international students tell us they are drawn to Toronto and being in the city enhances the appeal of our programs.

2.4.3 Student Completion Rates and Time to Completion

The Faculty of Forestry supports the University’s viewpoint that good students are attracted to programs by the expectation of reasonable timelines for completing their programs. In line with University’s strategic direction, the Faculty has made significant efforts to recruit high quality students and to monitor their progress through milestone-driven programs with a relatively shorter duration of the degree completion time.

The graduate rates for undergraduate students in the Arts and Science program group, which includes the Forestry undergraduate programs, experienced an increase from 2012 to 2013 (Figure 11).

Figure 11
A Seven-Year Graduation Rate

2005 cohort graduating by 2012.

<table>
<thead>
<tr>
<th>Program Group</th>
<th>Cohort</th>
<th>Graduated</th>
<th>Grad Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arts &amp; Science</td>
<td>4,908</td>
<td>3,632</td>
<td>74.0%</td>
</tr>
<tr>
<td>Total First Entry Programs</td>
<td>10,915</td>
<td>7,996</td>
<td>73.3%</td>
</tr>
<tr>
<td>Total University of Toronto (First and second entry undergraduate programs)</td>
<td>12,857</td>
<td>9,901</td>
<td>77.0%</td>
</tr>
</tbody>
</table>

2006 cohort graduating by 2013.

<table>
<thead>
<tr>
<th>Program Group</th>
<th>Cohort</th>
<th>Graduated</th>
<th>Grad Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arts &amp; Science</td>
<td>4,355</td>
<td>3,297</td>
<td>75.7%</td>
</tr>
<tr>
<td>Total First Entry Programs</td>
<td>10,420</td>
<td>7,865</td>
<td>75.5%</td>
</tr>
<tr>
<td>Total University of Toronto (First and second entry undergraduate programs)</td>
<td>12,407</td>
<td>9,809</td>
<td>79.1%</td>
</tr>
</tbody>
</table>

Source: Standardized Data
The time for completion for Forestry graduates, compared to all of the University of Toronto, is lower for the M.F.C. program and for full-time doctoral degrees. For the Research Master’s degree, the time for completion for Forestry graduates is at par with university average. The mean time to completion of the professional M.F.C. program is 1.3 years, and the corresponding means for the M.Sc.F. and Ph.D. programs are 2.4 years and 5.4 years, respectively (Appendix 12).

The Faculty supports the University’s goal of completion of the doctoral degree in a reasonable time (i.e., four years), without sacrificing quality. The Faculty of Forestry’s doctoral students’ degree time to completion is slightly superior (5.4 years) to the university average (5.9 years), but it is higher than our four year goal. Consequently, the Faculty is examining the potential for taking more action to guide and monitor our time lines. In recent years, the Faculty has encouraged supervisors to increase their interaction with the doctoral students to improve their time to completion.

Withdrawals during the seven-year period from 2009-2015 were three of 56 in the M.Sc.F. program, four of 105 in the M.F.C. program, and six of 53 in the Ph.D. program. These are typical rates of progress and attrition, and are indicative of effective evaluation and intellectual development of the graduate students in these programs.

2.4.4 Quality of the Educational Experience, Teaching, and Graduate Supervision

The Dean of Forestry periodically holds “Town Hall” meetings for undergraduate and graduate students. The open forum is designed to facilitate the communication between students and divisional leadership.

In preparation for the self-study, student Town Hall meetings were hosted by the Dean in September and December. Students expressed their high degree of satisfaction in all programs and also identified some areas for improvement. One issue raised by the students is early notice of ancillary fees, especially those associated with the M.F.C. professional program. Faculty administration will endeavor to post the earliest notice of significant ancillary fees. Those related to the international field camp are particularly difficult to predict one year in advance.

Another issue raised by the students is the shortage of electives offered within the division. This matter has been discussed with the Faculty’s Curriculum Committee and it has reached a pessimistic conclusion. The Committee examined the current status of eight full-time tenured professors and noted that the last five retirements have not been replaced. Each faculty member teaches courses above the university average, which is surprising considering that Forestry is one of the most active research intensive units within the University (see Section 3.0). The Committee concluded, therefore, that it is practically impossible for the tenured faculty members to assume additional courses and new instructors were needed for teaching more electives.
The Dean assured students that this matter would be addressed. Subsequently, the decision was made to allow more “status only” professors from research intensive government laboratories to help develop much-needed elective courses. As a result, the Faculty now has three “status only professors” and two more under consideration.

The hiring of sessional is seen by the Faculty as a short term solution. In fact, sessional and stipendiary compensation, as a percentage of the total academic compensation budget, is low for Forestry at 7.4 per cent compared to the University average, which is 11.8 per cent, as shown in the divisional budget statistics. To further enhance the student experience, the Faculty strongly believes that full-time instructors and lecturers are the best options. The Dean is actively pursuing this matter with stakeholders for their help in obtaining instructors on a more continuing basis. The strategies for raising revenue are discussed in Section 5.3.

To further enhance the quality of student experience, teaching and graduate supervision, the Faculty agreed to develop a pilot project in which students will design the questions and participate in an online survey at the end of each term, with some administrative help from Dean’s office. Our expectation is that this unbiased approach, from the students’ perspective, will help to obtain exceptionally good feedback from them. It should be instructive to our Faculty members for improving student experience.

The Faculty strives to enhance the quality of educational experience. For example, the interdisciplinary nature of our professional M.F.C. program raised an obvious challenge for some students coming from social science and arts backgrounds, who need additional assistance in acquiring the foundational statistical knowledge. The Faculty Curriculum Committee under the leadership of the graduate coordinator, Prof. Malcolm, found a solution by organizing a special team of research-intensive Faculty members and their senior grad students to supplement the statistical module in the analytical methods course (FOR 3012), which is taught to all M.F.C. students.

In another example of responding to student concerns, the Faculty is making significant changes in their M.F.C. internship allocation process. Each internship request received from an interested host employer is now being posted publicly, within the Faculty, to give equal opportunity to each M.F.C. student to enquire about all the eligible internships in a given year. This suggestion came from the students and the Faculty responded accordingly.

The student experience for Forestry undergraduates is partially captured below. The reported quality of the undergraduate student learning experience, where data exist, is comparable to that of undergraduate students in the Faculty of Arts and Science.
The course evaluations by undergraduate students in Forestry programs are comparable to those reported by undergraduates in the Faculty of Arts and Science (Appendix 13). The evaluation process involved six questions and the results of question four are displayed in Figure 13.
Figure 13

Undergraduate Course Evaluation

Source: Standardized Data

The National Survey of Student Engagement (NSSE) reported that Forestry undergraduate students indicate satisfaction above the University of Toronto average in three of the five areas shown below and close to the other two benchmarks (Figure 14). Forestry undergraduate students also reported higher evaluations for “their entire educational experience” at the University of Toronto (Appendix 13).
# Undergraduate Student Satisfaction

**NSSE Results for Faculty of Forestry (Arts and Science) (Senior Student responses only)**

<table>
<thead>
<tr>
<th>Benchmarks (0 to 100 scale)</th>
<th>NSSE</th>
<th>U of T Forestry¹</th>
<th>U13/U15 (Forestry)²</th>
<th>U of T All disciplines</th>
<th>U13/U15 All disciplines</th>
<th>Ontario All disciplines</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Level of Academic Challenge (LAC)</td>
<td>2011</td>
<td>58.9</td>
<td>54.3</td>
<td>56.8</td>
<td>54.8</td>
<td>56.2</td>
</tr>
<tr>
<td>2. Active and Collaborative Learning (ACL)</td>
<td>2011</td>
<td>38.7</td>
<td>45.3</td>
<td>39.3</td>
<td>43.9</td>
<td>45.8</td>
</tr>
<tr>
<td>3. Student-Faculty Interaction (SFI)</td>
<td>2011</td>
<td>31.1</td>
<td>33.7</td>
<td>32.2</td>
<td>30.9</td>
<td>32.7</td>
</tr>
<tr>
<td>4. Enriching Educational Experiences (EEE)</td>
<td>2011</td>
<td>43.9</td>
<td>38.0</td>
<td>34.1</td>
<td>35.9</td>
<td>34.5</td>
</tr>
<tr>
<td>5. Supportive Campus Environment (SCE)</td>
<td>2011</td>
<td>51.0</td>
<td>58.0</td>
<td>47.7</td>
<td>51.5</td>
<td>53.5</td>
</tr>
</tbody>
</table>

¹ U15 benchmark data for 2011 is based on the Classification of Instructional Programs (CIP) code 030506 (Forest Management/Forest Resources Management)


Source: Standardized Data

The recent Canadian Graduate & Professional Student Survey (Spring 2013) revealed outstanding student satisfaction in our M.F.C. program (Appendix 14).

The Faculty received better scores than combined professional programs at the University of Toronto for 23 of the 26 questions, and the difference was statistically significant for seven questions:

- The intellectual quality of the faculty
- The relationship between faculty and graduate students
- Helpfulness of staff members in my program
- Opportunities to take coursework outside my own department
- Your student life experience at this university?
- Your academic experience at this university?
- Your overall experience at this university?
Figure 15

Student Satisfaction Benchmarks

Professional Master’s M.F.C.

<table>
<thead>
<tr>
<th>Benchmarks</th>
<th>CGPSS</th>
<th>U of T (Forestry)</th>
<th>U15 (Forestry)</th>
<th>U of T (All disciplines)</th>
<th>U15 (All disciplines, excl U of T)</th>
<th>Ontario (All disciplines Excl U of T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Quality of Teaching</td>
<td>2010</td>
<td>4.53</td>
<td>3.86</td>
<td>3.89</td>
<td>3.77</td>
<td>3.76</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>4.11</td>
<td>3.85</td>
<td>3.88</td>
<td>3.79</td>
<td>3.74</td>
</tr>
<tr>
<td>Orientation</td>
<td>2013</td>
<td>3.66</td>
<td>3.08</td>
<td>3.23</td>
<td>3.17</td>
<td>3.08</td>
</tr>
</tbody>
</table>

1. U of T, U15 and Ontario values only include responses from doctoral and research master’s students
2. U15 and Ontario values exclude University of Toronto
3. U15 includes Alberta, British Columbia, Calgary, Dalhousie, Laval, Manitoba, McGill, McMaster, Montreal, Ottawa, Queen’s, Saskatchewan, Waterloo, Western

Source: Standardized Data

Benchmark indicators of student satisfaction for Forestry’s doctoral-stream students are also shown in Appendix 14. Our students give the Faculty high marks for the quality of our teaching and research training and career orientation.
2.4.5 Implications of any Data (where available) Concerning Post-Graduation Employability

The employment rates for Forestry undergraduate students are high compared to other programs. These results are from the Ontario University Graduate Survey and are displayed in Figure 16.
## Figure 16

Employment Rates for Graduates of Undergraduate Degree Programs

<table>
<thead>
<tr>
<th>PROGRAM AREA</th>
<th>TWO YEARS AFTER 2006 GRADUATION (%)</th>
<th>TWO YEARS AFTER 2007 GRADUATION (%)</th>
<th>TWO YEARS AFTER 2008 GRADUATION (%)</th>
<th>TWO YEARS AFTER 2009 GRADUATION (%)</th>
<th>TWO YEARS AFTER 2010 GRADUATION (%)</th>
<th>TWO YEARS AFTER 2011 GRADUATION (%)</th>
<th>TWO YEARS AFTER 2012 GRADUATION (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural &amp; Biological Sciences</td>
<td>94.1</td>
<td>91.8</td>
<td>89.9</td>
<td>90.2</td>
<td>89.5</td>
<td>89.2</td>
<td>91.4</td>
</tr>
<tr>
<td>Architecture &amp; Landscape Architecture</td>
<td>97.5</td>
<td>91.8</td>
<td>96.4</td>
<td>96.1</td>
<td>92.6</td>
<td>93.1</td>
<td>91.2</td>
</tr>
<tr>
<td>Business &amp; Commerce</td>
<td>96.5</td>
<td>96.5</td>
<td>94.9</td>
<td>95.6</td>
<td>94.8</td>
<td>94.9</td>
<td>96.1</td>
</tr>
<tr>
<td>Computer Science</td>
<td>95.3</td>
<td>97.0</td>
<td>95.8</td>
<td>96.2</td>
<td>95.3</td>
<td>96.5</td>
<td>95.9</td>
</tr>
<tr>
<td>Dentistry</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>97.4</td>
<td>100.0</td>
<td>100.0</td>
<td>94.7</td>
</tr>
<tr>
<td>Education</td>
<td>97.3</td>
<td>97.1</td>
<td>95.8</td>
<td>94.1</td>
<td>92.8</td>
<td>94.4</td>
<td>95.6</td>
</tr>
<tr>
<td>Engineering</td>
<td>96.0</td>
<td>94.6</td>
<td>94.9</td>
<td>93.8</td>
<td>93.8</td>
<td>94.1</td>
<td>94.0</td>
</tr>
<tr>
<td>Fine &amp; Applied Arts</td>
<td>94.2</td>
<td>92.6</td>
<td>93.5</td>
<td>90.4</td>
<td>91.0</td>
<td>91.6</td>
<td>92.4</td>
</tr>
<tr>
<td>Food Science &amp; Nutrition</td>
<td>98.5</td>
<td>93.4</td>
<td>93.8</td>
<td>95.0</td>
<td>90.2</td>
<td>94.9</td>
<td>91.4</td>
</tr>
<tr>
<td>Forestry</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>90.9</td>
</tr>
<tr>
<td>Health Professions (^1)</td>
<td>95.4</td>
<td>95.7</td>
<td>93.9</td>
<td>93.4</td>
<td>91.4</td>
<td>93.0</td>
<td>92.9</td>
</tr>
<tr>
<td>Humanities</td>
<td>93.4</td>
<td>93.4</td>
<td>90.9</td>
<td>90.7</td>
<td>90.4</td>
<td>91.2</td>
<td>91.9</td>
</tr>
<tr>
<td>Journalism</td>
<td>98.3</td>
<td>93.2</td>
<td>95.2</td>
<td>93.3</td>
<td>95.9</td>
<td>92.2</td>
<td>93.6</td>
</tr>
<tr>
<td>Kinesiology/Recreation/Phys.Ed (^2)</td>
<td>95.3</td>
<td>97.2</td>
<td>93.4</td>
<td>94.4</td>
<td>91.7</td>
<td>92.0</td>
<td>92.0</td>
</tr>
<tr>
<td>Law</td>
<td>97.0</td>
<td>94.0</td>
<td>94.4</td>
<td>94.5</td>
<td>93.9</td>
<td>93.9</td>
<td>91.5</td>
</tr>
<tr>
<td>Mathematics</td>
<td>98.2</td>
<td>95.6</td>
<td>91.6</td>
<td>93.1</td>
<td>92.2</td>
<td>92.1</td>
<td>90.9</td>
</tr>
<tr>
<td>Medicine</td>
<td>100.0</td>
<td>100.0</td>
<td>99.3</td>
<td>99.1</td>
<td>98.9</td>
<td>98.4</td>
<td>99.5</td>
</tr>
<tr>
<td>Nursing</td>
<td>99.8</td>
<td>99.6</td>
<td>99.0</td>
<td>98.9</td>
<td>97.6</td>
<td>97.4</td>
<td>98.1</td>
</tr>
<tr>
<td>Optometry</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>97.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Other Arts &amp; Science (^10)</td>
<td>93.2</td>
<td>96.0</td>
<td>92.6</td>
<td>90.2</td>
<td>91.0</td>
<td>91.0</td>
<td>91.8</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>100.0</td>
<td>98.1</td>
<td>98.5</td>
<td>98.9</td>
<td>100.0</td>
<td>97.2</td>
<td>98.7</td>
</tr>
<tr>
<td>Physical Sciences</td>
<td>92.2</td>
<td>93.1</td>
<td>93.7</td>
<td>89.5</td>
<td>89.0</td>
<td>89.8</td>
<td>90.1</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>95.4</td>
<td>94.2</td>
<td>92.5</td>
<td>91.2</td>
<td>89.8</td>
<td>91.3</td>
<td>91.9</td>
</tr>
<tr>
<td>Theology</td>
<td>90.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>90.6</td>
<td>96.2</td>
</tr>
<tr>
<td>Therapy &amp; Rehabilitation</td>
<td>100.0</td>
<td>100.0</td>
<td>96.0</td>
<td>100.0</td>
<td>na</td>
<td>100.0</td>
<td>81.8</td>
</tr>
<tr>
<td>Veterinary Medicine</td>
<td>100.0</td>
<td>100.0</td>
<td>97.6</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Overall Annual Average: 95.7 95.2 93.8 93.1 92.2 93.0

---

\(^1\) Graduates were considered working full-time if they indicated that they worked 35 hours or more per week. This is consistent with Statistics Canada definitions of full-time work.

\(^2\) Health Professions includes students enrolled in Basic Medical Science programs, Medical/Laboratory, Paramedical Sciences, Epidemiology and Public Health, and Medical Technology. Medical therapy degrees have been excluded.

\(^3\) Kinesiology/Recreation/Phys.Ed also includes students enrolled in programs in non-designated fields.

\(^10\) Other Arts and Sciences includes students enrolled in general Arts and Science majors not specified by other categories or unspecified.

Source: [http://cou.on.ca/reports/graduate-survey-2014/](http://cou.on.ca/reports/graduate-survey-2014/)
The Faculty of Forestry is also proud of the success of our Master of Forest Conservation program. The endorsements of students, employers and partners were discussed earlier in the context of other sections of this self-study. Beginning in 1996, the Faculty pioneered the first professional forest conservation program in Canada and it has been replicated elsewhere.

The strategic importance of professional Master’s programs was emphasized in the external reviewers’ report (page 6) on the University’s Faculty of Arts and Science self-study in 2013. The observation was made that few tenure track positions are opening up in North America and professional Master’s programs offer universities increasing student enrolments and better alignment with employment opportunities.

There are few data on post-graduation employability of students, consequently the Faculty decided to survey the views of M.F.C. employers in preparation for the self-study. In January 2016, the Faculty sent a survey to 48 employers of M.F.C. graduates.

The purpose was to gauge thoughts on the performance of these graduates in the workplace. Survey Monkey was used to gather and analyze results.

We asked six questions about knowledge and capabilities in the work settings. The survey concluded with two open-ended questions about employers’ views of the strengths and contributions of M.F.C. graduates. The questions were derived from the Conference Board of Canada.

The results generally show that employers are pleased with the knowledge, capabilities and robust involvement of M.F.C. graduates/employees in their organizations. The response summary to the questions below shows the combined percentage total for those who either “strongly agree” or “agree” and the numbers in parentheses show the breakdown between “strongly agree” and “agree” respectively.

**Survey Highlights:**

<table>
<thead>
<tr>
<th>Question</th>
<th>Response Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of surveys distributed</td>
<td>48</td>
</tr>
<tr>
<td>Number of responses received</td>
<td>28</td>
</tr>
<tr>
<td>Responses received as a percentage of surveys distributed</td>
<td>58 %</td>
</tr>
<tr>
<td>Q1 Does your MFC graduate/employee communicate effectively (write and speak so others pay attention and understand)?</td>
<td>100% (78.6/21.4)</td>
</tr>
<tr>
<td>Q2 Does your MFC graduate/employee access, analyze, and apply knowledge from various disciplines (e.g., science, technology, and/or social sciences)?</td>
<td>96.5% (62/34.5)</td>
</tr>
</tbody>
</table>
Q3 Does your MFC graduate/employee creatively approach problem solving (e.g., recognizes the human, interpersonal, technical, and scientific dimensions of a problem)?

<table>
<thead>
<tr>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>96% (55/41)</td>
</tr>
</tbody>
</table>

Q4 Is your MFC graduate/employee adaptable (e.g., copes with uncertainty and responds constructively to change)?

<table>
<thead>
<tr>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>85.5% (53.5/32)</td>
</tr>
</tbody>
</table>

Q5 Does your MFC graduate/employee work collaboratively (e.g., recognizes and respects people’s diversity, individual differences and perspectives)?

<table>
<thead>
<tr>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>96% (65.2/31)</td>
</tr>
</tbody>
</table>

Q6 Does your MFC graduate/employee manage and resolve conflict effectively?

<table>
<thead>
<tr>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>92.9% (39.3/53.6)</td>
</tr>
</tbody>
</table>

**COMMENT HIGHLIGHTS**

**Q7 Top 3 strengths of your MFC graduate/employees**

- “We have hired many MFC graduates to work in the Urban Forestry Renewal section of the [large urban] City of... I feel that the strengths of the candidates are: 1. They are very enthusiastic. They are very interested in protecting and enhancing the urban forest. 2. The students have had exposure to urban forestry through their course work but also as part of their thesis...so many of them have worked with community groups involved in urban forestry related issues. 3. The students have an excellent understanding of tools used in urban forestry; tools such as GPS units, ARCGIS mapping skills, programs used for tree forestry work.”

- “Strong background in Urban Forestry, excellent communications skills, ability to address diverse assignments effectively.”

- “Good communications skills, self-directed problem solvers, civic minded.”

- “Critical thinking, communications skills, knowledge of forestry issues.”

- “Excellent team members, strong work ethic and hard worker.”

**Q8 Other comments about the performance and contributions of MFC graduate/employees**

- “It is the only professional forestry program relevant to southern and urban settled/cultural landscapes; Most of MFCs I find very professional and enthusiastic about forestry – this is what every profession needs; As part of my work I had graduates (undergrad degrees) from geography, environmental science and other areas. [All of them were missing the vision, strategic and integrative thinking of forestry and MFCs; conservation emphasis combined with the forestry makes them stand out among the huge environmental graduate and undergraduate crowd. After internship many of those MFC were hired to continue work on various projects.”

- “For urban forestry professionals, the MFC programme provides people with diverse professional skills, basic principles of tree management and an ability to manage themselves and others effectively. As a graduate myself, the MFC was a stepping stone from the practical into the professional realm that was invaluable to the success of my professional career.”

- “The knowledge and experience of MFC graduates/employees supports not only our organization’s forestry programs but a broader mandate to manage watershed resources for a healthier environment. MFC graduates bring an openness to share forestry knowledge and integrate with other conservation initiatives in a multi-disciplinary approach to program and project successes.”
2.4.6  Availability of Student Funding

The Faculty of Forestry is committed to a minimum guaranteed level of funding support for graduate students in the research stream. The financial support packages for Faculty of Forestry research students for 2015-2016 is shown on the Faculty’s website http://www.forestry.utoronto.ca/index.php/current-student-resources/.

The Faculty is well positioned for graduate student funding and undergraduate scholarships. Over the years, our supporters have contributed to a student fellowship endowment fund that now assists the Faculty in generating up to half a million dollars annually (i.e., based on a four per cent annual yield). The revenue generated from the endowed fund allows the Faculty to leverage matching funds from supervisors’ research grants. This matching fund strategy puts the Faculty in a unique position to fund graduate students compared to many other cognate divisions. On the measure of the “endowed aid per FTE student”, Forestry ranked the highest in the University in 2015 according to divisional budget statistics.

It is important to appreciate that the Faculty’s endowed funds means that Forestry takes less money out of the University Operating funds for doctoral stream students than the University of Toronto average for other divisions (i.e., 49 per cent versus 59 per cent) as shown in divisional budget statistics. A positive consequence of the Faculty’s student fellowship fund is a resulting reduction in our operating expenditures and this has helped the Faculty to improve operating cash flow.

The University of Toronto average funded cohort graduate student income (net of tuition and incidental fees), was reported to be approximately $21,848 in 2014-2015. In the standardized data set, Forestry was ranked below average in this category. Up until 2014-2015 though, Forestry research stream students were paid for teaching assistantships in addition of the guaranteed funding package. The correct figure for Forestry in 2014 is $19,711 and not $18,821. On average, Forestry students earned an additional $1,000 on top of their 2015-2016 funding package through teaching assistantships. The Faculty has now introduced a policy whereby Ph.D. students in year two and year three of their program are required to complete a mandatory 30-hour tutorial assistantship as part of their funding package; however, it can be noted that this policy will phase in gradually, and at the present time, the majority of TA hours, which are allocated to students, are over and above the guaranteed funding package.
As would be expected, the Faculty’s minimum guaranteed funding package does not extend to students in the professional M.F.C. program. The University’s expectation is that students enrolled in professional masters programs will be self-funded. Nonetheless, merit-based scholarships from the Faculty of Forestry are awarded to M.F.C. students. We have found over the years that to attract the best students to the program, we need to provide some financial support to selected students, based on high academic performance. The Faculty annually awards up $50,000 to domestic M.F.C. students and up to $50,000 to international M.F.C. students. We are currently providing admission scholarships to over 75 per cent of M.F.C. students. The M.F.C. coordinator pursues MITAC funding that can provide several $10,000 internships specifically designed for students who are pursuing the licensed Registered Professional Forester designation.

Regarding undergraduate funding, the Faculty has an endowment fund that makes awards annually. It is a graduating scholarship for final year students registered in Forest Conservation programs taught by the Faculty and it is based on academic merit. Forestry undergraduates are eligible, of course, for awards made available through the University of Toronto such as the Natural Sciences and Engineering Research Council of Canada (NSERC) Undergraduate Student Research Award and the University of Toronto Excellence Award (UTEA) for research.

In 2015, the Faculty was particularly proud of an M.F.C. graduate who was one of two Canadian recipients of the Prince of Wales Forest Leadership Award-Endorsed by HRH The Prince of Wales, and delivered in partnership by the Canadian Institute of Forestry (CIF-IFC), the Institute of Chartered Foresters (ICF), and the Duchy of Cornwall, and sponsored by TD Bank. The award recognizes young forestry professionals in Canada and the United Kingdom who possess dedication to sustainable forestry and the skills and aptitude to become our future forestry leaders.

2.4.7 Provision of Student Support through Orientation, Advising/Mentoring, Student Services

One of the Faculty’s important values is support for students. Undergraduate Administrative services are provided by Susan Lee and the undergraduate Academic Coordinator is Sean Thomas. For graduate students, Deborah Paes is the Graduate Administrator and the graduate Academic Coordinators are Jay Malcolm for the research stream and Sally Krigstin for the M.F.C. program.

The Forestry Graduate Student Association (FGSA), which also represents undergraduate interests this year, serves an important role. Among other activities, the FGSA is involved in orientation for new students, communicating with students regularly online, advising students, organizing athletics (such as the annual Provincial Timber Games), and encouraging students to attend conferences and make poster presentations. The FGSA communicates student concerns to the Dean and conducts fundraising for philanthropy and social events.
The University of Toronto has excellent services for all students including accessibility, athletics, housing, and health and well-being among many others. Descriptions of these can be found at https://www.utoronto.ca/. Forestry also helps students find accommodation.

The Faculty provides two days of orientation in September for new M.F.C. students. Orientation activities include introductions, program details, the overview of some courses and a history of forestry and forest conservation and dendrology. The one-half day research stream orientation takes place at the same time in September and introduces students to Forestry’s research laboratories.

The annual barbeque lunch happens during the orientation sessions, providing an opportunity for undergraduate and graduate students, all faculty members and staff and some alumni and visitors to become acquainted. In February, the Faculty hosts a more formal evening event, the Annual Banquet, where the accomplishments of students, staff and faculty members are acknowledged and awards are given.

Faculty members and staff assist in briefing International students. The topics covered include resources for international students, academic integrity, cultural adjustments, and work permits. Forestry is hoping to access more English language training programs and has discussed this project with New College. Such an additional resource will not only assist our current international students but also help support the projected increased enrolment of international students.

All Faculty members are involved in mentoring students whether it concerns academic, professional or personal matters. The following quotes from Forestry graduates acknowledge the value of personal commitment.

“I always felt welcomed approaching faculty members for guidance. I was awarded opportunities to be employed by several faculty members during enrolment and after graduation. I value these experiences greatly.”

“Grateful to staff and profs for time and energy that was spent in fostering our individual interests and providing us with the ever so important “first step” that is needed for graduates to thrive in today’s market.”

“There is a lot to be gained from being able to engage closely with faculty in important discussions in class as well as feel comfortable enough to approach professors when needed. My incredible experience in my undergrad is the reason I returned to do my Masters with the Faculty of Forestry.”

“I was privileged to work with and learn from renowned faculty and researchers who were dedicated and passionate about educating tomorrow’s leaders in forest...
conservation science, forest ecosystem management, forest governance and policy, and biomass utilization through excellent interdisciplinary research, teaching and outreach. “

“I stayed on to do my Ph.D. in tropical forest ecology, working in Brazilian Amazonia. It was the best decision I ever made. The education and training I received from its dedicated professors was excellent, the help from administrative staff was superb, and the student-learning environment was exciting and engaging.”

Faculty members circulate employment information to recent alumni and current students. The M.F.C. coordinator is heavily involved in professional mentoring associated with the internship course. This involves helping students identify their career path and the gaps that can be addressed through internship or other activities (i.e. recommend volunteer activities, introduce students to other mentors, past students, professionals). The M.F.C. coordinator also reviews cover letters and CV’s and works with students on addressing the requirements of the position.

2.4.8 Program Outreach and Promotion

As mentioned earlier, since 2008-2009, the undergraduate programs experienced an increase of 15 per cent, but in 2012, the University administration cut the Faculty’s budget. The Faculty’s undergraduate programs are governed by the Faculty of Arts and Science and the Faculty has no additional resources for outreach and promotion to increase undergraduate enrolment. Moreover, the Faculty observes that the Forestry programs listed in the Faculty of Arts and Science undergraduate calendar do not receive equal exposure to the other undergraduate programs run by Faculty of Arts and Science. Attempts have been made in the past to overcome this bottleneck without much result.

The Faculty conducts annual information open houses for interested M.F.C. and other students. The Faculty has also been represented at the University’s career day activities and high school science events.

Students come to our programs through the University of Toronto and due to the Faculty’s reputation. It is acknowledged that much more could be done by way of student recruitment.

The Faculty does pursue active international recruitment for the M.F.C. and doctoral programs. This involves a number of initiatives including the Brazilian “Science Without Borders” and the National Fellowship Program in China involving forestry schools in Beijing and Nanjing. Agreements are in place with institutions in India and discussions are underway in Singapore to attract excellent science and research students.
Another avenue for our graduate program outreach is students already studying Forestry programs. We estimate that about 10 per cent of our Forestry undergraduates come into our graduate programs.

3.0 Faculty/Research

3.1 Scope, Quality and Relevance of Faculty Research Activities

A community inspired by nature and motivated by technological drive

As Canada's first faculty of forestry, our world-class, award-winning faculty is globally recognized as a power house in scientific advancement and technological creativity, with pioneering programs in Forest Conservation, Forest biomaterials, Urban Forestry and Green Infrastructure, and Bio-nanotechnology and Bio-refinery. Together with our many academic, government, industry, and community partners, we take an interdisciplinary and collaborative approach to forestry, expanding on the art and science of managing our forests to meet both our current needs, and those of future generations.

Unique in capacity, demography, and diversity

Our faculty members, students and graduates provide leadership that strengthens our sector through innovative and collaborative work that reflects a convergence of disciplines and interests within our field. We focus on cutting edge-research and professional advancement programs, with innovative and unconventional approaches, and projects spanning all five continents.

The Urban Forest and Green Infrastructure

Over 80 per cent of the world’s population is now living in cities, and many of tomorrow’s forests will be urban. Increasing global recognition of the value of green infrastructure to human health and wellbeing, and to a city’s infrastructure as a whole has given a new importance to term ‘urban forestry’, first coined here at the University of Toronto’s Faculty of Forestry and now recognized widely. If managed properly, urban forests help to mitigate climate change and urban heat island effects, and act as carbon sinks, air filters, water purifiers, air conditioners, noise dampeners, wildlife and/or biodiversity refuges, and green spaces for benefitting human health.

A world leader in urban forestry

We continue to grow and develop the urban forestry legacy, which began here with our own Dr. Eric Jorgensen in the 1960’s, who first introduced and defined the “urban forest.” Today, the Faculty is a go-to place for Toronto’s diverse forest communities: we provide scientific and advisory information to promote evidence-based policy and planning, and conduct research focused on the development
of practical tools that can enable communities and local governments in long-term and sustainable urban forest planning. In collaboration with the City of Toronto and the Toronto Regional Conservation Authority, we provide scientific and advisory support for the diverse urban forest challenges both within our city and beyond.

**Innovative and practical research**

Invasive species control involves research into novel forms of bio-control, policy, and management to deal with invasive species such as the Emerald ash Borer, dog strangling vine (in partnership with the City of Toronto and TRCA), earthworms, and honeybees.

- Promotion of Community stewardship – development of techniques and protocols - such as the Neighbourwoods Protocol, used widely by community groups and municipalities in southern Ontario, that encourage and empower communities to care for their urban forests in a responsible and sustainable way.
- The issue of native and non-native biodiversity as it applies to the urban forest and their effects on ecosystem services and values.
- The use of Bio-char as a way to capture biomass resources and return them to the city’s ecosystem.
- Research into sustainable urban practices that support agriculture
- The effects of disturbance on the Urban forest, mitigation measures

**Forest Ecology and Restoration**

Building on more than 100 years of forestry tradition, our research into forest ecology has a wide scope and an unconventional, inter-disciplinary approach. Our research is rooted in maintaining the highest scientific standards, with a focus on quantification, fieldwork and practical application. We seek to better understand biodiversity and ecosystem services, climate change, and the role of forests and the forest sector in combating climate change and other human-induced pressures. We strive to reach beyond academics, and into the application of scientific knowledge to better forest stewardship and appreciation.

**Wide reaching, international applicability**

Our program is aimed at informing global issues, and we work with a multitude of stakeholders both locally (from the Niagara escarpment to the Hudson Bay Lowlands to Essex county), throughout Canada (locations as diverse as the Yukon and Haida Gwaii in BC), and internationally (with projects in the Brazilian Amazon, Malaysia, and the Democratic Republic of Congo, for example).

**Diverse, relevant projects**
Ongoing programs in forest ecology and silviculture extend across many ecosystems and climactic zones, comparative ecology of trees, forest canopy biology, and the ecological aspects of global environmental change, provide our partners and society with quantifiable and rigorous scientific studies to inform forestry practice and policy.

Our projects:

- Furthering our understanding of forest diversity and biodiversity globally.
- The effects of Bio-char on forest dynamics and as a form of waste management.
- The impacts of wood utilization and its effects on biodiversity.
- Forest interactions in a changing climate; using the climate envelope modelling framework.
- Harvesting impacts on non-organic environmental factors such as atmospheric and greenhouse gasses, and soils.
- Mining restoration and Vegetation.

The Faculty is currently the only group in Canada looking at the use of bio-char in a forestry context. We are concerned with its effects on the local environment (from a lifecycle analysis framework), on mitigating negative effects of salination and other forest stressors, its economic viability as a means of increasing forest productivity, and its potential to create a carbon negative forestry sector.

*Biorefinery, Biofibre, and Biocomposites*

Globally there is an urgent need to examine the role of carbon (e.g., the life time of petroleum) within the context of sustainability. It can only happen if, and only if, a substantial replacement can be made available. When the price of oil and other products made from non-renewable fossil fuels fluctuates, there is a growing interest in the development of technologies that can derive suitable alternatives from renewable resources. The Faculty of Forestry’s pioneering Bio-refinery and Nano-Bio-Composite programs, which combine bio-technology with nano-technology by using forest biomass as feedstock for such innovative materials and chemicals, is poised to revolutionize the chemical, electronics, automotive, and construction industries. Through the conversion of forest waste products into bio-based green chemicals and bio-nano-materials including plastics, lightweight composites, carbon fibre and foams, we explore more sustainable practices, and increase forest sector efficiencies.

*Collaborative, innovative programs, for a greener tomorrow*

Current programs work with stakeholders and industry partners to create value-added products including lightweight bio-composites, nano-cellulose, cellulose-based composites and products, and industrial plastics. We work in the intersection of many sectors beyond forestry, including the chemical, automotive and construction industries, and we foster a practical and collaborative process.
Some of our projects include:

- Green chemicals and adhesives from forestry biomass conversion
- OLED and battery substrates from nano-cellulose substrates
- DLFT for automotives
- Green bio-based composites and products from renewable forestry resources
- Development of novel nano-cellulose crystal based composite films
- Development of light weight sandwich panels for construction and automotive applications
- Paper-based inexpensive sensors and devices
- High yield pulp utilization in digital printing papers
- Bark Bio-refinery project
- Bio-car project
- Bio-carbon fibre project

The bark bio-refinery project is collaboration among multiple universities, the forest, chemical, and automotive industries, and the public sector. This project aims to replace petroleum-based materials with green value-added products developed through the conversion of bark. The outcomes of research will enhance the competitiveness of Ontario’s forestry sector, and will contribute to “Bio-Economy and Clean Technology” focus area of the provincial Innovation Agenda. In addition, this project forms the basis for a bio-refinery process which uses tree bark as the chief component for insulation, automotive, building and construction applications (www.barkbiorefinery.com).

Bio-economy and Forest Sustainability

The forest sector is integral to the growing Canadian and global bio-economy (or “green economy”), and requires the support of excellent forest economics research to inform responsible decision making in the coming years. There is a need for the refinement and adaptation of conventional forest economics issues such as forest tenure, timber pricing, and international trade of forest products, if it is to remain globally competitive. Ontario, more specifically Toronto, is uniquely situated to play a leading role in the development of a sustainable bio-economy because of its vast supplies of forest biomass, strong industrial base, and scientific and technological capabilities.

Building a sustainable forest industry

The Faculty of Forestry’s interdisciplinary and integrative approach to the emerging bio-economy strives to promote responsible economic choices in the forests and natural resource sector through research; training of undergraduate and graduate students and Post-Doctoral Fellows; and through collaboration with local governments, international universities, and the Ontario Ministry of Natural Resources and Forestry.
Our goals:

- Enhance the global competitiveness of Ontario’s forest-based bio-product sector (as well as the traditional forest products sector) by better understanding the global business environment and providing research inputs to provincial policy formulation.
- Enhance the understanding of the forest-based bio-economy (that includes products as well as services) and its contributions to regional, provincial, and national economies.
- Enhance the economic understanding of various forest sector issues such as forest tenure, timber and forest bio-fibre pricing, international trade of forest products, softwood lumber disputes, and managing forests as economic assets.
- Provide support to and build the capacity of the Ministry of Natural Resources and Forestry in the area of forest economics and forest-based bio-economy.
- Prepare the future workforce for Ontario and beyond with excellent economics, management, and research skills in forest economics and the forest-based bio-economy.

3.2 Appropriateness of the Level of Activity Relative to National and International Comparators

The Faculty’s research fund is shown for 2011-2016. An important measure of the scholarly activity and intellectual leadership of the Faculty is the extent of extramural funding that we receive in support of our research programs.
Figure 17

Faculty of Forestry Total Research Fund from 2011 to 2016

Note: The surge in funding in 2013 is accumulated from 2011 and 2012.

Source: Faculty of Forestry
Over the past several years, Forestry faculty have been relatively successful in attracting grants and contracts in support of their research. During the period 2007-2014, annual funding averaged $2.95 million, including $769,855 in Tri-agency funding, $546,801 from institutional initiatives, $809,209 from other government sources, $88,429 from corporate sources, and $732,141 from non-profit entities (Appendix 15). Over that time period, participation by Faculty members in Tri-Agency funding exceeded that in Division IV (Life Sciences) and in the University as a whole (respectively, 76 per cent, 74 per cent, and 65 per cent participation rates (Appendix 16). The Faculty also had better Tri-Agency success than the University as a whole (93 per cent success [13/14] vs. 75 per cent success [1336/1792]), and had significantly better success than national rates (64 per cent [17706/27460], P = 0.03; Fisher’s Exact Test (Appendix 17).

The Faculty also outperformed the rest of the University of Toronto in many aspects of technological transfer. These include per capita “Disclosures, Licenses, Patent Applications, and Patents Issued” (Appendix 18).

These measures of research productivity are all the more notable in the context of Forestry’s complement. Research funding per FTE is increasing despite fewer faculty members.
3.3 Appropriateness of Research Activities for the Undergraduate and Graduate Students in the Faculty

Bringing the Faculty’s outstanding research programs closer to all the students’ learning experience, and more accessible to individual students, is an exciting challenge that Forestry welcomes. We have taken steps and are seeing some progress in involving students in publications and especially in exposing them to working with Faculty researchers. The number of undergraduates working with Faculty members in research and the number of graduate student co-authors demonstrate the Faculty’s commitment to optimize student exposure to and involvement in research. This is a significant initiative in the context of academic FTE.

**Figure 19**

Enhancing the Research Experience of Students

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peer reviewed Publications of Forestry Faculty</strong></td>
<td>54</td>
<td>58</td>
<td>63</td>
<td>72</td>
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<tr>
<td>With MFC student co-authors</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>3</td>
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<tr>
<td>With Grad Student co-authors</td>
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</tr>
<tr>
<td>With Undergrad student co-authors</td>
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<td>1</td>
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<tr>
<td><strong>Number of undergraduates worked with Faculty researchers</strong></td>
<td>35</td>
<td>33</td>
<td>40</td>
<td>26</td>
</tr>
<tr>
<td><strong>Spin-off companies by graduate students</strong></td>
<td>none</td>
<td>2</td>
<td>none</td>
<td>1</td>
</tr>
</tbody>
</table>

Source: Faculty of Forestry

Forestry is a research intensive unit. Consequently, the involvement of undergraduate and graduate students is a natural fit. Moreover, as a part of our curriculum development, instructors continue to
include their respective research findings within their course delivery. Course content of senior level undergraduate courses, and all levels of graduate courses, allows students to be familiar with current research areas of professors.

Forestry professors provide unique research expertise for students. For example, Dr. Laercio Couto, Federal University of Vicosa in Brazil observed, “two of the world’s top tropical ecologists (Drs. Thomas and Malcolm) are in the Faculty, which is striking from a global perspective (this may seem surprising but tropical biologists unfortunately are few and far between).”

Undergraduate students are exposed to the global environmental and economic challenges, which need scientific, technical and social solutions, through lectures. Students are then encouraged to participate in the Faculty’s research training components as one means of generating interest in forestry community issues. It is, therefore, a strategic priority of the Faculty to engage undergraduate students in the early stage of their program to make them aware of research opportunities and to help them develop skills that could lead to them to graduate research and on to careers in science and forestry.

Training priorities for undergraduates involve engaging them as research assistants where they are under the supervision of senior level graduate students, postdoctoral fellows and professors. These initiatives, from year one of their program, assist in developing early stage research skills such as literature review, deeper understanding of the problem set and familiarizes them with tools such as theoretical and experimental methods.

The Faculty’s mandate is to engage in world class research activities that develop highly qualified personnel to be the thinkers and problem solvers in future generations. They will help society with the challenges we see emerging in forestry and associated research fields. In this context the research appropriateness of graduate students are determined by the level of the graduate program and the research area. For example, at a master level, given the shorter nature of the research engagement, students are encouraged to investigate research topics that have immediacy to the research or, in other cases, research topics are part of a larger overall research program, which can reveal the scope to resolve deeper and more fundamental issues that are more suited for doctoral stream graduates. Master level research programs are appropriately designed for most of our graduates so that in year one, opportunities for more fundamental research allows students to make the transition to doctoral level research engagement.

3.4 Faculty Complement Plan

The current complement of faculty members is eight FTE. Faculty professors operate within an interdisciplinary academic unit including urban infrastructure, forest bio-refinery, bio-economy and
forests for society and human health. At present, Forestry also has three “status only” positions, which are described below, seven emeritus positions and a part time CLTA (i.e., contract limited term appointment) position. Although the faculty size decreased since the 2009 decanal review, Forestry has made impressive gains in growing enrolment, as discussed in Section 2.3.3 regarding the teaching of undergraduate students, and in research funding, as described above in Section 3.2. Faculty member information is shown in Appendix 19.

In terms of academic FTE, the Faculty is on a positive growth trajectory today and there is strong future potential for growth. Over the last four years, however, there were 3.49 retirements, with one part time position filled with CLTA. Additionally, there was no replacement of the earlier retirements of a soils expert position, and the 0.49 FTE retirement of a plant physiologist. The more recent loss of a social science position (i.e., forest policy and governance expertise) requires immediate replacement because this is a key area of our Faculty academic complement growth, which is based on our program need. The M.F.C. and M.Sc.F. programs are projected to grow significantly over the next five years.

Figure 20

![Graph showing All Domestic Masters Total Eligible FTES]

Source: Faculty of Forestry
The current limitation in the net available government funding (i.e., BIUs) is adversely affecting the Faculty as it attempts to generate additional revenues. This is associated with the Faculty being one of the smaller units, and as a result, constrained in our in graduate domestic funded space allocation (BIUs). The overall Faculty’s revenue is limited by the following factors:

1. Allocated government funding for 30 (BIUs) doctoral level domestic students and tuitions
2. International students tuition
3. Allocated government level funding for 40 (BIUs) master level domestic students (starting from 2016-17 academic year)
4. Interdivisional undergraduate teaching
5. Research overhead generated by faculty members
6. Faculty research overhead costs charged by the University (expense)
7. Faculty endowment income

The argument is made here that the Faculty’s growing enrolment merits a transfer of government based allocation (BIUs) to the Faculty for the purpose of hiring two new positions. The Faculty requires two new hires to maintain the graduate enrolment growth as well as to provide teaching services to our programs serviced through other divisions, including Faculty’s undergraduate program through Faculty of Arts and Sciences (FAS).

**Figure 21**

![Total Number of Graduate Students and Faculty Academic FTE from 2011 to 2021](image)
One strategy introduced by the Faculty to complement academic FTEs (in growth areas such as urban forestry) is to recruit “status only” professors (Ph.D.s) from external stakeholders. These individuals are highly qualified experts in research areas of high priority for teaching and research at the Faculty, but they do not have the salary and benefit components of academic FTEs. In the last five years, Forestry has recruited three “status only” professors from partnership organizations: Dr. Danijela Puric-Mladenovic, an urban forester with the Ontario Ministry of Natural Resources and Forestry; Dr. Michael Wotton, seconded from the federal Great Lakes Forestry Centre, Natural Resources Canada, with expertise in fire management; and Dr. Jeremy Allison, an entomologist also with the Canadian Forest Service at the Great Lakes Forestry Centre. This increases our supervisory capacity to allow for the increased enrolment of graduate students, and on a very cost-effective basis.

The current status is that the Faculty is limited by the University’s budget model to central allocated government funding for only 62 domestic graduate students (30 for doctoral and 32 for Masters). The complete additional academic FTE, described in Section 5.3, can only be achieved from large donations specific to endowed/research chairs. Within this context, the Faculty is undertaking the following strategic direction for the growth of faculty complement to 2021:

1. The Faculty will continue to engage eminent federal and provincial government scientists in Faculty curriculum in the role of “status only” professors. This mechanism affords Forestry an increase in capacity to recruit and engage more graduate research students (particularly from the international pool). It also gives students unparalleled access to high quality personnel (i.e., HQPs) operating in the Canadian federal and provincial labs on challenging national and international research problems. In recent years, the Faculty engaged three “status only professors”, as discussed above, to serve as replacements for the retirements. Cost savings are achieved because the costs associated with “status only” professors are library facilities and some additional research tools: there is no salary component from the Faculty’s budget.

2. The Faculty is engaged in fundraising for endowed research chairs, which will provide resources to increase faculty complement. The three-year projection is to fund three additional research chairs. The new research chairs will enable the Faculty to increase the enrolment in graduate research and professional streams, as well as to expand undergraduate teaching to meet the projected undergraduate enrolment to 250 students in Forestry programs, if a future initiative (4+1) of a potential double degree program is granted.

The total number of academic FTE projected in the 2021 strategic plan is 15, which includes 10 budgetary positions and five “status only” positions. This is discussed in detail in Section 5.3.

3. One of the research chairs identified above includes a Canada Research Senior Chair-Tier One, which was denied to the Faculty in 2012. The reason for this is associated with the University administration’s perception at that time of securing enough Federal funding and its allocation.
process. This situation was recently revisited by the Faculty’s Graduate Committee and there is evidence, based on Forestry’s research funding and the quality of researchers, demonstrating the feasibility of allocating the CRC-Tier One chair to the Faculty.

At the time of the 2009 decanal review, the total faculty complement was 11.6 FTE. At present, our Faculty FTE is 8.0 with the phasing out retirement of Prof. Dave Martell. We anticipate approval to fill two new full-time tenure-stream positions (priorities include the areas of forest policy and governance and social aspects of forestry) which will be filled during the next two to three academic years, based on our enrolment and revenue growth projections. We anticipate a replacement for the soils position from our recent initiative of the Ford-Forestry matching endowment fund, which is discussed in Section 5.3.

The Faculty has three categories of adjunct and retired faculty: faculty members from other units of the University of Toronto; faculty members from other universities and eminent scientists from other research organizations; and Professional Associates practicing professional forestry or working in the area. Generally, the cross-appointed professors from other departments of the University serve as members of supervisory committees for students in the M. Sc. F. and Ph. D. program. We place a high emphasis on using all the available expertise within the University and, therefore, in a Ph. D. supervisory committee, there is at least one member from other related departments of the University of Toronto such as Cell and Systems Biology, Chemical Engineering, Ecology and Evolutionary Biology, Economics, Geography or Political Science. Depending upon the research focus of students, adjunct faculty members from other universities and organizations, such as the Canadian Forest Service and Ontario Ministry of Natural Resources and Forestry, also work on the supervisory committees of graduate students. Our faculty members also have joint research projects with many adjunct professors. We also draw on this pool of expertise for invited guest lectures on selected topics.

The Professional Associates category was created specifically to provide a professional perspective and experience for students in the M.F.C. program. These members contribute to the program through occasional guest lectures, the arrangement and supervision of summer internships, and evaluation of final research papers.

In summary, by 2021 the Faculty is anticipating 10 tenure track faculty FTE, one CRC Tier One faculty and five “status only” professors. This complement is necessary to sustain the projected growth in enrolment and programs.
4.0 Relationships

4.1 Strength of the Morale of Faculty, Students and Staff

The morale of the students, faculty members, and staff are critically important for the functioning of the Faculty precisely because it is a smaller unit. One of its strengths is the personal relationships that are unable to be fostered to the same extent in larger units.

The Faculty has formal and informal platforms for continuously monitoring and strengthening the morale of the students, stuffs and faculty members. People within the Faculty and our alumni and partners outside are sensitive to the transformation process the Faculty is undergoing and the frustration was demonstrated recently in a letter to President Gertler (Appendix 20).

The Advisory Board, Faculty Council and the Forestry Graduate Student Association all play key roles in providing guidance to the Dean. This advice assists in developing strategies to continue strengthening the Faculty’s integrity and coherence and enhancing motivation and the overall functioning of the Faculty.

The Dean has daily interaction with students and faculty members as well as scheduled meetings. The Faculty conducts regular faculty and staff meetings (monthly), and in other cases on short notice, to consult members of the Faculty, to help develop and improve administrative procedures, and to keep the Faculty motivated to achieve academic excellence.

The Dean introduced town halls, as described earlier, to discuss matters of interest and concern to undergraduate and graduate students. These “town halls” are highly effective for the Dean to listen to students individually, and on collective issues, and provide opportunities to resolve matters in a timely manner.

The Dean introduced an open door policy to have access to his office anytime by all Faculty members, staff and students. This helps the Faculty’s senior administrators to understand individual, as well as collective, issues that might warrant urgent and special attention.

Overall, it is the strength of the morale of our students, faculty members and staff that enables the Faculty to excel on all academic fronts. Their deep commitment to the future of Forestry teaching and research is demonstrated by maintaining high standards of excellence and assisting one another in performing their duties.

A Forestry undergraduate now pursuing a doctoral program in the Faculty described some aspects of the culture:

“I can recall many occasions where a professor spent significant amounts of time working closely with students to ensure their comprehension of course material,
whether inside the classroom, or field trips, or in more relaxed settings. This was in contrast to other departments where I completed courses for my minors. Indeed, around the Faculty of Forestry there has always been an unusually high level of camaraderie and engagement between undergraduates, professors, instructors and graduate students. This has fostered the development of many bright minds in the fields of resource management and environmental research.”

The comments of a graduate from the doctoral program, who is now a faculty member of Lakehead University, underscored the positive culture at the Faculty.

“I find the Faculty of Forestry at the University of Toronto to be a close-knit community of staff, students, research fellows, professors and professional associates from diverse backgrounds who are engaged in providing new leadership values to emerging professionals in the field of forestry. They are committed to meeting the challenges and opportunities of the forestry sector in the 21st century.”

4.2 Scope and Nature of Relationships with Cognate Faculties, Academic Departments and Units

The Faculty of Forestry is truly inter-disciplinary in nature. Undoubtedly our relationship with cognate divisions, departments and units reflects this reality and is highly critical to our continuing success and growth.

Today our undergraduate programs are situated within the Faculty of Arts and Science curriculum. A significant amount of our faculty FTEs are being allocated to inter-divisional teaching. It is the position of Forestry that these arrangements should be encouraged with sustainable and long term budgeting, as discussed in Section 5.3. In addition to the 17 undergraduate courses taught by Forestry faculty, many graduate students are being co-supervised through inter-divisional programs. It is important to our overall strategy to expand our inter-divisional teaching and to be compensated by revenue sharing and/or Undergraduate Course Development Fund. We hope to build even stronger relationships with the Faculty of Arts and Science and we are committed to the inter-disciplinary education model, contingent on solving some of the Faculty’s transitional revenue challenges.

We continue to strengthen our relations with the Engineering Faculty and its departments. In 2014, the Faculty of Forestry and the Faculty of Applied Science and Engineering (FASE) agreed to run a certificate program in Renewable Resource Engineering by identifying eight elective courses to be shared by the two Faculties. Currently, our faculty members teach five courses to FASE students with enrolment spanning from 20 to over 200 in individual courses. This enrollment has been growing on a year over year basis and it is more evidence of the importance of stronger inter-divisional relations and the resultant innovation in academic excellence.
Faculty members from across the divisions are cross-appointed. Our Faculty Council has drawn members from practically all cognate Faculties, which include Dentistry, Pharmacy, Public Health, FAS, FASE, School of the Environment, Architecture, and two campuses located outside the downtown St. George Campus, University of Toronto Scarborough and University of Toronto Mississauga. There are tremendous growth opportunities to enhance our relationships with all cognate Faculties, divisions and centres and Forestry is committed to doing so.

4.3 Extent to which the Faculty Has Developed or Sustained Fruitful Partnerships with Other Universities and Organizations in order to Foster Research, Creative Professional Activities and to Deliver Teaching Programs

The Faculty’s diverse student and faculty member profile is a strong advantage and reflects our inter-disciplinary reach and international network. Moreover, our faculty members are individually driven and collectively engaged in our common vision to enhance teaching and academic excellence by being leaders in their respective fields. As a result, the Faculty functions as a network lead for practically all facets of our academic programs and areas.

Our faculty members either individually or collectively have led many national academic initiatives. As shown in Appendix 19, these include convening conferences, developing highly integrated university research networks, and participating as invited guests or sabbatical residents. Over the past eight years Faculty members provided leadership for provincial and national networks concerned with the following initiatives:

1. Biocar Network (eight universities, 25 external stakeholders)
2. Bark Refinery network (five universities, 12 external organizations)
3. Green Composites (six universities, 11 external organization)
4. Biochar and Ecological Restoration (seven external stakeholders)

Forestry Faculty members provided leadership in multi-university based research and educational programs:

5. Sustainable Forest Management Network
6. Sustainable Manufacturing Network
7. Biofuel Network
8. Auto 21 Network of the Centre of Excellence
9. Value-added wood product strategic network
10. New Frontiers of Forest Economics (NeFFE) Group

Forestry Faculty members provided strong leadership in convening conferences:
In pursuit of strategic partnerships, the Faculty has developed and nurtured biomaterials programs with the University of Guelph and the University of Windsor. The Faculty played a central role in developing bio-product educational curriculum development across Ontario and translated the knowledge gained to other provinces including Alberta, Quebec, Manitoba and New Brunswick.

Joint supervision of graduate students involving other university professors has become a norm of Forestry’s transformative program. Currently 25 per cent of Forestry’s students are jointly supervised by a faculty member from a university other than the University of Toronto. This number is growing because our faculty members are leaders in national and international research programs that are focused on addressing global challenges in education and environmental problems.

Evidence of this collaboration with Forestry’s academic and professional partners can be seen in the number of joint paper publications and joint thesis supervision as shown in Figure 16. The Faculty is heavily involved with book editing and writing for the next generation of professionals and graduates. Forestry faculty have edited and co-authored more than 11 books in the last five years in partnership with non-University of Toronto professionals. This does not include their other scholastic activities such as publishing in high quality journals, invention disclosures, patents, policy papers and helping to bring ground-breaking discoveries into practice.

**Figure 22**

**Partnerships with universities and organizations (non-University of Toronto)**

<table>
<thead>
<tr>
<th></th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Books edited and co-authored</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Joint paper publications</td>
<td>23</td>
<td>28</td>
<td>35</td>
<td>30</td>
<td>46</td>
</tr>
<tr>
<td>Joint thesis supervision</td>
<td>11</td>
<td>6</td>
<td>16</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>Joint course development</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

*Source: Faculty of Forestry*

Inter-university partnerships inevitably lead to the development of other professional activities. For example, the Faculty of Forestry, in partnership with University of Wisconsin, convened world’s first wood fibre composite conference in 1990 and the Faculty has since become the leader in this field.
This type of initiative has become characteristic of our faculty leadership. We lead and co-organize conferences in ACS, UFRRI, UN and many other smaller events.

The Faculty is also active with the AUFSC (Association of University Forestry Schools of Canada). The forestry faculties of Canada agreed to work together to meet the challenges of the forestry sector, and establish a common strategy and action plan. It endeavors to enhance effective partnerships among all forest research organizations in Canada, effective cooperation with each other and government agencies and domestic and international forestry education and research.

Although these are not identified in the Terms of Reference for the Cyclical Review, the Faculty of Forestry also offers online education courses and certificate programs. These range from introductory courses to more advanced offerings to serve the needs of professionals seeking to update and upgrade their skill sets in the following areas:

- Urban Forest Conservation Planning: Urban and Cultural Landscapes
- Forestry: Profession and Practice
- Wood Protection and Design

Forestry Profession and Practice I and II, for example, are designed both to introduce students with non-traditional forestry backgrounds to the art and science of forestry, and to provide access to fundamental forestry-related studies for those preparing for entrance examinations into Canadian professional forestry associations. They are also designed to provide up-to-date instruction for established forestry professionals wishing to maintain and enhance their command of the core competencies required of practicing foresters in the dynamic world of modern forestry. They are consecutive fall and spring term courses structured to coincide with the academic calendar. These 10-week courses each consist of three, three-week long learning modules separated by reading weeks, plus a final week devoted to synthesis of all modules and the study of professionalism and ethics in Forestry. Students may enroll in specific modules only, or a full term course.

http://www.forestry.utoronto.ca/index.php/professional-development/

4.4 Scope and Nature of the Faculty Relationship with External Government, Academic and Professional Organizations

The Faculty has always pursued a deep engagement with society and government because of the nature of forestry education and research. In Ontario, for example, parks and protected areas and forest industry operations take place on publicly owned Crown Land, comprising about 85 per cent of the province’s land base of almost 108 million hectares. The Faculty’s “local” research partners, therefore, are provincial and federal governments.
The priorities of the Ontario Minister of Natural Resources and Forestry, as shown in the most recent public directive from the Premier of Ontario (https://www.ontario.ca/page/mandate-letters-2014-2015), align with some of the Faculty’s programs including supporting the forestry sector, minimizing the impact of invasive species, guiding land use planning and managing aggregates. The Ontario Minister of Northern Development and Mines is pursuing priorities that concern the Faculty’s research in the bio-economy: to foster innovation and entrepreneurial prospects, and help the North to continue to become a “sustainable, diverse, stable, innovative region”. The mandate letter to the Minister of Training, Colleges and Universities identifies priorities that are consonant with the goals and priorities of the University and the Faculty: to assess the labour market success of graduates and to attract international students to Ontario. The priorities of the Ontario Ministry of the Environment and Climate Change are directly relevant to the future of the broader forestry sector and more immediately urgent to the Faculty’s teaching and research.

The Faculty is well aware of the education and research mandates of the federal and provincial governments. Faculty academic members are involved with government for the purpose of helping guide the future direction of forestry education and research and also to provide input and advice on issues such as policy development and future directions for government funded research and educational initiatives in the Forestry discipline. The Faculty of Forestry currently has members on the Ontario Provincial Forest Policy Committee.

To encourage dialogue and strengthen these relationships, the Faculty of Forestry has two members on its Advisory Committee, the Deputy Minister of Natural Resources and Forestry of Ontario and a federal government Assistant Deputy Minister of Natural Resources Canada. Their presence on our Advisory Committee is a mechanism for open dialogue with our important government partners. Another member of our Advisory Committee is the Ontario Environmental Commissioner.

During the past seven years, many of our faculty members were involved in research fund disbursement committees and some were committee chairs. These include the National Science Foundation, USA; USDA, DOE funds, EU framework, South Africa funding network, India DST funding, Finland Tekkes Funding, Swedish Wallenberg Funding; and China Nanopolis funds.

There are regular activities that give faculty and students opportunities to collaborate with professional foresters. The annual field camps involving the Canadian Institute of Forestry (CIF) the Canadian Ecology Centre and Haliburton Forest were discussed earlier. The Dean and faculty members make presentations to the Council of the Ontario Professional Foresters’ Association, to the annual meetings of Forests Ontario, and the annual conferences of the CIF. The Ontario Professional Foresters Association holds its annual Toronto regional meetings at the Faculty and students and faculty participate in these meetings.
4.5 Social Impact of the Faculty in Terms of Outreach and Impact Locally and Nationally

The description in Section 3.3, giving an overview of the Faculty’s research interests, indicates that Faculty members are driving and leading many projects including the urban green initiative. Faculty members are influencing local and provincial governments to enhance their policies and take action.

Professor Sandy Smith, since 2012, has been the lead in urban forestry at the Faculty of Forestry drawing from her long research career in forest health and invasive species. Prof Smith works collaboratively with Professor Danijela Puric-Mladeovic, a graduate of the Faculty, and an expert in natural heritage systems and green infrastructure and developing innovative and integrative sampling methodologies to support conservation planning and management. Today, there is unprecedented global interest in urban forestry as a result of global urbanization, yet these concepts have been taught at the Faculty since its inception (1907). The expanding network of students and graduates being placed worldwide in fact speaks to the long-term commitment to research and teaching in this area at the Faculty. In many ways, the availability of modern urban forest expertise can be seen as a direct result of the Faculty’s recognition of the critical role urban forests can play in mitigating the effects of increasing urbanization and climate change.

The Faculty’s focus in urban forestry has been on facilitating forestry thinking into community-based, ecosystem level management. This has meant broad engagement of non-academic players from the urban forestry community, some of whom are identified in the following:

**MUNICIPALITIES**
Cities of Montreal, Winnipeg, Hamilton, Oakville, Kitchener
City of Toronto, Department of Forestry, Parks & Recreation and the Planning Department
York Region, Forestry Department
Toronto District School Board
Toronto Catholic District School Board
Evergreen
Green Infrastructure Ontario
Local Enhancement Appreciation Forests (LEAF)
Toronto Parks & Trees Foundation
Toronto Regional Conservation Authority (TRCA)
Cabbagetown ReLeaf Association
TreesPlease Annex Association
Trinity Bellwoods Park Association
Treeing the Village Harbord Village Resident’s Association HVRA
Faculty members have worked effectively with environmental non-governmental organizations (ENGOs) and have played active roles in the environmental community through targeted research projects, invited presentations, and contributions to workshops. For example, Professor Malcolm has taken an active role in events organized by the Canadian Parks and Wilderness Association,
Greenpeace - Canada, the Wildlife Conservation Society (Canada), and World Wildlife Fund (for which he currently serves as a member of their National Council). One of the Faculty’s instructors, Faisal Moola, also serves as Director General for the David Suzuki Foundation for Ontario and northern Canada.

The Faculty has made significant contributions to an issue of great importance to Canadian society. Professor Kant, for example, has worked with First Nations and Aboriginal communities on issues related to aboriginal tenure and reform. He has also advised the Credit Valley Conservation Authority on an environmental benefit index for wetlands. The Ontario Ministry of Natural Resources and Forestry has come to him for advice on public policies associated with the economics of biomass-based bio-products on public forest lands and of non-timber, non-carbon ecological goods and services on private lands in Southern Ontario.

Some of the Faculty’s impacts are difficult to gauge but have larger social implications. As one M.F.C. graduate explained:

"the influences of Forestry’s social impact is most evident in small towns across Canada...over 100 communities depend on the forestry sector......while many of these small towns are losing their younger generations to the cities, my Faculty of Forestry classmates are moving to them and raising families there. This brings new life to towns like Mattawa, Thunder Bay and Cochrane. “

The Faculty’s bio-refinery and wood science team, through their relentless work with stakeholders including industry and governments, has influenced Canada to develop a bio-economy platform. The Faculty has been instrumental in creating at least three non-profit organizations, the Canadian Natural Composite Council (CNCC), BioAuto Council and ISO Nanotechnology committee (Canadian Chapter), that helped develop the bio-product platforms in Ontario and nationally. This work will position Canada to compete internationally.

Moreover, Faculty members are listening to the public debate about government investment in research and are encouraging their students to translate their research into practice. Three spin-off companies have been started in recent years by the Faculty’s research students: Greencore, GreenNano and Nature Affinity. Faculty graduates also own other types of businesses related to forestry. A female graduate describes her route to self-employment,

“I was a part-time student in the Master of Forest Conservation program from 2009-2013. Participation in the program was supported by my employer who was a global, multi-disciplinary consulting company...I am currently self-employed as a consultant in landscape architecture, arboriculture and urban forestry. I have a contract with Evergreen as a school ground design consultant.”
4.6 Faculty Activities to Build National and International Partnerships

The Faculty of Forestry is globally known for its innovative research and educational programs. It is deeply involved in national and international partnerships and collaborative activities. A more detailed listing of the Faculty’s partners is found in Appendix 22.

THE URBAN FOREST
New York City Urban Forestry Department
Invasive Species Panels
Tree Canada
Rouge Federal Urban Park
Canadian Urban Forest Network CUFN

TEACHING AND RESEARCH
Association of University Forestry Schools of Canada
Brazilian Science without Borders (graduate education)
Brazil: CAPES International program (student exchange)
Sao Paulo University Brazil
Sao Paulo State University
University of Campinas
University of Sao Carlos (UFSCAR)
Haida Gwaii Higher Educational Society
Costa Rica: Las Cruces Botanical Garden
Royal Botanical Gardens, Ontario
The Niagara Escarpment Commission
FUSOME, Suzhou University joint research initiative with China Scholarship Council
HTF University joint student exchange and research program, Switzerland
University of Buenos Aires, Argentina
Ankara University, Turkey
Harper Adams University, UK
Agricultural University of Faisalabad, Pakistan
Fujian Agriculture & Forestry University, China
Agricultural University Gazipur, Bangladesh
Universidade Federal de Juiz de Fora, Brazil
University of Namur, Belgium
University of Pau, France
Cornell University
Michigan State University
University of Rhode Island
Universite Quebec Montreal
Laval University
Lulua University of Technology, Sweden
McGill University
University of New Brunswick
**PROFESSIONAL ASSOCIATIONS**

Canadian Institute of Forestry
Ontario Professional Foresters Association
Sustainable Chemistry Alliance
Entomological Society of Canada
Royal Forestry Society
Royal Ontario Museum
Canadian Food Inspection Agency (CFIA) National Science Advisory Panels
Inter Congress of Biological Invasions (China) and Inter Congress of Entomology (S Korea)

**FOREST POLICY AND GOVERNANCE**

Natural Resources Canada and the Canadian Forest Service
UK Department for International Development (DFID)
International Union of Forestry Research Organizations
Ontario Ministry of Environment and Climate Change
United Nations Forum on Forests
USDA European Biological Control Lab, Montpellier, France
USDA Forest Service
CABI (Commonwealth Agr. Bureaux Inst) UK
Plant Protection, Desert Research Centre
Regional Forestry Dept., Guangxi Zhuang, China (Wei)
Regional Forest Pest Quarantine Kunming, China (Cui)
Canadian National Collection, AAFC Ottawa
Wood Fibre Centre CFS
AAFC Agriculture and Agri-Food Canada
Ontario Ministry of Agriculture & Rural Affairs

**WILDLIFE BIOLOGY AND BIODIVERSITY CONSERVATION**

Brazilian Center for Nature Conservancy and Sustainable Development
Canadian Forest Service
Greenpeace Canada
Haliburton Forest and Wild Life Preserve
IntAct
Ivey Foundation
Ontario Ministry of Natural Resources and Forestry
Wildlife Conservation Society Canada
Wolf Lake First Nation
World Wildlife Fund

**INDUSTRY PARTNERS (100+)**

Ford Motor Company
Total United States
Montoplus, Germany
Magna
KDX China
Future Soft, China
Crest Mould
Hutchinson, France
Chrysler Canada
Supply chain management companies
Automotive Part Manufacturing Association (APMA)
Bio-Auto Council
Mining industry support for the Research Chair in Bio-Char
Tembec
EACOM
Canmet
Walker Industries
FP Innovation
PMP –Pulp Moulded Products
MSIPME
HC Horticulture
Westmoreland
Natures Affinity Inc.

**BIO-REFINERY**
Huntsman
Arclin
Woodbridge
FPI

**BIO-PRODUCTS**
Swedish Composite Council Board
Composite Innovation Center

**BIO-NANOTECHNOLOGY**
Ontario Jianshu Nano Innovation Centre
Lulea University Joint Nanocellulose Research Program
Oulu University Joint Nanocellulose Research Program
Arbora Nano Board
NanoTech Ontario

**ENVIRONMENTAL ORGANIZATIONS (ENGOS)**
World Wild Life Fund, Canada
Greenpeace, Canada
CPAWS Wildlands League
Nature Conservancy Canada

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5.0 Organizational and Financial Structure

5.1 The Appropriateness and Effectiveness of the Faculty's Organizational Structure, Including the Organization of the Dean's Office and Extra-Departmental Unit, and the Effectiveness of the Financial Structure

The organizational structure and governance of the Faculty of Forestry are approved by the University’s Academic Board and the Governing Council. As mentioned in Section 2.3, Appendix 6 describes the current status of Forestry’s organizational structure.

It is important to note that in the past eight years, the Faculty developed two extra-departmental units (EDU): the Centre for Bio-composites and Biomaterials Processing and the Centre for Urban Forestry and Urban Ecosystems. Both these units are classified as EDU D units (see Appendix 21) and http://vpacademic.utoronto.ca/academic-units/extra-departmental-units/). The Faculty is also in the process of developing an extra-departmental unit for Ecosystem Management and Remediation. These three extra-departmental units are the result of the development of critical mass in these areas of global focus and of the contemporary educational and research priorities of the Faculty of Forestry. Each EDU D unit is uniquely situated to foster inter-disciplinary educational and research activities in which students and professors from the University of Toronto, and other universities, research organizations and government can collaborate in resolving key national and global challenges.

5.2 The Appropriateness with Which Resource Allocation, Including Space and Infrastructure Support, Has Been Managed

Resource allocation is a critical issue for the University. The Faculty recognizes the value of resources and works diligently with central administration to maximize the utilization of the University’s resources.

The Faculty’s resource allocations can be divided into three major categories:

1. Faculty academic complement and support staff
2. Faculty operational resources (library, human resources, research administration, advancement, international outreach)
3. Faculty space and infrastructure
5.2.1 Academic Complement

As reported earlier in Section 3.4, the Faculty has approximately eight FTE today. The Faculty needs to maintain the current levels of teaching and research and enhance the Faculty’s revenue to sustain this level and to hire replacements for retirement.

If the former University administration’s criticism was that Faculty members were not teaching enough, such is certainly not the case today. What follows is a summary of the activities of Forestry faculty members over the last two years:

1. Taught on average three courses (graduate and undergrad) per year (i.e., above the university average) with above average senior class enrolment
2. Supervised on average four graduate students (in cohort) per year (mostly doctoral)
3. Successfully awarded on average $200,000 per FTE in research funding annually
4. Involved in administrative and outreach activities over 10 times per year per FTE
5. Helped run the following programs:
   i. Graduate research programs (Ph.D. and M.Sc.F.; enrolment over 48 students per year)
   ii. M.F.C .professional master program (enrolment over 55 students per year)
   iii. Taught 17 undergraduate courses, contributing significantly to inter-divisional teaching

In conclusion, the activities of Forestry faculty members generated substantial revenue for the University.

5.2.2 Support Staff Complement

Today the Faculty has 4.6 support staff in the University’s budgetary allocation through university operations. One senior administrative staff is on long term leave. The University administration has argued that the Faculty of Forestry has too many staff per academic member, approximately one support staff per two Forestry faculty members (i.e., 8/3.6=2.1). A different picture is revealed, however, if support staff allocation is based on BIUs (i.e., government allocated funding) for graduate and undergraduate students and tuition rather than per academic FTE.

From this perspective, the Faculty's staff allocation is lower than the university average (on the assumption that all domestic students are funded). This calculation assumes that graduate student BIUs are four times the average undergraduate student BIUs and an amount of $750 per undergrad student taught per course. This way of looking at support staff recognizes the fundamental fact that much of the work of support staff is in support of student programs.

The Faculty’s plan calls for hiring a business officer and an international program administrative assistant. The Faculty has not had a business officer since 2014 and is currently seeking to fill this position. The administrative workload and planning and budgeting processes make such a position essential to the functioning of the Faculty. Our domestic and international programs are expanding
and our enrolment in both professional and graduate research streams is increasing, therefore, these positions are warranted.

5.2.3 Faculty Space

It is important to mention that the building in which the Faculty of Forestry resides is the result of a fundraising effort by our Faculty alumni. A space allocation of slightly above 3000 NASM (i.e., net assignable square meters) was allocated to the Faculty in the Earth Sciences Centre, as the building complex was named. In the late 1990s, the Faculty released some space to host the Centre for Environment, now known as the School for the Environment. In 2012, the Faculty released an additional 750 NASM to the Faculty of Arts and Science to host complimentary research units and faculty members from the Department of Ecology and Evolutionary Biology. Today the Faculty occupies 2514 NASM residual space.

In a recent publication by the University space and facility service, Forestry is shown as having the highest research and office space per FTE. Forestry’s 210 NASM is compared to the University of Toronto average of 92.5 NASM.

Allocating resources per faculty FTE, however, is not the most appropriate means of doing so in the context of facility resource utilization. As the “do more with less” approach became the norm for managing resources, it is argued here that a more meaningful approach is relating NASM to actual graduate student numbers and the Faculty’s research revenue generation. To this end, the Faculty did its own analysis based on the total BIUs and tuition and other revenues generated and the results are shown below.
It is notable that space allocation, based on research funding, shows an average space utilization of 50 NASM/100K research grant, which is on par or slightly less than the University’s central space resource revenue model. The Faculty’s research lab and research support lab space utilization is 1306 NASM. The Faculty presently has 104 registered graduate students and 65 post-doctoral fellows, research assistants and research associates, many of the latter being funded through professorial research funds. To our mind, a truer picture of space allocation needs emerges from accounting for the broader number of students and researchers and their research output rather than a singular, and perhaps inaccurate, focus solely on the number of professors.

One of the single largest cost factors results from the high volume of research per Forestry faculty member and the reduced allocation for overhead expenses from government funding. The cost associated only with space maintenance and utilities accounts for more than 25 per cent of the Faculty’s budget.

At this point in time, the residual space of the Faculty (2514 NASM) is barely adequate for the Faculty’s level of research and teaching activity. Retirements have put more pressure on the Faculty to generate additional revenue, and the Faculty is under budgetary pressure to maintain the space, which is a real threat to the existence of the Faculty as a stand-alone unit. These factors required
the Faculty to offset high operating costs through increasing enrollment in professional programs.

Revenues from increasing student enrolment, domestic and international, could offset operational costs in the future and also impact the size of Faculty space requirements. These projections are set out in Figure 25.
### Figure 24: Current Allocation of Office Space in the Faculty of Forestry and Predicted Future Needs (2016-21)

<table>
<thead>
<tr>
<th>Category</th>
<th>2015-16</th>
<th></th>
<th>2020-21</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td># Individuals</td>
<td># Offices</td>
<td># Individuals</td>
<td># Offices</td>
</tr>
<tr>
<td>Administration including contract admin employees (part time)</td>
<td>4 full time plus 2 part time.</td>
<td>5</td>
<td>7</td>
<td>5</td>
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<tr>
<td>Faculty (tenured/tenure track)</td>
<td>7.5</td>
<td>8</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>CLTA</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Students</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Research Stream</td>
<td>50</td>
<td>16</td>
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</tr>
<tr>
<td>Professional Degree program student meeting rooms</td>
<td>56</td>
<td>4</td>
<td>92</td>
<td>4</td>
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<tr>
<td>Interdisciplinary students (other divisions-research students)</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>1</td>
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<tr>
<td>Research Associates/PDFs</td>
<td>12</td>
<td>6</td>
<td>14</td>
<td>6</td>
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<tr>
<td>Allocated to Geography (Dr. Tat Smith)</td>
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<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Graduate Students Assoc.</td>
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<td>1</td>
<td>N/A</td>
<td>1</td>
</tr>
<tr>
<td>Undergrad. Students Assoc.</td>
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<td>N/A</td>
<td>1</td>
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<tr>
<td>Emeritus</td>
<td>8</td>
<td>4</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Professors Visiting/Sabbatical</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>148.5</td>
<td>50</td>
<td>197</td>
<td>50</td>
</tr>
</tbody>
</table>

* includes one contract

- 28 student offices
- five emeritus/visiting/Sabbatical offices
(i) Administrative Space

The administrative space allocation of 220 NASM consists of office space for the Dean, administrative assistants, the senior development officer, the senior technical supervisor and the computer systems manager, the Faculty’s conference room, records storage, a shared staff lounge plus first aid centre, and the mail and photocopying room. Administrative offices are located primarily on the ground floor and are just sufficient for the present administrative complement.

The summary of administrative space is as follows:

Current space: five offices, one conference room, one mail room, one records storage room, one staff lounge and a first aid centre

No additional administrative space is required for the Faculty until the year 2020.

(ii) Faculty and Student Office Space

Office space is provided for all academic staff (one per office) totalling 212.4 NASM and for all students registered in Faculty research graduate programs (3-4 per office) totalling 331.8 NASM. Please note that Prof. Tat Smith, who is a faculty member of the Geography Department, has his office in our Faculty. Shared office space is provided for a small number of emeriti professors who are active in research and teaching (2-3 per office, 26.68 NASM) and for research assistants, research associates and a few visiting professors. Two offices have been allocated for use by the Forestry Graduate Students Association and the Undergraduate Forest Conservation Students Club. Four student meeting office spaces are also provided for “inter-disciplinary students” and professional master students who do not have their own desk. These students are registered in the M.F.C. program or in other divisions (mainly the FAS and the Faculty of Applied Science and Engineering) who are supervised by members of the Faculty, and carry out their research in the Faculty. Total current office space allocation and requirements predicted in the plan period are shown in Figure 24.

Although the present space allocation is just adequate for Faculty needs, future needs for office space cannot be fully accommodated. The deficit can be addressed in part by restricting lower priority uses (emeritus professors, visiting professors) and possibly by some increase in the density of research associates, though all these measures have some negative academic implications. For example, the significant anticipated growth in research associates/postdoctoral fellows is primarily related to the development of the Centre for Bio-composite and Biomaterials Processing with two chairs (wood composite and the Ford-CBBP endowment), with pilot scale space allocation of (50 per cent of 81 NASM or 40.5 NASM) and the Biochar and Ecological Restoration Laboratory, both of
which are globally significant research centres. An inability to accommodate international scholars associated with the Centre would restrict the scope of research activities and, ultimately, the influence of the Centre. Some alleviation of future demands may be possible through, for example, placement of some research-stream students in “dry” laboratory space. Even with such measures, pressure on space will remain severe and it will be difficult to accommodate everyone appropriately within the current Forestry space allocation.

(iii) Research Laboratory Space

All professorial staff have access to dedicated research laboratory space. A recent review of our space inventory allocation indicated that average research space used by the Faculty is 142 NASM per faculty FTE. Most of the research space is in high-service laboratories, but the economic and policy group share “dry” laboratory space, as does the fire management group. There are a total of 15 dedicated research laboratories with a total area of 670 NASM, of which 80.20 NASM are in “dry” laboratory space. In most cases, dedicated laboratory space is focused on an individual professor’s research group; however, the wood science and wood product research space is functionally organized around jointly-used equipment. This is true also of the space dedicated to the Centre for Bio-composites and Bio-materials Processing (40.5 NASM). In addition to major research laboratories, there is also some communal research space (cold rooms, environmental chambers, greenhouse, sample and field equipment storage, prep. labs) which are not individually allocated, but assigned as required by the senior technical supervisor. These are used by members of almost all the research groups. The total research laboratory space available is approximately 670.62 NASM.

(iv) Teaching Space

Most student laboratory demands are accommodated within the research laboratory space. One high-service laboratory (ES1005, 57.6 NASM) is reserved during the academic year for teaching in professionally-focused master’s programs and for courses in the undergraduate programs in Forest Conservation Science. This laboratory is also used for “overflow” research space during the summer.

In addition to the teaching laboratory, the Faculty space allocation includes four small seminar rooms (total area 148.4 NASM). All of these rooms are very heavily used for formal courses, seminars, lectures, meeting and thesis defenses. The Faculty’s seminar rooms (e.g. 1015, 1016M) are also shared by the Centre for Environment. Finally, the Faculty has a computer laboratory and systems service laboratory 4001B (94.78 NASM) that supports all teaching programs and a significant proportion of research activity. A more recent space inventory review revealed that four labs are used 50 percent time for teaching undergraduate students enrolled in FOR 300 and 400.
5.2.4 Library Resources

The Faculty of Forestry relies on the University of Toronto library system. A description of excellent resources offered by the University libraries is contained in the Library Report prepared by the University and attached as Appendix 22.

5.3 Achieving Financial Sustainability

Key to our self-study is one question: is the Faculty of Forestry financially viable? The answer is yes. The financial plan, presented here in summary, indicates a strong path to increase growth and revenue. The Advisory Group endorsed the key elements of the plan: increasing enrolment, pursuing funding for Research Chairs in urban forestry and the bio-carbon-economy and investigating a possible move to a new location with reduced facility costs.

Undergraduate programs:

For budget allocation purposes, the University’s model is tied to the number of students registered, mostly in undergraduate programs, but there is a ceiling on the size of the FTE. When the formal undergraduate forestry program was closed in 1994, a decision related to a worldwide cyclical trend away from traditional undergraduate forestry education, the Faculty reacted by focusing its efforts on its graduate programs. As a result, because of the University’s allocation model, revenues in the Faculty declined. This effect was exacerbated by the University’s cap on the number of graduate students in Forestry.

The Faculty continued – and continues to this day – to contribute to the University’s undergraduate programs. Forestry courses (as shown in Figure 3) are being taught to students who are enrolled in other units such as the Faculty of Arts and Science. The reason for this is that Forestry faculty began teaching forestry courses to small numbers of Arts and Science students and the student interest in these courses has grown steadily. A conservative estimate of the Faculty of Forestry’s revenue associated with the 17 courses currently taught in FAS to approximately 800 undergraduates should be above $600,000. At present, this teaching contribution is not allocated as revenue in its budget. In our view, the failure to recognize Forestry’s contribution to these undergraduate students is inappropriate.

It is understood, however, that the Faculty receives funds to run its operating budget deficit and that this amount is a part of this central fund transfer. This teaching revenue is transferred to the Faculty as a part of the central fund allocation, resulting in the Faculty’s net deficit of about 70 per cent. This anomaly in revenue accounting is an unfortunate shortcoming of the current revenue accounting protocol. It gives a University-wide incorrect perception that the Faculty of Forestry survives on others’ revenue and work effort, resulting in a negative institutional perception of a
small Faculty such as ours. On the other hand, if the teaching amount mentioned above is counted as the Faculty’s net revenue (which should be the case) then the Faculty’s budget shortfall at present would be only marginal. This anomaly in the revenue and operating budget deficit needs to be adjusted to clarify the Faculty’s actual overall revenue situation. It is clear that the Faculty of Forestry’s new programs are resonating with students, including those in Faculty of Applied Science and Engineering, reflecting societal concerns about the environment and the Faculty’s programs focused on bioenergy, sustainable green products and conservation of the world’s disappearing forests. In fact, 123 students are registered in 2015-2016 for undergraduate Forestry degrees, despite the fact that the University has made no significant funds available to help the Faculty attract such students.

Figure 3 projects doubling the number of forestry undergraduates to 250 by 2021. Despite the absence of active recruitment, the number of forestry undergraduates has grown significantly since the inception of the program. The projected growth, therefore, assumes that the undergraduate programs are attractive to students, and with an organized promotion strategy, can be expected to increase substantially in five years. For example, Forests Ontario, one of Forestry’s professional associates, contacts thousands of Ontario high school teachers and students to participate in an annual international environmental competition called Envirothon. This partnership could be one approach to informing high school students about the new undergraduate forestry programs at the University of Toronto.

The University’s allocation model understates the Faculty’s economic contribution to the University’s undergraduate education as a whole, which enables the widespread but incorrect perception that Forestry is a “cost centre”, and accounts for a disproportionately high percentage of support from the University Fund. With more appropriate allocation, which properly includes the University’s revenue related to our undergraduate teaching, as well as the projected increased enrollment described below, it becomes clear that Forestry is, in fact, a research intensive and financially sustainable division.
The M.F.C. program, a hallmark of Canadian forestry education, has experienced 60 per cent growth since 2013 (Figure 1). Starting in 2016, 60 students will be enrolled in the Master of Forest Conservation program (i.e., 30 students in each of the two cohorts comprising the 16 month M.F.C. program). The number of FTEs permitted by the University-allocation of government BIUs is currently 32, but Forestry can grow the capacity to accommodate the projected increase to 80 students shown in Table 1. Even if there is no grant portion allocated for the additional number of students above the cap of 40, Forestry will have a net gain in its revenues from the M.F.C. tuition.

One challenge in expanding the capacity of the M.F.C. program is the pressure to continue to produce more high quality internships for each student. As described in section 2.3.4 above, a unique distinguishing feature of the M.F.C. program is that each student experiences a three month internship in the broader forestry sector. As reported above, most of the M.F.C. students are interested in aspects of urban and ecological forestry, the bio-economy and policy. The reason it is feasible to produce more internship opportunities is primarily because employers are enthusiastic about the experience (see Section 2.4.5). Additionally, Forestry is improving its online capabilities for
matching interns with employers and opportunities. In most years of the M.F.C program there has more interested employers than available interns.

**Doctoral Program:**

Figure 2 projects growing the number of doctoral students to 46 by 2021. The prospects of attracting qualified doctoral students are confirmed by Forestry’s high rate of acceptance by applicants (average of 74 per cent from 2008-2013). Alternatively, as discussed earlier in section 2.2, for all its programs, Forestry follows high standards for admission that comply with or exceed the requirements of the University of Toronto. The quality of applicants to the doctoral and other programs, therefore, will be enhanced by increased enrolment.

**Funding Research Chairs**

An important factor associated with funding research chairs is faculty complement, which is described earlier in section 3.4. By 2021 the Faculty is anticipating 10 faculty FTE, one CRC Tier One faculty and five “status only” professors. This involves two new faculty positions and two additional “status only” professors.

As shown in Figures 26, the objective of Forestry’s financial plan is to fund two new Faculty positions by creating two new Research Chairs over the next five years. A Research Chair has significant financial implications, in general it can be calculated that a Research Chair in Ontario funds a university professor’s salary in the range of $150,000 annual revenue.

In the past year, the Faculty has been successful in attracting funding for Industrial Chairs. Professor Sean Thomas obtained funding for an Industrial Research Chair in *Biochar and Ecosystem Restoration*, the first of its kind in the world. Dean Mohini Sain has obtained a funding commitment, contingent on the conclusion of his decanal term in 2017, for an Industrial Chair in the Bio-economy.

Work is underway to attract funding for a Research Chair in Urban Forestry. The prospects are encouraging. To begin with, there is a history to build on. The field of urban forestry was created in Canada in the 1960s at U of T’s Faculty of Forestry by Professor Erik Jorgensen, a forest pathologist. The University of British Columbia has the only Canadian urban forestry program, and it is not based on recruiting students from eastern Canada. There is potential for collaboration between the two universities.

The second Research Chair for which funding is being pursued is in the Bio-Carbon Economy. Discussions about showcasing Toronto and the GTA as a hub for clean and green technology has resonance with industry, especially in the context of government’s policy initiatives around climate change. One opportunity being pursued is for funding from the Ontario Ministry of the Environment.
and Climate Change from the proceeds of the upcoming “cap and trade system” to establish a Chair in the Bio-Carbon Economy.

One alternative to creating new Research Chairs is fundraising for endowment. This is discussed in Section 6.3.4.

Figure 26 illustrates the Faculty’s growth plan and it is discussed further in Section 6. In summary, the plan incorporates elements of revenue generation from interdivisional teaching, the prospects for increasing enrollments and the potential for funding research chairs.

Figure 26

Adjusted Revenue for Faculty of Forestry for 2016 and 2021

Source: Faculty of Forestry

6.0 Long-Range Planning Challenges

6.1 Consistency with the University’s Academic Plan

In supporting the University’s academic plan, the Faculty is orienting its renewal efforts towards achieving the shared goals of:
6.1.1 Enhancing the Global Reputation of the Faculty and the University of Toronto

Recruitment of high profile academics is a major priority of the Faculty. The high caliber and integrity of current Faculty members, and their success in operating within a harmonized interdisciplinary platform, comprise the strength of the Faculty of Forestry. As we embark in a new era of forest, health, society and bio-economy, the Faculty is making its mark on the global platform by educating highly qualified young scientists and professionals who represent gains in diversity, including gender. One of the challenges is to fund the hiring of world class faculty members to continue this educational path and to assist in extending the global reach of the Faculty’s programs. We began the dialogue with our external stakeholders to participate in long term cooperation involving creating research chairs and endowed chairs. This will allow us to overcome some of the challenges we faced over last decade. We are well positioned to build an environment that embraces academic excellence as a core value of our professional advancement.

6.1.2 Increasing Student Enrollment and Quality of the Student Experience

As members of a research intensive University, we are inspired to attract high quality graduate students, both nationally and internationally. Importantly, we are taking strategic initiatives to nurture a culture that encourages young researchers, beginning with undergraduate streams, to get involved in our research programs early in their learning. We are also transforming our teaching tools to give our students the knowledge of current innovation. It is enabling them to access and attend practicums in industrial and practice-oriented laboratories and premises.

6.1.3 Ensuring Financial Sustainability within the Constraints of the Provincial Funding Situation

As discussed earlier in this report, the reduction of domestic professional master student spaces (i.e., allocation of BIUs), coupled with the increased operational costs and fewer Faculty academic FTEs, put the Faculty in a challenging fiscal environment. Under these constraints, two approaches were considered: an increase in allocation in domestic professional master students BIUs and an increase in the international student enrollment. A sustained funding model for the Faculty over the long term is essential for the overall growth of the Faculty. In a time of reductions in government funding, the Faculty has sought, and will continue to seek, assistance and direction from its Advisory Committee on strategic issues in developing our long term revenue model.

The long term strategic plan for sustaining the Faculty

1. Increase enrolment in the professional Master of Forest Conservation program for domestic and international students. The Canadian Forestry Accreditation Board is moving towards accrediting
specialized program areas such as ecological restoration, urban forestry and renewable resource engineering. The opportunity for such professional licensing will attract students. As discussed in Section 2.4.2 and Section 6.0, launching “1+1” programs with divisions and highly-ranked international schools will also drive enrollments higher.

In order to achieve long-term fiscal sustainability, we have already demonstrated that our enrollment in professional programs can be further increased, provided we are not capped at BIUs in our professional M.F.C. program (Figure 25). We have also seen a sizable increase in our international students’ applications for professional masters. We understand that similar growth is taking place at other Canadian forestry schools, largely as a result of “1+1” programs with international institutional partners.

2. Increasing enrollment in undergraduate programs (Forest Conservation (Science), B.Sc., Hons.: Specialist, Major, Minor, Forest Conservation (Arts), B.A., Hons.: Specialist, Major, Minor and Forest Biomaterials Science, B.Sc., Hons.: Major, Minor) offered through the Faculty of Arts and Science indicates significant potential for growth. This is particularly the case with the potential for launching “2+2” programs wherein two years of undergraduate teaching resources would accrue primarily to the Faculty of Forestry FTE. This agreement with the Faculty of Arts and Science would provide the needed increased revenue sharing.

Our strategic initiative for enhancing the undergraduate student experience is starting to show success in drawing undergraduate students into our graduate research programs. We are beginning to see our Forestry undergraduate students moving into graduate programs, and being placed in industry and working with the Faculty on the research projects they experienced as undergraduates. These emerging results are shown in Figure 19.

3. Creating two additional funded chairs: the Chair on Bio-Carbon to be created with national and international partners and the Urban Forestry Chair to be created in partnership with GTA municipalities, NGOs and private partners.

4. A multi-party initiative for developing Toronto’s first 12 Storey Wood Building that has dedicated space to accommodate the Faculty and an Institute for Carbon Management (EDU C/D) is being discussed (see http://www.nrcan.gc.ca/forests/industry/products-applications/16834 ). A series of stakeholders’ discussions are now underway to obtain an exemption for permission to obtain the first permit in Toronto to build a tall wood building. Associated with this project, is planning for fundraising to secure space in this landmark development for the Faculty and to create a new Institute for Carbon Management. The costs are estimated to exceed $50 million and would be shared by diverse private partners and others such as FPInnovations (in engineering design). The business plan for this “green/clean technology hub” is expected to involve multiple tenants.
including a student residence, City innovation office, builders, Toronto construction industry, and many more.

6.2 Progress Towards the Faculty’s Academic Priorities, Including the Capacity to Meet Opportunities and Challenges Ahead Successfully.

We have actively pursued fundraising as one means of bringing on new faculty members. In this respect, we experienced some initial success with industrial partners, which enabled us to secure two research chairs in last 3.5 years. Another Chair in Urban Forestry is under discussion at this point and it is expected to be finalized by the end of next year.

In addition, as discussed in Section 2.4.6, we have increased our NSERC partnership funding significantly and, as a result, we are expecting a reallocation of a CRC Tier I chair.

We have already secured three outstanding “status only” faculty members as discussed in Section 3.4, to enhance our existing FTEs. We are also in discussions with provincial and federal research laboratories to recruit two more in next two years in our strategic areas of First Nation and Aboriginal Crown Land policy and social science-related developments.

6.3 Appropriateness of Complement Plan and Enrollment Strategy

6.3.1 Complement Plan, Including Balance of Tenure-Stream and Non-Tenure Stream Faculty

Our complement plan, as discussed in Section 3.4, is based on future program initiatives and revenue growth projections. A social science and a forest policy position will lead to four additional graduate courses being taught. This would involve the expansion of the M.F.C. program further into the areas of urban forestry and restoration ecology. A social science undergraduate course and a forest policy undergraduate course are also part of our long term plan for the development of a professionally accredited undergraduate stream. Soil science and GIS positions will be drawn from “status only” (non-tenure stream) appointments to reinstate our undergraduate and graduate elective courses which were lost due to retirements.

These four additional complement positions will lead to the intake of 16 additional research graduate students (domestic or international), further reinforcing our research strengths. These four additional positions over five years will enable the Faculty to maintain the projected growth in all undergraduate and graduate programs and the resulting revenue will lead to the Faculty’s long term sustainability.
6.3.2 Enrollment Strategy

i. Undergraduate:

As mentioned earlier in Section 2.4.2, we plan to develop “4+1” double degree programs to combine our Arts and Science undergraduates in our Majors and extending the program for one more year to give a professional Master double degree over five years. We can also develop “2+2” program with international institutions, which are world-ranked in our discipline such as Nanjing Forestry University, and Beijing Forestry University in China, and with UNESP’s Forestry and Agricultural Faculty in Brazil. This mechanism will allow us to secure a minimum of 50 students per year in Forest Conservation (Science), B.Sc., Hons.: Specialist, Major, Minor, Forest Conservation (Arts), B.A., Hons.: Specialist, Major, Minor and the Forest Biomaterials Science, B.Sc., Hons.: Major, Minor. It is anticipated that the growth opportunity in these programs will be 15 per cent annually, based on the experiences of the Universities of Alberta and British Columbia to date (2018 time frame).

The feasibility of pursuing professional accreditation for undergraduate forestry programs, in conjunction with the Canadian Forestry Accreditation Board, also offers incentives to enhancing undergraduate enrolments in forestry programs. A critical mass of about 50 students graduating annually from Forestry undergraduate programs is our objective. As discussed earlier, the Canadian Forestry Accreditation Board is making progress in recognizing non-traditional forestry programs, such as urban forestry and ecological restoration in the master’s program. We are encouraged by this progress to seek approval for our Bachelors programs, including the Forestry Biomaterials Science program. We propose implementing these strategic initiatives by 2021. It is our aspiration that once the critical mass of an accredited undergraduate program is reachable, the University will permit the undergraduate programs to be administered through our own division.

Approval of professional accreditation for these programs will enable us to sustain the Faculty’s growth. This is contingent on adequate BIUs being approved and made available.

Language competence is one of the challenges in developing undergraduate and graduate programs for non-English speaking international students. In the Forestry discipline, it is particularly challenging as many good universities are located outside the urban environment and attract students from rural areas. Therefore, as mentioned earlier, the Faculty is proposing a University of Toronto English language testing and English language training program for eligible candidates to acquire the necessary competency. This proposal is in addition to conventional ILETS and TOFEL systems. The University of Toronto has an established program for undergraduate English language skill development, which is run through New College and is designated as the International Foundation program. The Faculty will seek approval for its students to enter this program. This will enable high caliber international students to enter Forestry programs.
ii. Graduate Program:

As discussed in Section 2.1, the Faculty of Forestry enjoys strong international collaboration in graduate research with the United States, China, India, and Brazil, among others. The Faculty is currently exploring “1+1” program opportunities with two Forestry schools in China (Nanjing Forestry and Jengjing Forestry and Agriculture) and one Forestry school in Brazil (UNSEP).

The proposed program would allow high caliber students to come to the University of Toronto in the final year of their undergraduate program, and study courses offered by Forestry faculty members through the Faculty of Arts and Science as special-category students. On completion of the course, the home university (international) would confer the undergraduate degree to students who have successfully completed the program. Students who would satisfy SGS qualifying criteria would then be eligible to be admitted to the M.F.C. program. We are projecting that the number of students in this special stream could reach a steady state of 30 students per year over the four years of the program. This capacity building is in addition to our projected growth of M.F.C. students shown in Figure 1.

With the research stream program, we plan to continue to expand our international partnerships with China, India and Brazil and open new partnership with Malaysia and Chile in next four years. Based on our present enrolment growth, we anticipate a steady growth of up to 12 M.Sc.F. and Ph.D. students in our research stream program bringing to a maximum cap of our research based graduate students to 58 by 2021, with the addition of two faculty FTEs.

6.3.3 Student Financial Aid

The situation of our funding model for graduate students not being fully captured in the University data base was discussed in Section 2.4.6. Our minimum base funding, which conforms to the University’s recommended minimum base funding, consists of tuition and research fellowship or research assistantship and excluded TA-ships. It is clear that the Faculty funding of research stream students is close to the average University funding. The uniqueness of our funding arrangement, however, is such that our graduate students are minimally involved in TA-ships and, therefore, can devote much of their time in research.

We are able to offer our graduate students this unique funding mechanism because, as reported earlier, the Faculty of Forestry is fortunate to have endowed scholarships, the highest per student in the University. We also have scholarships to encourage our undergraduate students to become involved in research training early in their academic career.
6.3.4 Development/Fundraising Initiatives

From 2011 until late in 2015, the Faculty of Forestry was not a part of the University’s “Boundless” fundraising campaign, although the Faculty continued to fund advancement operations as a part of our central cost. Since then, the Faculty has been invited again to attend fundraising meetings arranged by the University Advancement office.

Despite the Faculty’s omission from fundraising campaigns, the Dean continued to develop and implement a plan for the Faculty. In early 2012-2013, the Faculty’s fundraising plan was mainly focused on identifying major donors for high level recognition such as “naming” the Faculty. Unfortunately, given the economic recession in the forest products industry, this proved to be an unsuccessful strategy at that time.

A modified plan was developed in 2013 to raise funds to develop industry chairs to be matched by Faculty funds. This fund raising campaign is now in effect with two funded chair money being pledged and one more in Urban Forestry being considered.

**Landmark Project to develop new and cost effective space for the Faculty**

The Faculty’s fundraising efforts are now focussed on developing additional space in Toronto’s first 12 Storey Wood Tall Building for the Faculty and for a new Institute of Carbon Management, as discussed above.

6.3.5 Management and Leadership

The Faculty has weathered a turbulent time. As requested by the Provost, the Faculty was involved in exploring two other organizational models to develop a long-term sustainability plan.

In the first instance, following the former Provost’s recommendation, the Dean, faculty and staff members explored the potential to develop a sustainable unit (EDU A) by exploring a potential merger between the Faculty of Forestry and the School of Environment (Edu B). The Faculty proposed a re-structured model of developing a merged Unit (EDU A) whereby the EDU A would have the independence to hire full time academic staff. This model has not been realized (2012) because we concluded that the offer of an Edu B model as a merged Unit threatened the existence and integrity of the Faculty’s programs.

In yet another proposed model, the Faculty explored the development of another unit (EDU A) at the University of Toronto at Scarborough (UTSC). After a three-month consultation process, the Faculty developed a proposal and it was submitted to UTSC for their review and approval. The UTSC administration revised the proposed model. The USTC counter-proposal had at least two significant shortcomings which prevented this process from going forward. First, the revised model by UTSC did
not consider the Unit’s long term growth: no resources were committed for Forestry’s faculty complement, even though two of the nine Forestry professors were approaching retirement. Second, it did not have a plan for research space allocation for Forestry researchers and graduate students. The exercise, therefore, proved futile.

Following those two unsuccessful attempts, the Faculty has developed a long term plan for sustainability. These strategic plan elements are described above in section 6.1.3.

An alternative solution to joining another department is to find a new space for Forestry. Forestry’s present location, which was built in the 1980s through the Faculty’s fund raising initiative and significant funding of alums, is valuable real estate. The Dean is investigating the feasibility of relocating Forestry to a new location. FPInnovations is a potential sponsor through their “building with wood” program. A model for such an approach is found at the University of British Columbia where there was similar collaboration with the School of Architecture and a student residence.

7.0 International Comparators

The involvement of the Faculty in international education and research has been extensively described throughout this report. In Section 3.2, the Faculty is shown to be successful in attracting research funding (Figure 17) and in obtaining Tri-Council Research funding. This success is all the more remarkable because it has been accomplished while Faculty FTE was declining (Figure 18).

Research and scholarly activity can be assessed with technology transfer indicators and this was mentioned in Section 3.2. As reported in the standardized data (Appendix 23), and shown in Figure 27, Faculty of Forestry researchers out-perform other divisions on the number of patents and licenses issued per capita FTE.
Figure 27

International Comparators

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Source: Faculty of Forestry

The University of Toronto ranks highly in forestry publications and citations among leading North American research universities (Appendix 23). The rankings also include the work of University scholars outside the Faculty of Forestry but it is the Faculty that contributes significantly to these rankings.

The Faculty’s research partners and supporters offer insights into the global reach and impact of Forestry faculty members.

“We wish to state that Prof. Sain is regarded here in Brazil and internationally as a pioneering scientist in the development and utilization of environmentally beneficial materials such as lignocellulosics for the synthesis of environmentally beneficial materials such as polymers, composites, medical biomaterials, battery, lubricants, chemicals and food. His is an unorthodox approach in that he is a forest engineer and chemist. His success is generally regarded internationally to be as a result of the application of this unique approach.” UNESP Brazil

“But I would like to enlarge further from an international perspective. Across the world forests are both under threat from deforestation, pest and diseases, and at the same time are seen as part of the solution, for example, to climate change. Yet, perversely, we
see education and training in the profession taking a ‘back seat’. Now is the time to
invest in forestry education and research in its widest sense. Canada is a world leader in
forestry and the forest industry. It must ensure that the next generations of competent
foresters and forest scientists are thoroughly grounded in the basic silvics and
silviculture to ensure as far as possible the well-being of the nation’s great resource.”
Professor Julian Evans, Chair, UK Forestry Commission’s Expert Committee on Forest
Science

“The Faculty of Forestry is a unique faculty in the forestry field, having high quality
research and faculty staff in a range of disciplines from ecology, forest restoration and
conservation to biomaterials processing and product development for industry. I have
not seen this type of research and education constellation (anywhere else. ....we have
had many collaboration activities over the last 15 years and we also have joint
professorships, Ph.D. students, as well as master students...We have several national
project proposals in Europe, as well as in Sweden, Finland and Canada.” Professor
Kristiina Oksman, Chair Professor Lulea University of Technology

“From our perspective as an organisation that promotes ‘close to nature’ principles of
forest management, we have found much of the work originating from Toronto to
closely align with our conservation ethic. The University has a brilliant track record for
pioneering research in many aspects of forestry and forest products, and has a history of
collaboration with countries all over the world. “ Philippe Morgan, Pro Silva, Wales