1. Institution: Virginia Polytechnic Institute and State University

2. Program action (Check one):
   - New program proposal **x**
   - Spin-off proposal ______
   - Certificate proposal ______

3. Title of proposed program: Sustainable Biomaterials and Innovation

4. CIP code: 03.0509

5. Degree designation: Bachelor of Science

6. Term and year of initiation: Fall 2013

7a. For a proposed spin-off, title and degree designation of existing degree program

7b. CIP code (existing program)

8. Term and year of first graduates: Spring 2014

9. Date approved by Board of Visitors

10. For community colleges:
    date approved by local board
    date approved by State Board for Community Colleges

11. If collaborative or joint program, identify collaborating institution(s) and attach letter(s) of intent/support from corresponding chief academic officers(s)

12. Location of program within institution (complete for every level, as appropriate).
    - Departments(s) or division of Dept of Sustainable Biomaterials
    - School(s) or college(s) of College of Natural Resources and Environment
    - Campus(es) or off-campus site(s) Virginia Tech Blacksburg VA
    - Distance Delivery (web-based, satellite, etc.) none

13. Name, title, telephone number, and e-mail address of person(s) other than the institution’s chief academic officer who may be contacted by or may be expected to contact Council staff regarding this program proposal.

   Dr. Daniel Hindman, Assoc. Professor, Dept. Sustainable Biomaterials, 540-231-9442, dhindman@vt.edu
   Dr. Barry Goodell, Department Head – Dept. of Sustainable Biomaterials, 540-231-8853, goodell@vt.edu
   Dr. Robin Panneton, Director, Office of Degree Management, 540-231-9770, panneton@vt.edu
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Proposal for B.S. in Sustainable Materials and Innovation  Virginia Tech
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I. Description of the Proposed Program

Overview

The Department of Sustainable Biomaterials at Virginia Tech has expanded its teaching, research, and outreach programming into broader programmatic education related to natural, renewable materials for production of useful bio-based products. This proposal therefore requests approval for a new Bachelor of Science degree in Sustainable Biomaterials and Innovation to commence in the Fall semester of 2013. For this degree, the term “sustainable” is defined as a multi-faceted balance of long-term environmental, economic, and social priorities as applied to natural and renewable biomaterials. “Sustainable Biomaterials” are materials systems based on woody plant biomaterials (lignocellulosic materials) such as wood, bamboo, rattan and palm used for residential construction and production of consumer goods. The uniqueness of this proposed program relies on the use of innovation theory to catalyze both sustainability and biomaterials under a new educational option with the goal of transforming traditional materials production methods, building construction methods, and current business management practices into the new lasting, and best value-added solutions for the benefit of human society, the environment, and social systems. For instance, green building construction is an emerging field that requires the understanding and integration of new techniques such as life cycle analysis, and risk assessment with innovative technologies used in housing and building infrastructure. New sustainable business practices in green building construction require an integrated approach with supply chain management, public services, and business issues. The complexity and constant evolution of these business practices not only affect building construction but other industries in the manufacturing and service sector. During the last decade new emerging business management methods such as lean, innovation-based manufacturing, sustainable manufacturing, and business process management have become top agenda items for all sustainable-based material industries.

We perceive this degree offering serving the needs of Virginia and the $25.2 Billion forest products industry in the Commonwealth, as this industry seeks to change in adopting green and sustainable solutions in response to growing demand from the public for renewable, green materials. In addition to service to the Commonwealth, the intent is that this degree will provide students with a national and global perspective, as the use of other lignocellulosic fibers and materials in addition to wood for structural and consumer products is widespread throughout the world, and is growing rapidly in the US.

The proposed degree program supports the goals of the Department of Sustainable Biomaterials, the College of Natural Resources and Environment, and Virginia Tech in the following ways:

- The Department of Sustainable Biomaterials is a leading source of outreach, education, and research related to plant-based biomaterials, and this proposal is consistent with that mission.

- The College of Natural Resources and Environment leads national and international innovation in environmental and natural resource science, with strong emphasis on forest resources, the largest single source of plant-based biomaterials, leading to solutions towards development of a sustainable society.
Virginia Tech’s mission is to create, convey, and apply knowledge to expand personal growth and opportunity, advance social and community development, foster economic competitiveness, and improve the quality of life (Virginia Tech Mission Statement, VT 2006). The proposed degree program accomplishes these goals through a focused curriculum in the development and use of sustainable materials, innovations in housing, and entrepreneurial activities. The graduates from the proposed degree will be proficient in the high-demand field of biomaterials and will provide an exceptional talent pool to sustain a vibrant Virginia economy consistent with Virginia Tech’s mission statement. Advancing community development, improving the quality of life, and fostering economic competitiveness are embodied within the Sustainable Biomaterials and Innovation degree.

In supporting the mission of Virginia Tech, programmatic efforts must change and adapt to address the changing needs of a new business model that can provide value-added solutions to meet societal needs in a greener, more sustainable manner through a workforce of future leaders. The traditional forest products business models (i.e., lumber, paper, and housing) have entered a period of rapid change – becoming more global and varied in their production lines. The public has demanded, and these industries have recognized, that in an increasing competitive world they must also provide “greener” and more sustainable products. The Department brings expertise in the development, use, and business/marketing/entrepreneurship of biomaterials. The proposed B.S. degree program in Sustainable Biomaterials and Innovation builds upon this experience to serve a leaner, more environmentally friendly forest products sector, while expanding into the field of new biomaterials development and applications. The proposed degree will serve a growing need for innovations in biomaterials and related technologies. As the field has grown, education (and technology) has expanded beyond a focus solely on timber-based products (i.e., lumber, plywood). Today a myriad of other nature-based products including alternative wood products (bamboo, rattan), non-timber products from the forest (medicinal plants, dietary supplements), composite biomaterials, and fibers are all included in our teaching and educational programming. Beyond this, the proposed major will train students and provide knowledge about innovations in business practices for marketing bio-based products critical to long-term sustainability of the Commonwealth’s resources. To better serve our students and the economy of Virginia and the region, the proposed major will address societal changes that impact how sustainable materials are obtained and used with regard to manufacturing processes, market values and how businesses are developed.

**Curriculum**

The goal of this degree program is to give students a strong technical foundation in understanding natural biomaterials and how they perform as a basic building block for structures and products that society needs, as well as how their application scores in terms of environmental life-cycle impacts. Students can then build upon this technical foundation through one of four tracks with which to further develop their knowledge base: 1) Sustainable Enterprise, 2) Sustainable Society, 3) Design and Craftsmanship and 4) Sustainable Residential Structures (see Figure 1).

Respective learning outcomes in each of these tracks leads to a deeper understanding of how 1) business, 2) society, 3) design, and 4) housing technologies can influence overall sustainability issues when sourcing, using, maintaining, and recycling natural biomaterials. These tracks have been planned such that students gain appreciation of how disciplines in engineering, marketing, product design, process technology, and management can contribute towards the best sustainable use of our natural resources in meeting the needs of society.
Figure 1. Schematic diagram of the Sustainable Biomaterials and Innovation degree showing the relationship between University Core, degree core, 4 track courses and free electives.

The common core of the new degree includes six courses that have been developed and are taught by existing faculty in the Department of Sustainable Biomaterials (see Appendix B for catalog descriptions). These courses address the core requirements of the new degree concerning the sustainability of biomaterials and perspectives of craftsmanship of those materials in the formation of today’s society.

The Sustainable Biomaterials and Innovation degree comprises 120 credit hours distributed among the following categories (see Figure 1): 1) core liberal education [36 credits]; 2) Sustainable Biomaterials and Innovation common core courses [30 credit hours]; 3) Track Courses [16-19 credit hours]; and (4) Free Electives (35-38 credit hours).

Curriculum for Liberal Education (general education): (36 credits)
Area 1: Writing and Discourse (6 credit hours: ENGL 1105 & 1106)
Area 2: Ideas, Cultural Traditions and Values (6 credit hours)
Area 3: Society and Human Behavior (6 credit hours: ECON 2006 and other)
Area 4: Scientific Reasoning and Discovery (8 credit hours: BIOL 1105 & 1115, CHEM 1035 & 1045)
Area 5: Quantitative and Symbolic Reasoning (6 credit hours: MATH 1016 & 2015)
Area 6: Creativity and Aesthetic Experience (1 credit hour)
Area 7: Critical Issues in a Global Context (3 credit hours: SBIO 2784/FOR 2784)
Common Core in Sustainable Biomaterials and Innovation:  (30 credit hours)
SBIO 1234 Introduction to Wood, Design and Craftsmanship (3)
SBIO 2124 Structure and Properties of Biomaterials (3)
STAT 3615 Biological Statistics I (3)
STAT 3616 Biological Statistics II (3)
SBIO 3004 Sustainable Nature-based Enterprise (3)
SBIO 3445-3446 Entrepreneurial Wood Design and Innovation (6)
SBIO 3454 Society, Sustainable Biomaterials, and Energy (3)*
SBIO 4715-4716 Wood House (6)*

Track Courses
Sustainable Enterprise Track:  (18 credit hours)
SBIO 2614 Introduction to Forest Products Marketing (3)
SBIO 3464 Forest Products Business Systems (3)
SBIO 3554 Sustainable Biomaterials Enterprises (3)*
ACIS 2115 Principles of Accounting (3)
FOR 4014 Natural Resources Economics (3)
MKTG 3104 Marketing Management (3)

Creating Sustainable Society Track:  (18 credit hours)
FOR 2554 Nature and American Values (3)
SBIO 3324 Green Building Systems (3)
FOR 4014 Natural Resources Economics (3)
SBIO 2994 or 4994 Undergraduate Research; SBIO 2964 or 4964 Field Study; or SBIO 3954 Study Abroad (at least 3 credit hours)
SBIO 3554 Sustainable Biomaterials Enterprises (3)*
AAEC 3314 Environmental Law (3)

Design and Craftsmanship Track:  (16 credit hours)
SBIO 2384 Behavior of Biomaterials (3)
ART 3004 History of Interiors (3)
AHRM 1624 Residential Drafting Lab (1)
AHRM 2654 Housing Environment (3)
AHRM 4664 Universal Design (3)
A professional elective chosen by the student and advisor (3)

Sustainable Residential Structures Track:  (19 credit hours)
CHEM 1036 General Chemistry (3)
PHYS 2205 General Physics (3)
SBIO 2384 Behavior of Biomaterials (3)
SBIO 3314 Wood Mechanics (4)
SBIO 3324 Green Building Systems (3)
SBIO 4984 Design of Wood Structures (3)

Free Electives:  (35-38 credit hours)

*New courses developed and approved in support of the proposed degree offering.
Admission Requirements

Students will be admitted to the program from the general applicant pool of Virginia Tech, or will transfer to the program from other majors at Virginia Tech. No special admissions for this program are anticipated or required. Admission to Virginia Tech requires that students entering as freshmen meet the following academic requirements:

- 18 units of high-school coursework
- 4 units of English
- 3 units of math (includes algebra I, geometry, and algebra II)
- 2 units of laboratory science (chosen from biology, chemistry or physics)
- 2 units of social science (one must be history)
- 3 additional academic units (foreign language is highly recommended)
- 4 elective units
- Virginia Tech accepts either the SAT Reasoning Test (including critical reading and math) or ACT test scores
- GPA: Mid-50% = 3.81–4.24 (average = 4.0); This means that 25% of freshmen offered admission to Virginia Tech had GPAs lower than 3.81; each applicant is evaluated in the context of the high school(s) attended
- SATs: Mid-50% = 1160–1340 (average = 1250); This means that 25% of freshmen offered admission to Virginia Tech scored below 1160 on the SAT (combined critical reading and math)

Faculty

Faculty for the new degree in Sustainable Biomaterials and Innovation are housed within the existing Department of Sustainable Biomaterials (see Appendix D).

Learning Outcomes and Program Assessment

The B.S. degree program in Sustainable Biomaterials and Innovation will provide students with the knowledge, understanding, and leadership experience to allow them to become problem-solvers in sustainable innovation, businesses, entrepreneurial ventures, non-government organizations, and public organizations.

Specifically, successful graduates in the Sustainable Biomaterials and Innovation degree will develop skill sets that include:

- Experience with life cycle analysis, environmental assessments, and risk analysis to transform traditional design and construction methods into innovative solutions for the benefit of the industry and the society.
- The ability to address critical infrastructure and economical needs of our society in such manner that our future generations will be able to meet their needs.
- Technical knowledge relative to creating innovative solutions that address societal needs for integrated systems such as residential housing, transportation, public services, and businesses.
• A holistic and innovative approach that integrates materials and process technologies with new business practices such as lean management, green building construction, sustainable manufacturing, business process management, and emerging information technologies to support economic development.

Upon completion of the degree core requirements, key learning outcomes include the following:

• Compare and contrast basic tools to analyze the performance of materials with respect to life cycle costs and environmental impacts.
• Apply the scientific method towards creating functional material innovations throughout the entire value chain from sourcing raw biomaterials to delivery of final solutions to society.
• Identify the effects of sustainable processes upon the value chain and final product.
• Integrate materials and processes to create energy efficient systems with lower environmental impact.

The various tracks in this degree will offer a unique blend of learning in areas such as creativity, materials science, process engineering, residential design and construction, conservation fundamentals, and marketing of the products that come from these processes. The learning outcomes give students hands-on experience on evaluating the effectiveness of different systems from the different track perspectives.

Assessments in each course use a variety of methods for student learning evaluation such as: examinations, quizzes, laboratory reports, student projects, written papers and oral presentations. Student grades are based on demonstrated improvements in knowledge, skill, and critical thinking.

Program assessment will occur through a persistent review of “Student Performance & Experiences” and of “Industry & Government Feedback” as outlined below.
### Student Performance & Experiences

<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>Mechanism</th>
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<tbody>
<tr>
<td>• Graduation rate</td>
<td>Data base</td>
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<tr>
<td>• Grade point averages (after sophomore &amp; final years)</td>
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<tr>
<td>• Sustainable Biomaterials and Innovation core course grades</td>
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<tr>
<td>• Selected chem./phys./bio course grades</td>
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<tr>
<td>• Student choice of professional electives (writing or technical skills)</td>
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<tr>
<td><strong>Exit poll of graduating students</strong></td>
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<tr>
<td>• Rate/comment on experiential learning activity</td>
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<tr>
<td>• Describe positive &amp; negative impressions of degree</td>
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<td>• Describe employment status/outlook</td>
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<tr>
<td><strong>Poll of students 2 years after graduation</strong></td>
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<tr>
<td>• Describe employment status/outlook</td>
<td>Web-based poll/</td>
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<tr>
<td>• Describe positive &amp; negative impressions of degree</td>
<td>database</td>
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### Industry & Government Feedback

- **Companies & government organizations affiliated with discipline**
  - Review curriculum and program vision

- **Companies & government organizations employing graduates**
  - Review student preparation
  - Review curriculum and program vision

Emphasis will be placed on an integrated and coordinated review of assessment data collected through web-based tools and stored in a data base. Assessment for the program through the lens of the measurable learning outcomes above will be the foundation from which to monitor our program and improve it continuously as technology and science evolve. A shared trust between the learners and the faculty will be created by having the learning outcomes relate to meaningful and high expectations. Assessments in each course will use a variety of methods for student learning evaluation such as examinations, quizzes, laboratory reports, student projects, written papers, and oral presentations. Included in this approach will be evaluation of skills in experiential learning exercises by faculty or supervisors. This requirement will provide an opportunity to evaluate the higher order learning skills listed in the outcomes above such as critical thinking and creative thinking. Student feedback regarding individual courses and instruction will be obtained through on-line evaluation of each course.

Emphasizing integration and coordination of assessment data, companies and government organizations will be engaged in critical review of the program and its effectiveness. This would include companies and government organizations that are affiliated with the discipline described here, but that have not hired our graduates. Likewise, the employers of our graduates will of course be invaluable for program assessment.

*Academic Program Review* - The Department and its degree programs go through the Academic Program Review conducted by the Office of the Provost. This review is required at least once every seven years. Our last departmental review was in 2009 and it is anticipated that we will be reviewed again in 2016.
Benchmarks Of Success

The program will be considered a success if:
- 76 students are enrolled in the degree by the fourth year it is offered (2016-2017)
- 80% or more of the students complete the program requirements in 4 years
- 80% of the graduates either find employment in sustainable biomaterials fields after graduation or successfully secure admission to relevant graduate programs.
- 75% of employers remain satisfied with graduate job performance after 3 years of employment.

Student progress in the degree will be monitored each spring to determine if the benchmarks above are being met. Students contemplating leaving the program will be interviewed to determine if changes in advising, or other elements of the program could be implemented to better serve them.

Exit interviews with graduating seniors are currently conducted in both the fall and spring of each year through the Virginia Tech Office of Academic Assessment using an annual on-line survey. This survey will specifically assess student interests in the degree programs of the department, varying degrees of interest in several different aspects of the overall Sustainable Biomaterials and Innovation degree program, and provide space for comments on the strengths and weaknesses of program elements. Over time, these surveys will provide aggregate data for a longitudinal study of the degree program to track changes in student interests in the curriculum. For example:
- Which courses were influential in leading students into the Sustainable Biomaterials and Innovation field and relate more positively to various elements of the program?
- In what order were courses taken when flexibility was given within programming categories?
- How did students choose to meet the professional electives and how did the professional electives support the curriculum?

The results of the annual survey will be examined each year by the Department’s Enrollment Management Committee. Recommendations for changes will be made to the Sustainable Biomaterials and Innovation faculty.

Previously, retention has been exceptional due to a variety reasons:
- First year student experience
- Faculty mentoring students
- Student ambassador program
- Faculty advising: it has been a policy with the Department that students meet with faculty advisors every semester before course preregistration. This one-on-one contact between students and faculty results in a high retention rate and this policy will help ensure the success of the new degree.
- Large number of scholarships and internships available to students
Relation to Existing programs

The Department of Sustainable Biomaterials currently graduates B. S. students under the major, Wood Science and Forest Products. The educational programming in this field has changed over time both nationally and globally to respond to a growing need for skills that effectively assess the environmental efficiencies and impacts of systems leading to innovative and sustainable solutions, and a new degree is appropriate. This new degree and major will incorporate innovative advancements in built environments, manufacturing, and business processes to meet the high demand for graduates in the field of Sustainable Biomaterials. Typically, there have been 3-4 positions available for every graduate in the field. Once approved, the department will phase out the Wood Science and Forest Products major.

Collaboration or Stand Alone Program

The B. S. degree program in Sustainable Biomaterials and Innovation is a standalone degree.

II. Justification for the Proposed Program

Response to Current Needs

The Commonwealth of Virginia’s forest resource contributes over $25.2 billion annually and 184,000 jobs to our economy; one of the largest contributors to the Gross State Product (VDOF 2006). This is a key statistic with regard to jobs-creation in the field and why the B.S. degree program in Sustainable Biomaterials and Innovation is needed. The proposed degree program will enable graduates to make Virginia and the United States more competitive in the world economy through the innovative use of sustainable biomaterials from Virginia’s forests and agricultural lands. The majority of the Commonwealth’s biomaterials are forest-based (VDOF 2006), therefore, sustainable forestry and forest products business practices are essential for maintaining clean water, clean air, and the current high quality of life (VDOF 2006). There are 16 million acres of healthy and productive forestland in Virginia. To promote the wise use of this natural resource, the Commonwealth needs leaders trained to utilize, market, and manage products and services while recognizing long-term environmental, economic, and social priorities (VDOF 2006).

Forest-based industries are located in every county of the Commonwealth (see Figure 2), but these represent only a portion of the potential for new bio-based industries using wood, other forest-based and non-forest based residues in Virginia as summarized in (USDA 2009). Between the years of 2000 and 2050, it is projected that the world’s population will grow 50%, global economic activity will grow 500%, and global energy demand use will grow 300% (EPA 2009). The Virginia economy typically matches or exceeds growth and development statistics for the nation (Virginia Dept. of Taxation 2010). Natural resource use will also increase in response to national and global demand. Continued innovation will be required to serve human needs using forest biomaterials productively and sustainably, minimizing the amount of materials used to produce products, and reducing associated environmental impacts. The goal of the proposed degree is to produce graduates who can create and implement innovative solutions to the challenges of providing sustainable supplies of housing, home furnishings, and other renewable products which society demands.
The forest resource of the Commonwealth (VDOF 2006):

- Contributes $25.2 billion annually to Virginia's economy.
- Continues to support the largest value-added industries in the state, ranking first in employment, wages and salaries.
- Contributes $276 million back to Virginia landowners for selling their timber and other forest-based products.
- Provides more than $2.4 billion in recreational opportunities to two-thirds of citizens.
- Generates more than 184,000 jobs.
- Generates an estimated $60 million through specialty forest products.
- Protects Virginia watersheds from erosion and sedimentation.
- Provides long-term carbon sequestration through forest management on 16 million acres of forestland, which contributes to clean air and enhances our quality of life.
- Provides important social benefits including attractive sites for homes, scenic beauty, wildlife habitat, a draw for visitors and potential new residents (VDOF 2006).

In recent years, global competition has strained the Commonwealth’s forest-based enterprises. Additionally, competing societal demands on forestlands for development, clean water, and raw materials have impacted land use and the way forest biomaterials can be utilized. However, novel, emerging biomaterials from the forest, other plant-based residues, and new processing technologies offer promising solutions for a sustainable environment along with business opportunities and economic development. Many of Virginia’s existing forest products businesses tend to be family owned, relatively small in size, and lack the expertise to innovate and compete in a global economy. Yet, these small businesses can be flexible enough to develop critical new business models that are successful and sustainable. There are also large multi-national forest products companies in the Commonwealth that are adopting more sustainable business practices.
This new proposed degree would produce graduates that will advance these industries. Trained individuals from our degree program can help these businesses take advantage of the opportunities and make Virginia a leader in bio-based business (VDP 2011), thereby sustaining the long-term balance between our natural resources, our economic aspirations, and our human needs (Duran 2011).

Green building has become one of the most transformative forces in the building construction industry today. From 2009 to 2013, green construction is expected to generate $554 Billion dollars in GDP, 7.9 million jobs and $123 Billion dollars in labor earnings nationally (USGBC 2011). Green building practices have become the industry standard in residential construction (where most biomaterials are used) as evidenced by a recent NAHB study where 88% of the builders surveyed either used or want to use green building practices (Hudson 2011). Currently, no curriculum at Virginia Tech specifically addresses the methods and materials used in green building construction. The proposed degree program will address green building as well as sustainable business practices. Biomaterials play an important part in green building systems, as shown by the recent USDA announcement to promote wood products as a preferred green building material (USDA 2011). Biomaterials, specifically wood products, are the only structural building materials that use material certification systems for the procurement, sales and replanting of trees. Several of the classes taught in the department use innovative engagement teaching methods to help students understand the materials and business tools needed to create the next generation of sustainable, efficient, and cost-effective buildings.

The target outcomes of this degree are professionals that are well prepared to solve problems related to balancing our natural resources with the demands of our economy and society. As an example, two recent courses in green building systems, and green business have attracted students from within our existing department and also from several departments across campus. Due to special request of the students, an additional green business course section was added in Spring 2012, as well as an additional special study course for students who have taken either course to earn their LEED Green Associate certification. Another example is the global forest sustainability course, which was revised to reflect the current issues in sustainability and has increased in enrollment by 30% each year. The need for courses in the area of Sustainable Biomaterials and Innovation is present, and we will continue to add and adapt courses to reflect current issues and skills needed in the green sector.

Both the new courses and our adaptation of older courses to the green sector have helped draw attention to the department and suggest that the new proposed degree program will provide a successful path for recruitment of new students. In addition to the programmatic changes, the new degree name will resonate with students seeking employment in the green sector. The new proposed degree program will address needs in manufacturing, business management and strategies, and marketing of sustainable natural products as reviewed in a recent study by the International Society of Sustaining Professionals (ISSP) (Willard et al. 2010). The results of this study indicate that students are needed with training and education in “strategies” and technical skills for assessing the value of sustainability, evaluating product life cycle, and maintaining sustainability (through educational programs) of the many nature-based products (Willard et al. 2010). Several critical skills identified in the study include strategic planning, systems thinking, project management, problem solving, and communication. The curriculum in the proposed degree will address these needs.
Although the new degree program will serve the traditional forest products industry and employment base, it must be recognized that this industry is undergoing rapid change, and particularly as the world comes out of a global recession, that even more graduates will be needed in this field and in new areas that have grown out of the traditional industry. Older manufacturing facilities have closed or are closing, and are being replaced by newer, greener production facilities and technologies (Forth 2008). Manufacturers are seeking a workforce that is educated in lean and energy efficient processing methods to meet societal needs for green, sustainable products. Builders and homeowners are increasingly looking for more value-added and green building systems. Educational programming as embodied in the new proposed degree will allow graduates to understand the use of sustainable materials and how these materials can be produced and marketed in a changing business landscape. The proposed new degree will serve the growing green sector (www.sbio.vt.edu/careers/), equip our students with the skills and leadership necessary to be competitive, and help the Commonwealth maintain and expand its economic development and employment in this sector.

Employment Demand

Satisfying the ever-growing demand for biomaterials throughout the world means there is a continuing high demand for sustainable biomaterials professionals as shown in Tables 1, 2, and 3. Also demand for professionals proficient in “green marketing” is gaining in importance, and the proposed Sustainable Enterprise Track under this degree will provide students with a strong background in green business and marketing skills. Individuals with training in applied science or basic research, technical service functions, and manufacturing processes will be key players in initiatives to satisfy the growing demand for products. Newspaper headlines often provide a misleading perspective of what is occurring in the traditional fields of forest products. Even though traditional pulp and paper industries have declined during the current recessionary period, many other segments of the forest products field/industry, and the even broader field of Sustainable Biomaterials (www.sbio.vt.edu/careers/), have experienced strong growth as shown in the following employment tables. Table 1 shows national projected growth of various industry segments from 2010 to 2020. Table 2 shows national projected growth of various job positions, according to NAICS codes, from 2010 to 2020. Table 3 shows the Commonwealth of Virginia projected growth of various industry segments from 2008 to 2018.
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<td>Veneer, plywood and engineered wood</td>
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<td>Furniture and related product manufacturing</td>
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<td>Household and institutional furniture and</td>
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<td></td>
</tr>
<tr>
<td>Office furniture related product manufacturing</td>
<td>3379</td>
<td>36.5</td>
<td>41.0</td>
<td></td>
</tr>
<tr>
<td>Architectural engineering and related</td>
<td>5413</td>
<td>1280</td>
<td>1640</td>
<td></td>
</tr>
<tr>
<td>services</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management, scientific, technical consulting</td>
<td>5416</td>
<td>991</td>
<td>1570</td>
<td></td>
</tr>
<tr>
<td>services</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occupation</td>
<td>NAICS Code</td>
<td>2010 Employment, Thousands</td>
<td>2020 Projected Employment, Thousand</td>
<td>% Change</td>
</tr>
<tr>
<td>-------------------------------------------------</td>
<td>------------</td>
<td>----------------------------</td>
<td>-------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>Training and Development Specialists</td>
<td>13-1151</td>
<td>217.7</td>
<td>279.3</td>
<td>28.3%</td>
</tr>
<tr>
<td>Environmental Scientists and Specialists</td>
<td>19-2041</td>
<td>89.4</td>
<td>106.1</td>
<td>18.7%</td>
</tr>
<tr>
<td>Construction and Building Inspection</td>
<td>47-4011</td>
<td>102.4</td>
<td>120.8</td>
<td>17.9%</td>
</tr>
<tr>
<td>Construction Managers</td>
<td>11-9021</td>
<td>523.1</td>
<td>609.6</td>
<td>16.6%</td>
</tr>
<tr>
<td>Sales Representatives, Wholesale and Manufacturing Technical and Science Products</td>
<td>41-4011</td>
<td>400.0</td>
<td>465.5</td>
<td>16.4%</td>
</tr>
<tr>
<td>Sales Engineers</td>
<td>41-9031</td>
<td>66.4</td>
<td>75.9</td>
<td>14.4%</td>
</tr>
<tr>
<td>Health and Safety Engineers, except Mining</td>
<td>17-2111</td>
<td>23.7</td>
<td>26.8</td>
<td>13.0%</td>
</tr>
<tr>
<td>Civil Engineering Technicians</td>
<td>17-3022</td>
<td>79.0</td>
<td>88.5</td>
<td>9.4%</td>
</tr>
<tr>
<td>Materials Scientists</td>
<td>19-2032</td>
<td>8.7</td>
<td>9.5</td>
<td>10.2%</td>
</tr>
<tr>
<td>Industrial Production Managers</td>
<td>11-3051</td>
<td>150.3</td>
<td>164.0</td>
<td>9.1%</td>
</tr>
<tr>
<td>Architectural and Engineering Managers</td>
<td>11-9041</td>
<td>176.8</td>
<td>192.0</td>
<td>8.6%</td>
</tr>
<tr>
<td>Natural Sciences Manager</td>
<td>11-9121</td>
<td>49.3</td>
<td>53.1</td>
<td>7.7%</td>
</tr>
<tr>
<td>Conservation Scientists</td>
<td>19-1031</td>
<td>23.4</td>
<td>24.6</td>
<td>5.2%</td>
</tr>
<tr>
<td>General Operations Manager</td>
<td>11-1021</td>
<td>1767.1</td>
<td>1848.6</td>
<td>4.6%</td>
</tr>
</tbody>
</table>
Table 3. Current and projected Commonwealth of Virginia job positions available to Sustainable Biomaterials and Innovation Students (VEC 2011).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction of Buildings</td>
<td>236</td>
<td>50.7</td>
<td>61.2</td>
<td>20.7%</td>
</tr>
<tr>
<td>Wood Products Manufacturing</td>
<td>321</td>
<td>16.2</td>
<td>15.0</td>
<td>-7.4%</td>
</tr>
<tr>
<td>Furniture and related product manufacturing</td>
<td>337</td>
<td>13.7</td>
<td>12.8</td>
<td>-6.6%</td>
</tr>
<tr>
<td>Lumber and other construction materials merchant wholesales</td>
<td>4233</td>
<td>63.9</td>
<td>69.3</td>
<td>8.3%</td>
</tr>
<tr>
<td>Architectural engineering and related services</td>
<td>5413</td>
<td>64.3</td>
<td>80.7</td>
<td>25.5%</td>
</tr>
<tr>
<td>Management, scientific, technical consulting services</td>
<td>5416</td>
<td>62.4</td>
<td>114.1</td>
<td>82.8%</td>
</tr>
</tbody>
</table>

Employment opportunities are also shown in the selection of recent position announcements that are included in Appendix E. Recent Job Openings.

Letters of support are included in Appendix F. Letters of Support from prospective employers demonstrate the need for our graduates and potential employment opportunities.

Student Demand

By creating a new B.S. degree program in Sustainable Biomaterials and Innovation, it is anticipated that the undergraduate enrollment will increase to 76 students in the next 4 years. This anticipated increase in enrollment is justified in light of student surveys (see Appendix G), discussions with advisors of undecided students, and employment opportunity listings.

The current major in Wood Science and Forest Products has sustained an average enrollment of 40 students per year over the last 10 years (VT Institutional Research). This major has focused on traditional wood science and forest products technologies. Surveys conducted (Goodell and McLain 2011) of high school seniors and college freshman have demonstrated that respondents had negative views of the terms of “Forest Products” and “Wood Science”. Students were more interested in majors focusing on renewable materials to help sustain the environment (OSU 2010). Another survey of 635 college students (UBC 2009) found that students believe that sustainability should be a component of their degree. The unique aspect of this proposed degree is that it has sustainability as a core component and is focused on transforming traditional building construction methods and current business management practices into the new lasting, and best value-added solutions for the benefit of human society, the environment, and social systems.

During an interview with advisors of undecided students at VT, there was strong consensus that potential students for the new degree program would be excited and would readily pursue the new program in Sustainable Biomaterials and Innovation (Hammott 2011). Furthermore, these advisors indicated that the new degree program will attract more women and other under-
represented students (Hammett 2011). For example, consider the experience with our current course SBIO 2784 “Global Forest Sustainability” where enrollments in this course more than doubled from 2008 to 2010 when the course was modified to include a focus in current issues related to sustainable resources. Previously this course focused narrowly on forestry and forest products issues.

These findings combined with the current and projected employment opportunities indicate a demand for students trained in sustainable biomaterials.

Letters or emails of support from prospective students have been included in Appendix H: Inquiries and Expressions of Interest from Potential Students.

**Projected Enrollment**

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4 Target Year (2-year institutions)</th>
<th>Year 5 Target Year (4-year institutions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDCT 20</td>
<td>FTES 20</td>
<td>HDCT 39</td>
<td>FTES 39</td>
<td>HDCT 58</td>
</tr>
</tbody>
</table>

We estimate attrition in the program will be less than 10%, as a few students may discover that they may have overestimated their abilities to handle certain aspects of the coursework. That attrition will likely be made up however by transfer students discouraged by other majors and by greater than predicted interest. A projection of 20 students entering the degree program per year is fully attainable. Transfer students from other Virginia Tech majors have always been a vital component of student enrollment. The unique nature of the Sustainable Biomaterials and Innovation degree program within the state will also attract students who would not otherwise have considered Virginia Tech. Full-time students in the Sustainable Biomaterials and Innovation degree program are expected to take approximately 15 credits per semester in order to graduate in 4 years.

**Duplication**

This will be the only B. S. degree program focused on Sustainable Biomaterials and Innovation in the Commonwealth. No other program offers the common core of courses nor has the depth and breadth of faculty expertise in this area, which has been a focus in the Department of Sustainable Biomaterials for decades.
III. Projected Resource Needs

Full-Time Faculty
Seven faculty are involved in the core degree area of Sustainable Biomaterials and Innovation where at least 50 percent of their teaching effort is directed (Bond: 0.67 FTE; Buehlmann: 0.5 FTE; Kline: 0.75 FTE; Hammett: 0.6 FTE; Hindman: 0.75 FTE; Loferski: 0.75 FTE; Quesada: 0.5 FTE). In addition to the current Sustainable Biomaterials and Innovation degree faculty members, additional members of our departmental faculty have research interests related to innovations utilizing sustainable biomaterials. Collaboration and interaction with these other faculty will provide benefit to students in the degree, while supporting the teaching activities of the core faculty members in the proposed degree program.

Part-Time Faculty
Three other faculty members from our department (Zink-Sharp: 0.25 FTE; Renneckar: 0.25 FTE; Bush: 0.2 FTE) will also contribute to the core curriculum.

Adjunct Faculty
This degree program has no Adjunct Faculty.

Graduate Assistants
Two graduate teaching assistants will be assigned to the new degree program to assist with the expected large class sizes. These are currently funded in the department.

Classified Positions
Two classified staff positions (Research Specialist and Wood Shop Manager) are assigned to the Department. These individuals will assist faculty and students in courses that require specimen preparation and testing. Classified personnel in the Department currently working on academic matters under the current degree (Forestry and Wildlife) will be reassigned to work in the new degree program. An existing Senior Administrative Assistant & Business Manager, and a Secretary will also provide assistance and support for faculty.

Space
No additional facilities or space are needed for this new major. The Department has facilities in two primary locations on campus. Facilities for use by the new degree program are in Cheatham Hall and the Brooks Forest Products Center. Cheatham Hall has three stories of offices and classrooms and faculty offices for approximately one-half of the faculty. The Brooks Forest Products Center has two classrooms, a conference room and laboratories for biomaterials processing, engineering, entrepreneurship, innovation & design, microscope lab, and computer lab for student use. The Center also has faculty offices and office equipment for all faculty at the current time.
Library

The Newman Library at VT currently has many holdings of historic and current interest in the new degree area. The Library offers internet access and interlibrary loan to millions of pages of documents, and has a research librarian assigned to the College of Natural Resources and Environment to assist students and faculty in the degree program in finding and accessing materials.

Equipment (Including Computers)

Because of the long history of research that has been conducted by the faculty in the Department, a wide array of equipment is available for use to support the teaching program. Examples include six universal testing machines, microscopes and associated analysis equipment, lab ovens, balances, moisture meters, complete wood shop equipment, dust collection systems, dry kiln, fume hoods, etc. Essentially, all required major equipment needed to offer this degree/major is already in the Department and is readily available for use by students in the new program. Several computer labs are also available for student use. Software tools for drawing, publishing, and designing are also available. Business and simulation software is available for teaching and student use.

Telecommunications

All faculty offices and laboratories have telephones, and internet access. Wireless internet is available in most buildings on campus including Cheatham Hall and Brooks Center.

Other Resources

No other resources are required.
IV. Certification Statements

Estimated Costs and Funding Sources

Part A: Answer the following questions about general budget information.

- Has or will the institution submit an addendum budget request to cover one-time costs? Yes____ No__X__

- Has or will the institution submit an addendum budget request to cover operating costs? Yes____ No__X__

- Will there be any operating budget requests for this program that would exceed normal operating budget guidelines (for example, unusual faculty mix, faculty salaries, or resources)? Yes____ No__X__

- Will each type of space for the proposed program be within projected guidelines? Yes__X__ No____

- Will a capital outlay request in support of this program be forthcoming? Yes____ No__X__

Part B: Fill in the number of FTE positions needed for the program

<table>
<thead>
<tr>
<th></th>
<th>Program Initiation Year</th>
<th>Expected by Target Enrollment Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2013 - 2014</td>
<td>2017 - 2018</td>
</tr>
<tr>
<td></td>
<td>On-going and reallocated</td>
<td>Added (New)</td>
</tr>
<tr>
<td>Full-time faculty*</td>
<td>4.52</td>
<td>0.00</td>
</tr>
<tr>
<td>Part-time faculty (faculty FTE split with other unit(s))</td>
<td>.70</td>
<td>0.00</td>
</tr>
<tr>
<td>Adjunct faculty</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Graduate assistants</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Classified positions</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>TOTAL</td>
<td>5.22</td>
<td>0.00</td>
</tr>
</tbody>
</table>

* Faculty dedicated to the program
** Added after initiation year

The data on this worksheet represent the amount of effort faculty members will expend toward the core curriculum of the degree (not electives).
Part C: Estimated resources to initiate and operate the program

<table>
<thead>
<tr>
<th></th>
<th>Program Initiation Year</th>
<th>Expected by Target Enrollment Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2013 - 2014</td>
<td>2017 - 2018</td>
</tr>
<tr>
<td>Full-time faculty salaries</td>
<td>4.52</td>
<td>0.00</td>
</tr>
<tr>
<td>fringe benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-time faculty (faculty FTE split with unit(s)) salaries</td>
<td>0.70</td>
<td>0.00</td>
</tr>
<tr>
<td>fringe benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjunct faculty salaries</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>fringe benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate assistants salaries</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>fringe benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classified Positions salaries</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>fringe benefits</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Personnel cost                      |                         |                                   |
| salaries                             | $0                      | $0                                |
| fringe benefits                      | $0                      | $0                                |
| Total personnel cost                 | $0                      | $0                                |

| Equipment                            | $0                      |
| Library                              | $0                      |
| Telecommunication costs              | $0                      |
| Other costs (specify)                | $0                      |
| TOTAL                                | $0                      | $0                                |

The data on this worksheet represent the amount of effort given faculty members will expend toward the core curriculum of the degree (not electives).
Part D: Certification

1. Estimated costs and funding source to initiate and operate the program.

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Program initiation year 2013 - 2014</th>
<th>Target enrollment year 2017 - 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reallocation within the department or school <em>(Note below the impact this will have within the school or department.)</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reallocation within the institution <em>(Note below the impact this will have within the school or department.)</em></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other funding sources <em>(Please specify and note if these are currently available or anticipated.)</em></td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Statement of Impact/Other Funding Sources**

Support for this program will come from existing resources with no adverse impacts anticipated on the Department of Sustainable Biomaterials, the College of Natural Resources and Environment, or Virginia Tech. Faculty currently teaching in the Forestry and Wildlife degree program under the Wood Science and Forest Products major will instead teach in this new degree. No new students will be enrolled in the Forestry and Wildlife degree program under the Wood Science and Forest Products major after Fall 2013.

**Secondary Certification**

If resources are reallocated from another unit to support this proposal, the institution will **not** subsequently request additional state funding to restore those resources for their original purpose.

Agree  ________________________________
Signature of Chief Academic Officer

Disagree  ________________________________
Signature of Chief Academic Officer
References (Including Attachments)


Virginia Department of Taxation. 2011. The Economic Outlook and Revenue Forecast through Fiscal Year 2014.  


Appendix A: Core Course Descriptions for Proposed Degree

SBIO 1234 Introduction to Wood, Design and Craftsmanship (3)
Wood as a material. Students learn how to design and craft wood-related pieces, but also receive an introduction to laboratory techniques, wood processing, machining and woodworking, moisture interactions, species characteristics, microscopic techniques, measuring material properties, characteristics of forest products industry, career opportunities.

SBIO 2124 Structure and Properties of Biomaterials (3)
Macroscopic and microscopic structure and basic chemical composition of biomaterials including wood, grasses, bamboo, and bagasse. Impact of structure on physical and mechanical properties. Identification of commercially important woods and other biomaterials. Preparation and analysis of microscope slides and scanning electron micrographs.

STAT 3615-3616 Biological Statistics (3,3)
Descriptive and inferential statistics in a biological context. 3615: Fundamental principles, one- and two-sample parametric inference, simple linear regression, frequency data. 3616: One- and two-way ANOVA, multiple regression, correlation, nonparametrics, using the MINITAB computer package.

SBIO 3004 Sustainable Nature-based Enterprise (3)
Planning for green and sustainability values for profit and non-profit enterprises that produce and market nature-based products and services (e.g., wood products, wildlife, fish, ecotourism). Understanding current green business environments to foster natural resource-based enterprises.

SBIO 3445-3446 Entrepreneurial Design and Innovation (3,3)
3445: Concept to market design and innovation project applied to the biomaterials industry. Innovative biomaterials product design based on consumer need. 3446: Preparation and execution of a business plan including, product development and marketing, strategic planning, production planning, technology utilized, packaging and distribution to final market.

*SBIO 3454 Society, Sustainable Biomaterials, and Energy (3)

SBIO 4715-4716 Wood House (3,3)
Appendix B: Elective Courses with Titles

Track Courses

**Sustainable Enterprise Track:** (18 credit hours)
SBIO 2614 Introduction to Forest Products Marketing (3)
SBIO 3464 Forest Products Business Systems (3)
SBIO 3554 Sustainable Biomaterials Enterprises (3)
ACIS 2115 Principles of Accounting (3)
FOR 4014 Natural Resources Economics (3)
MKTG 3104 Marketing Management (3)

**Creating Sustainable Society Track:** (18 credit hours)
FOR 2554 Nature and American Values (3)
SBIO 3324 Green Building Systems (3)
FOR 4014 Natural Resources Economics (3)
SBIO 2994 or 4994 Undergraduate Research; SBIO 2964 or 4964 Field Study; or SBIO 3954 Study Abroad (at least 3 credit hours)
SBIO 3554 Sustainable Biomaterials Enterprises (3)
AAEC 3314 Environmental Law (3)

**Design and Craftsmanship Track:** (16 credit hours)
SBIO 2384 Behavior of Biomaterials (3)
ART 3004 History of Interiors (3)
AHRM 1624 Residential Drafting Lab (1)
AHRM 2654 Housing Environment (3)
AHRM 4664 Universal Design (3)
A professional elective chosen by the student and advisor (3)

**Sustainable Residential Structures Track:** (19 credit hours)
CHEM 1036 General Chemistry (3)
PHYS 2205 General Physics (3)
SBIO 2384 Behavior of Biomaterials (3)
SBIO 3314 Wood Mechanics (4)
SBIO 3324 Green Building Systems (3)
SBIO 4984 Design of Wood Structures (3)

**Free Electives:** (20 – 23 credit hours)
### Appendix C: Sample Programs of Study
#### Sustainable Biomaterials and Innovation Degree, Sustainable Residential Structures Track

<table>
<thead>
<tr>
<th>Year</th>
<th>Fall Semester</th>
<th>Spring Semester</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CHEM 1035 General Chemistry (3)*</td>
<td>CHEM 1036 General Chemistry (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CHEM 1045 General Chemistry Lab (1)*</td>
<td>ENGL 1106 Freshman English (3)*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BIOL 1105 Principles of Biology (3)*</td>
<td>MATH 2015 Elem Calculus w/Trig II (3)*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BIOL 1115 Principles of Biology Lab (1)*</td>
<td>SBIO 1234 Introduction to Wood, Design and Craftsmanship (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ENGL 1105 Freshman English (3)*</td>
<td>CLE Area 2 Elective (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>MATH 1016 Elem. Calculus w/Trig I (3)*</td>
<td>CLE Area 6 Elective (1)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>STAT 3615 Biological Statistics (3)</td>
<td>STAT 3616 Biological Statistics (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SBIO 2124 Struc. Prop. of Biomatlts. (3)</td>
<td>SBIO 2384 Behavior of Biomaterials (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SBIO 2784 Global Forest Sustainability (3)*</td>
<td>ECON 2005 Principles of Economics (3)* or AAEC 1005 Econ. Food Fiber Systems (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>PHYS 2205 General Physics (3)</td>
<td>CLE Area 3 Elective (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CLE Area 2 Elective (3)</td>
<td>Free Elective (3)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>SBIO 3445 Entrepreneurial Design and Innovation (3)</td>
<td>SBIO 3446 Entrepreneurial Design and Innovation (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SBIO 3324 Green Building Systems (3)</td>
<td>SBIO 3314 Wood Mechanics (4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Professional Elective (3)</td>
<td>SBIO 3454 Society, Sustainable Biomaterials, and Energy (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Professional Elective (3)</td>
<td>Free Elective (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Free Elective (2)</td>
<td>Free Elective (3)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>SBIO 4715 Wood House (3)</td>
<td>SBIO 4716 Wood House (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SBIO 4984 Design of Wood Structures (3)</td>
<td>Professional Elective (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SBIO 3004 Sust. Nature-based Enter. (3)</td>
<td>Professional Elective (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Professional Elective (3)</td>
<td>Free Elective (3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Free Elective (3)</td>
<td>Free Elective (3)</td>
<td></td>
</tr>
</tbody>
</table>

*also counts in general education (Curriculum for Liberal Education)*
Appendix D: List of Faculty in Sustainable Biomaterials and Innovation

Associate Professor Brian Bond. Areas of Specialization: Sustainable material manufacturing and efficiency.

Associate Professor Urs Buehlmann. Areas of Specialization: Manufacturing Systems Engineering, Lean Manufacturing, Business Benchmarking, Competitive Strategy, Globalization

Professor Robert Bush Areas of Specialization: Marketing of forest products and the management of wood-based companies and the wood pallet industry.

Professor D. Earl Kline. Areas of Specialization: Lean thinking for sustainable manufacturing and business processes, systems engineering design principles.

Professor A. L. Hammett. Areas of Specialization: International marketing and trade, non-timber forest products utilization and marketing, forest based economic development, certified products, niche markets

Associate Professor Daniel Hindman. Areas of Specialization: Green building systems, efficient use of wood materials for residential and commercial applications.


Assistant Professor Henry Quesada-Pineda. Areas of Specialization: Continuous improvement and organizational innovation with applications in sustainable material-based industries; supply chain management and international marketing.

Professor Audrey Zink-Sharp. Areas of Specialization: Anatomy of sustainable biomaterials, properties, and processing; cell wall architecture and development of improved wood-based composites.
Appendix E: Recent Job Openings in Sustainable Biomaterials and Innovation

Georgia-Pacific

Process Control Technician

Georgia-Pacific, a leader in the forest products industry, is seeking a skilled candidate for a Process Control Technician position opening in our oriented strand board plant located in Emporia, VA. The plant is located between Emporia, VA, and Roanoke Rapids, NC.

LIST OF JOB RESPONSIBILITIES

- Works with the Team Leader to resolve quality and/or production problems, while working safely and within the MBM® Guiding Principles.
- Performs daily quality control tests as outlined by Georgia-Pacific Corporation standards and APA specifications including but not limited to: surface inspections, thickness tolerance checks, verification of flake geometry and flake moisture content, cross-panel density. Destructive testing of small specimens including internal bonds, MM, EI, for parallel, perpendicular, MM, EI.
- Possess an understanding of statistical and quality control tools, process modeling, root cause analysis, and performance gap/efficiency tracking.
- Maintain laboratory housekeeping, ordering reagents, wax, and prepare R&D samples for shipment.
- Cover for the Team Leader when they are on vacation, supervising the production team.
- Participate in our safety program.

LIST OF JOB REQUIREMENTS

- Safety conscience individual with a desire to work in a team-based environment.
- Pro-active involvement with the operating production team on issues relating to safety, environmental compliance, data reporting, problem solving, and technical training.
- Willingness to work rotating shifts which will include weekends and holidays.
- Ability to recognize opportunities for improvement and implement changes.
- Excellent interpersonal communication skills.
- Ability to compose technical material including letters, reports, and proposals.
- 3 - 5 years of job related experience and/or a Bachelor's Degree in Wood Science, or other science degree.

WHAT ALL APPLICANTS CAN EXPECT

- Interested applicants should forward a current resume, and cover letter to:
  
  Georgia-Pacific Corporation
  
  Attn: Michael Tillman
  
  Post Office Box 368
  
  Skippers, Virginia 23879

  Or email: mtillman@gapac.com

- Any applicants offered employment would be required to take a post-offer drug screen.

An Equal Opportunity Employer M/F/V/D
Production Management Trainee

BASIC FUNCTION:
The Production Trainee is responsible for developing a detailed knowledge of UFP manufacturing operations through on-the-job training and formal/self study.

ESSENTIAL DUTIES:

- Attains knowledge of plant operations by performing every plant hourly job.
- Performs work assignments in other UFP operations, Engineering, Wood Preservation, Manufacturing, Purchasing, Marketing, Customer Facility, and Lumber Mill.
- Attains certification/licensure in first aid, CPR, forklift operation, and pesticide application.
- Successfully performs quality control and lead person assignments.
- Successfully served on plant Safety Committee which includes chairing a meeting, conducting safety tours, and demonstrates knowledge of safety and lockout procedures.
- Successful completion of training courses: Production Management, Supervisory Skills 100, UFP Training Class, Plywood Correspondence, Lumber and Basic Engineering Principles, Timber Products Lumber Grading, and UFP Training Manual.
- Attains understanding of UFP manufacturing and inventory processes/procedures, product costing and plant maintenance.
- Performs special projects/assignments as required.

QUALIFICATIONS:

- Bachelor degree in related discipline or equivalent.
- Demonstrated ability to interact with all organizational levels.
- Demonstrated proficiency in the English language in reading, writing, and speaking.
- Demonstrated ability to be mobile in the work environment.
Weyerhaeuser Company: Job Description
Plant Technical Director-ID #01005603

Description
At Weyerhaeuser, our most valued resources aren't just the trees and timberlands we oversee. We're a leader in the world's structural frame market with innovative products, systems, and services for use in a variety of residential, commercial and industrial applications worldwide. We're looking for people who can contribute, grow, think and create! We thrive in a culture that embraces diversity and rewards innovation. Our associates are the real reason we've been in business for over 100 years. Their skill and ingenuity have made Weyerhaeuser one of the largest manufacturers and distributors of wood products in the world.

The Natchitoches facility is located in central Louisiana, approximately 75 miles south of Shreveport, LA and 60 miles north of Alexandria, LA just off I-49.

This position is part of the Natchitoches Plant Leadership Team and reports directly to the Plant Manager and indirectly to the Senior Technical Director. The Technical Manager:
- Provides technical expertise and leadership to the plant as it relates to process, product quality and performance,
- Interacts with the technical and customer sales team as it relates to products manufactured and quality claims
- Helps lead and direct the plant operations.

Key Functions:
- Demonstrated personal commitment to safety and the safety of others. This position is responsible for:
- Managing the onsite technical staff and technically related processes and procedures safely & effectively,
- Ensuring quality control tools and processes are effective in maintaining product performance requirements and customer expectations
- Developing and executing plant level trials and related reporting,
- Lead and contribute to Continuous Improvement Projects
- Tracking key process changes and variables,
- Optimizing and maintaining product performance
- Owner of the quality management system (QMS), and
- Responsible for maintaining 3rd party and external/internal supplier relationships.

Qualifications:
- A Bachelors degree in Wood Science, Engineering or related field is preferred
- A minimum of three (3) years in a technical supervisory role.
- Must be safety and team oriented,
- Exhibit a strong work ethic,
- Be capable of managing multiple projects;
- Excellent communication skills,
- Have strong problem solving and computer skills,
- and be skilled in industrial statistics.

Weyerhaeuser is an Equal Opportunity Employer building a capable, committed, diverse workforce.

Job: Operations, Manufacturing, & Construction
Primary Location: USA-LA-Natchitoches
Schedule: Full-time
Job Level: Manager
Job Type: Experienced
Shift: Day (1st)
Travel: Yes, 10% of the time
Relocation Assistance Available
 viewing job: 125983/Inside Lumber Sales

You cannot perform activity on this job as you do not currently have all the required documents on file.

You need to submit the following categories: Resume

Save your application for later.

The job has been submitted. We will notify you when your application is reviewed. Your resume can be used for future applications.

Job Title: Inside Lumber Sales

Organization Name: Industrial Timber and Lumber

Number of Openings: 1

Work Schedule: Full Time

Job Location: Beaverton, OR

Job Description: Inside Lumber Sales

ITL, Inc., also known as Industrial Timber and Lumber, is one of the leading manufacturers and producers of hardwood lumber. ITL processes and sells over 220 million board feet of hardwood lumber annually. Each of ITL's facilities is strategically located to take advantage of the hardwood resources unique to their various geographic regions. Each facility is continually updated and equipped with advanced lumber handling and processing equipment.

We are seeking an individual who has the qualifications, interest, and desire to join our Inside Sales team at our corporate office in Beaverton, OR. The responsibilities include, but are not limited to the following:

- Always provide customers with timely, courteous service.
- Build and maintain relationships with customers by learning key contacts, following up on orders, addressing issues, and providing information about our products and programs.
- Prepare sales and marketing materials for new business, existing, and potential customers.
- Identify opportunities to increase sales volume, and assist in industry production.
- Support the outside sales team in sales efforts.
- Maintain status of orders to make sure they are processed and delivered to a timely manner.
- Maintain and improve customer databases.
- Communicate customer needs to facilities.
- Optimize all sales opportunities using best management practices and continuous improvement.
- Provide customer services in a timely, safe manner while making the process easier for customers.
- Cross-training will be required with other departments as needed.

The Requirements:

- Personality: upbeat, energetic, personable, and enthusiastic.
- Communication: Excellent verbal and written communication skills.
- Computers: You must be very comfortable with Microsoft Windows & Office, and be able to learn new applications quickly. A large part of the job requires working with computers and software.
- Multitasking & followership: The ability to keep track of multiple priorities and issues, and complete them through to completion is crucial.

Education:

- Preferred: Bachelor's degree in Wood Sciences / General Business

We are an equal opportunity employer.

Qualifications:

- High School Diploma

Proposal for B.S. in Sustainable Biomaterials and Innovation 31 of 54 Virginia Tech
Virginia Tech
Division of Student Affairs

Viewing Job 23248/Management Trainees Program

Profile View

Profile Information

Below you will find detailed information for this job. Click the link for organization name to view more information about the employer.

If application is available online, visit it to submit your resume directly to the employer. If it is not, please read the application instructions below for details on how to send your resume to the employer.

"Job Title: Management Trainees Program"

Job Reference Number: 23248

Organization Name: JBD-WEN

Number of Openings: 10

Work Schedule: Full-time

Salary: $25,000

Employment Start Date: 5/16/2011

Application Deadline: 5/16/2011

Job Description: JBD-WEN is looking for a group of motivated individuals who have completed their first 2 years in college. We are looking for people who have earned a degree in an engineering or business field, with a strong interest in working in a team environment. We will be looking for individuals with strong problem-solving skills and the ability to work independently.

Qualifications:

Education:

Bachelor's degree in an engineering or business field.

Experience:

Minimum of 2 years of experience in a related field.

Salary:

$25,000 per year.

Application Deadline:

5/16/2011

*Deadline Date: 5/16/2011

*Expiration Date: 5/16/2011


3/7/2011

Proposal for B.S. in Sustainable Biomaterials and Innovation

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Virginia Tech
Job Profile

Virginia Tech
Division of Student Affairs

Viewing Job: 24007/Operational Excellence Specialist

Profile View

Below you will find detailed information for this job. Click the link for organization name to view more information about the employer.

If Resume is available above, click it to submit your resume directly to this employer. If it is not, please read the Application Instructions below for details on how to send your resume to the employer.

Job Title: Operational Excellence Specialist
Organization Name: Furniture Branch - Thomasville Furniture Inc.
Number of Openings: 1
Work Schedule: Wage/Salary
Employment Start Date: Employment End Date:

*Job Description*
POSITIVE SUMMARY
OPERATIONAL SPECIALISTS BALL the organization in Continuous Improvement (CI) activities and training, ready planning, organizing, directing, leading, teaching, and training others in

SPECIFIC RESPONSIBILITIES
- Lead the development and execution of continuous improvement strategy and actions to attain the organization's objectives.
- Coordinate improvement activities with team's to ensure organization alignment with policy deployment objectives.
- Teach and train in the daily use and implementation of lean principles.
- Participate in Process Improvement Teams and Corrective Action Teams.
- Make suggestions to improve areas.
- Use tools to prevent equipment damage.
- Develop and lead CIP teams.
- Monitor safety procedures and proper training to prevent injury to self and others.
- Maintain accurate records as required.
- Perform other duties as required.

Qualifications:
- Bachelor's degree in Engineering or related field.
- Knowledge of continuous improvement principles and tools.
- Excellent communication and interpersonal skills.
- Ability to work independently and as part of a team.
- Ability to lead and mentor others.
- Ability to work with a high level of detail.
- Strong analytical and problem-solving skills.
- Demonstrated leadership and management skills.
- Excellent written and verbal communication/presentation skills.
- Knowledge of Excel and other software applications.

Other Requirements:
- Must have 2 years of experience in continuous improvement.
- Must have strong leadership and teamwork skills.
- Must have strong written and verbal communication skills.
- Must have strong analytical and problem-solving skills.


On-line Application Address:

Contact Information:
- First Name: Michelle
- Last Name: Miller
- Address Line 1: 492 2nd St
- Address Line 2: 2nd St
- City: Thomasville
- State/Province: NC
- Zip/Postal Code: 27366

Map of Address Above: (Click Map)

*Phone: 336-476-2122
*Fax: 336-476-2122
*Email: milyer@furniturebrands.com

Website: www.furniturebrands.com

https://www.myinterface.com/vs/job.aspx

3/7/2011

Proposal for B.S. in Sustainable Biomaterials and Innovation

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Virginia Tech
Job Announcements from Search North America


**Southeast Composite Panel Division Engineer**
Annual Compensation to $120K plus benefits. Major integrated forest products firm seeking senior engineer (BSME or equivalent) with 10 plus years of successful manufacturing engineering and equipment design experience to oversee significant process improvements in five manufacturing facilities.

Selected candidate must be a team player and able to communicate with all levels of operations, from the machine operators to the plant managers and beyond. Candidate must also demonstrate positive leadership in project coordination, problem solving, ability to identify value-added process improvement opportunities, mechanical engineering design (in either PB, MDF or OSB operations), contractor/vendor selection and supervision, successful lean manufacturing applications and competitor benchmarking. Initial candidate phone interviews by chief engineer will include presenting problem solving solutions for selected machine centers.

Client is currently reassessing all production facilities. Current plans are to consolidated 3-4 facilities into one large complex with extensive value-added remanufacturing processes. Position offers an excellent learning experience geared to improve the manufacturing and product quality with a forward thinking, well established forest products firm. (Search Assignment #6224)

**NEW - Assistant Remanufacturing Plant Manager**
Base Salary to $90K plus bonus and benefits. Multi plant firm ($300M/yr in sales) with operations in NW and SE seeking a skilled supervisor to manage all aspects of the wood remanufacturing operations. This includes cost control, plant productivity, employee safety training and hiring, environmental compliance and union relations.

Selected candidate should have a four-year college degree or equivalent, believes in the principles of performance management, ensures everyone is involved in achieving positive results. This requires solid leadership and motivation skills. Other skills include statistical quality control, six sigma and lean manufacturing experience.

Responsibilities on the job include production / inventory cost control, manage operations with a focus on a continuous improvement mindset. Candidate can utilize outside resources within limits (engineering and equipment vendor support) towards making the plant operations become a rapid adapter of improved manufacturing processes resulting in achieving the goal of a low cost, high product quality industry producer. (Search Assignment #6233)

**NEW - Sawmill Superintendent**
Base Salary to $80K plus benefits. Multi-sawmill complex seeking a high energy sawmill floor leader to oversee large and small log breakdown operations. Product mix is focused on 65% plus export grades. Significant investment has been made in upgrading production lines. Firm is seeking a leader with skills in motivation, safety, and operator training. Job offers selected supervisory candidate with 10 years of lumber production experience an opportunity to improve current operations and be mentored by a gifted sawmill operations professional. Employer is a significant player in the Far East lumber markets. Product
quality and delivery through motivated operators has been a key factor in the company’s success in today’s tight domestic softwood lumber markets. (Search Assignment #6228)

**NEW - Plywood Complex Maintenance Superintendent**

Annual Compensation to $100K plus benefit DOE. Highly successful, growth-oriented international forest products firm seeking a qualified candidate to supervise all phases of maintenance support in a high-volume specialty products plywood complex.

Minimum qualifications include: Demonstrated leadership and coaching abilities for a diverse workforce; B.A./B.S. degree preferred but not essential; five + years senior supervisory experience; working knowledge of an integrated plywood facility from green end to shipping (selected candidate could also have experience in the composite panel, pulp or paper industries); computer literacy in Excel, Word, and CAD software, CMMS applications and a solid understanding of PLCs and HMI (human-machine interface) systems.

Selected candidate will coach and develop employees; work as a team member towards solving problems and implementing solutions; be a leader in the efforts towards safety improvement; develop training programs to keep maintenance people capable in dealing with current technology; work with all plant personnel to improve machine uptime; monitor and develop the maintenance business process to ensure it effectively meets the needs of the facility; provide leadership and coordination of all mechanical/machinery troubleshooting, repair and installation; work with purchasing to ensure proper supply of spare parts; be involved in purchasing of equipment; help advance new components and technology into operations towards making operations more efficient and competitive and be responsible for project management of capital and major maintenance projects. Recent major plant improvements focused on lean manufacturing have been achieved. Continuous improvement is the norm. (Search Assignment # 6229)
Sustainability Manager | Enviva LP

Sustainability Manager

Enviva is seeking a Sustainability Manager to work at its corporate headquarters in Raleigh, NC. The Sustainability Manager will work closely with the Director of Marketing, Communications and Sustainability and Director of Procurement.

Responsibilities:

The manager will have a thorough understanding of renewable industry regulations and policy, and a detailed knowledge of biomass-related issues and regulation in particular. Position will also require a thorough understanding of global renewable commodities and requirements, particularly Europeans, Asian and U.S. policy and regulatory parameters and how these parameters impact biomass industries in general and specifically Enviva's customer base.

The manager is responsible for customer sustainability requests and requirements including paper procurement, forms, certification coordination and administration. This includes interfacing directly with customer sustainability departments to ensure Enviva is compliant with individual customer requirements and providing all required materials. Manager is also responsible for working with Director of Sales in reviewing and approving sustainability appendices and scores to customer databases and for ensuring that product facilities (e.g., joint ventures projects, affiliate agreements, etc.) are in compliance with customer sustainability requirements and meet all certification requirements.

Manager will be responsible for supporting Enviva's sustainability certification team and all current certification efforts including SFI Certified Snowing, SFI/PFANDS Chain of Custody, Green Gold Label and the Belgian Green Certificate system and will interface with the various applicable audit firms to ensure that all applications and coordination parameters are complete.

Qualifications:

Candidates must have an understanding and appreciation for the renewable energy industry, particularly biomass. Skills required include complete understanding of MS Office Suite and proficiency among communication and interpersonal skills. Proficiency in a foreign language is plus. Position is based out of the Raleigh, NC corporate office and requires semi-frequent travel.

This is a full-time position offering competitive salary and benefits. Use the link below to submit a resume and apply.

All fields are required.

First Name

Last Name

Address

Address 1

Address 2

City

State

Zip Code

Phone

(p) (000) 000-0000

http://www.envivabiomass.com/careers/sustainability-manager/

3/20/2012
Appendix F: Letters of Support

Barry Goodell, Department Head
Department Wood Science and Forest Products
230 Cheatham Hall
Blacksburg, VA 24061

November 30, 2011

Dear Barry,

Timber Truss Housing Systems, Inc. would like to express our support for the formation of a Sustainable Materials and Innovation degree program at Virginia Tech. Most of our managers are Virginia Tech graduates and we are very excited at the prospects of the new programs in the Wood Science and Forest Products Department at Virginia Tech.

Timber Truss Housing Systems, Inc. was founded in 1960. We were one of the first fabricators of wood trusses at that juncture of the early history of wood structural components. We continue to introduce innovative products and technologies today. We have a facility in Salem, Virginia with approximately 140,000 square feet of manufacturing, storage and showroom space. The facility has roof truss, floor truss, wall panel, interior and exterior door manufacturing capabilities. We distribute many products like doors, windows, cabinets, trim, treated wood, sidings and roofing. We also have engineering design, architectural design and professional estimating services as well as an exciting product showroom. We have shipped our products all over the mid-Atlantic area as well as 12 different foreign countries.

After reviewing the new degree program, we feel that this curriculum will produce students in the wood products manufacturing and home construction industries. The emphasis on green building practices and techniques is invaluable in our industry. Our company has been working to demonstrate our green building advantages and the production of students with this knowledge would be a great benefit to any company. Just recently we had to show the advantages of wood framing in Chile and China with outstanding interest and results from those wood product presentations touting the green approach and wood design flexibility. Also, the focus on sustainable practices and efficient manufacturing methods is important for businesses to remain competitive. Virginia Tech has always been well known for providing quality employees to the wood construction industry and this program meets those expectations.
We have always looked to Virginia Tech for engineers, design professionals, sales professionals, IT professionals and other disciplines. However, quite honestly, we have had the best success of any of our Tech alumni from the wood science group. They have been good salesmen, good engineers, and good managers. We look forward to a new group of young talent from these new programs at Virginia Tech as we explore the Green approach to all wood products and marketing. We feel the students and faculty members of the Department of Wood Science and Forest Products have been most helpful to us in the marketing, engineering and production of wood products.

We look forward to this new leap into the future of wood products that will be taught at Virginia Tech.

Best Regards,

GARY

Gary W. Saunders 74 ARCH VP1854
President, Timber Truss Housing Systems, Inc.
November 30, 2011

Barry Goodell, Head
Department Wood Science and Forest Products
230 Cheatham Hall
Blacksburg, VA 24061

Dear Barry:

We would like to express the National Hardwood Lumber Association’s support for the formation of a Sustainable Materials and Innovation degree program at Virginia Tech.

As the creator and keeper of the North American hardwood lumber grading rules, NHLA works closely with the forest products industry. NHLA is the world’s largest and oldest hardwood industry association, representing more than 1,200 companies and one million hardwood families that produce, use and sell North American hardwood lumber, or provide equipment, supplies or services to the hardwood industry. NHLA currently offers an introductory class, Hardwoods 101, as well as a Leadership, Management and Development Program.

The Sustainable Materials and Innovation curriculum provides a solid basis for students to learn about the practices of sustainability and management of forest resources. By addressing sustainable practices and efficient manufacturing methods, this curriculum will help ensure that the responsible use of North American hardwood lumber will continue to be a dependable and abundant resource. Virginia Tech has always been well known for providing quality employees to the hardwood lumber industry and this program meets those expectations.

Sincerely,

Mark Barford, CAE
Executive Director
December 2, 2011

Dr. Barry Goodell, Head
Department of Wood Science and Forest Products
Virginia Tech College of Natural Resources and Environment
230 Cheatham Hall
Blacksburg, VA 24061

Dear Barry:

The Virginia Forest Products Association would like to express our support for the formation of a Sustainable Materials and Innovation (SMI) degree program at Virginia Tech.

The Virginia Forest Products Association is a non-profit, non-governmental, privately supported association of individuals, firms and corporations having an interest in the Commonwealth’s lumber and wood products industry. VFPA strives to create a better understanding of the importance of the lumber and wood products industry in the Commonwealth of Virginia by encouraging profitable production and distribution of native wood products, disseminating information about new markets, products and market challenges; providing a collective voice regarding government programs and legislation; and conducting educational programs to support the lumber and wood products industry.

We have read the curriculum of the Sustainable Materials and Innovation degree program and believe that it provides students with an understanding of many of the market, management, and production components associated with the wood products industry. Many challenging issues are presented, including the demand of products in housing and other markets, the importance of sustainable production of materials, competitive product marketing and efficient manufacturing methods.

We have had a long association with both the College of Natural Resources and Environment and the Department of Wood Science and Forest Products and look forward to continuing that relationship with the development of the Sustainable Materials and Innovation degree program.

Sincerely yours,

[Signature]

J. R. (Randy) Bush, CAE
President

A non-profit, non-governmental, privately supported association of individuals, firms and corporations having an interest in the Commonwealth's multi-billion dollar forest products industry.
Appendix G: Student Survey

Students from the University Studies program at Virginia Tech were provided a question (below) as part of a survey administered by University Studies staff in May and June of 2011. Responses to the question revealed that approximately 31% of the US students would have moderate to strong interest in a degree in Sustainable Biomaterials and Innovation. The survey was taken by 114 subjects. Extrapolation to the approximate 2,500 student enrollment in University Studies suggests that as many as 775 University Studies students would potentially have interest if this major were offered on campus.

If a "Sustainable Materials and Innovation" degree were offered at Virginia Tech would that be of interest to you as a student?
Definitely 2 (2%)
Highly likely 6 (5%)
Somewhat likely 27 (24%)
Unlikely 54 (47%)
Definitely would not 23 (20%)
no answer 2 (2%)

Background on the survey subjects:
Sex:
Male 57 (50%)
Female 56 (49%)
no answer 1 (1%)

Age:
16-20 110 (96%)
21-25 3 (3%)
26-30 0 (0%)
30-40 0 (0%)
Over 40 0 (0%)
no answer 1 (1%)

Interested in the environment?
Yes 99 (87%)
No 13 (11%)
no answer 2 (2%)

Hometown:
Instate 77 (68%)
Out-of-State 32 (28%)
non-US born 3 (3%)
no answer 2 (2%)

Languages spoken besides English:
Spanish 18 (16%)
French 4 (4%)
Chinese 3 (3%)
German 0 (0%)
none 63 (55%)
other: 9 (8%)
o no answer 17 (15%)
Appendix H: Inquiries and Expressions of Interest from Potential Students
Letters of Support from Students

Student comments about the Sustainable Biomaterials and Innovation proposed degree

"I think a degree in sustainable materials and innovation would have been a great addition, and a program I would have loved; it would allow me to learn crucial technical information for my workplace, while allowing me to focus on sustainable stewardship, and foster my creativity."

-Scott MacDonald, 2011 Graduate, Safety Manager, Riverside, CA plant of Universal Forest Products

"As a student, I am interested in understanding the design of safe and efficient housing structures using sustainable resources. I am excited for the Sustainable Materials and Innovation degree program as a way to learn to properly design all forms of wood frame residential construction and the best use of sustainable materials. I now feel comfortable with designing a home knowing that the work I have done will be safe for a family to live in while also being environmentally friendly."

-Khris Beagley, Current Student, Class of 2012

"As a current graduate student and graduate of the Wood Science and Forest Products undergraduate degree, I am very interested in the sustainable use of wood and earth-friendly processing of other biomaterials. The focus of the newly proposed major in Sustainable Materials and Innovation allows students to explore ideas of sustainability and green building methods to a greater degree than other majors. I believe that many undergraduate students would find this major very appealing and useful."

-Justin Morris, 2011 Graduate, Currently Graduate Student in Wood Science and Forest Products

"I actually came to Virginia Tech to discover why wood is so exceptional. Wood is the best and most sustainable material on Earth. Because of the wonderful job the high-level professors in the Wood Science department do, I now truly love and believe in what I do. And what I want to do is to create a more sustainable environment while still creating jobs and growing a future for people in my country who choose to work with wood and other natural resources. In that regard, I think the creation of the new Sustainable Materials and Innovation degree is great because it is what I am interested in, and I know it will be very valuable to future students."

-Jandir Santin, Current Student, Class of 2013
Appendix I: Discipline Specific Library Resources
Appendix J: Letters of Endorsement from VT Department Heads for Coursework Outside the Major

Support for Biology Department courses in the degree

Department of Biological Sciences
Virginia Tech
College of Science

Department of Biological Sciences
2621 Daneing Hall (6406)
Blacksburg, Virginia 24061
540/231-3603 Fax 540/231-9307
E-mail: rwalker@vt.edu
www.biology.vt.edu

December 8, 2011

Barry Goodell, Ph.D.
Head, Dept. of Wood Science and Forest Products
230 Cheatham Hall
Virginia Tech, Blacksburg, VA 24061

Dear Dr. Goodell,

The Department of Biological Sciences approves the inclusion of BIOL 1105 Principles of Biology and BIOL 1115 Principles of Biology Lab on the checksheets for your proposed new degrees in Sustainable Materials and Innovation and Packaging Systems and Design.

Please note our ability to provide seats to students in these degrees is dependent on sufficient enrollment support to meet course demand.

Sincerely,

Richard A. Walker
Associate Head
Department of Biological Sciences
Support for Chemistry Department courses in the degree

Dear Barry,

By means of this note, permissions are granted.

best wishes,

jim

J. M. Tanko, Professor & Chair
Department of Chemistry
Virginia Polytechnic Institute and State University
Blacksburg, VA 24061
phone: (540) 231-6687
e-mail: jtanko@vt.edu

On Dec 2, 2011, at 2:19 PM, Goodell, Barry wrote:
Dear Brenda, Jim, Peter, Eric and Beate,

As some of you are aware, the department of Wood Science and Forest Products has three degree proposals moving through University Governance review. Two of the proposals are being considered within the Committee on Undergraduate Curricula (CUC) but currently they have been tabled because of the need for permissions from the home departments for our use of these courses. These proposed degrees are: 1) Sustainable Materials and Innovation and 2) Packaging Systems and Design.

I have listed the COS courses below by department for the two proposed degrees, and I am seeking permissions from each of you for use of the courses in our proposed curricula. The maximal number of students in each course from this degree would be 20 students/year.

Our Associate Dean, Dean Stauffer, has communicated with Jill Sible in COS, and Jill has suggested the language below that may be acceptable to you as a means of providing conditional permission, dependent on the availability of resources. If you are willing to provide the needed permissions, the use of language similar to this would be appropriate:

Permissions for use of the "course/lab will be available to students in the proposed degree provided there is sufficient enrollment support to meet course demand."

Please let me know if you would be willing to provide permission to allow our future students in these degrees access to your courses. Thank you.
Sincerely yours,

Barry Goodell
Head, Department of Wood Science and Forest Products

PROPOSED DEGREE – Sustainable Materials and Innovation (SMI)
Core – 20 students/year after 4 years:

BIOL 1105 Principles of Biology (3)
BIOL 1115 Principles of Biology Lab (1)

CHEM 1035 General Chemistry (3)
CHEM 1045 General Chemistry Lab (1)

MATH 1016 Elem. Calculus w/Trig I (3)
MATH 2015 Elem. Calculus w/Trig II (3)

STAT 3615 Biological Statistics (3)
STAT 3616 Biological Statistics (3)

One SMI Track will also have 5 students/year (maximum after 4 years) with these additional proposed courses:
CHEM 1036 General Chemistry (3)
PHYS 2205 General Physics (3)

PROPOSED DEGREE – Packaging Systems and Design
Core only with no tracks – 20 students/year (maximum after 4 years):

BIOL 1105 Principles of Biology (3)
BIOL 1115 Principles of Biology Lab (1)

CHEM 1035 General Chemistry (3)
CHEM 1036 General Chemistry (3)
CHEM 1045 General Chemistry Lab (1)

MATH 1016 Elem. Calculus w/Trig I (3)

PHYS 2205 General Physics (3)

STAT 2004 Introduction to Statistics (3)
Support for Math Department courses in the degree

Re: Conditional permissions for use of COS courses?

Peter Haskell
Sent: Friday, December 2, 2011 5:30 PM
To: Goodell, Barry
Cc: Sibao, Yi; Robert Rogers

Dear Dr. Goodell,

Based on your assurance that the total impact will not exceed 40 students, at this time I anticipate that Math 1016 will be able to accommodate the students expected in Packaging Systems and Design and in Sustainable Materials and Innovation.

The situation for Math 2015, which is required for SMI, is harder to predict. Should there be any contraction in resources, Math 2015 will bear at least its share of that contraction. With current resources Math 2015 could accommodate an additional 20 students per year. If resources are reduced, I cannot make any promises.

Peter

---

Peter Haskell
Professor and Chair
Department of Mathematics
Virginia Tech
Blacksburg, VA 24061-0123
540-231-6538
fax: 540-231-5960
phaskell@math.vt.edu
Support for Physics Department courses in the degree

The Department of Physics approves the inclusion of PHYS 2205 into your proposed degree programs in "Sustainable Materials and Innovation" (SMI) and "Packaging Systems and Design".

This approval is contingent upon the availability of the necessary resources. Specifically, our course will be available to your students in the proposed degrees provided there is sufficient enrollment support to meet course demand.

We wish you much success with this program.

With best regards,
Beate.

Support for Statistics Department courses in the degree
RE: Conditional permissions for use of COS courses?

Smith, Eric

Sent: Wednesday, December 7, 2011 5:56 PM
To: Goodell, Barry

Yes the wording is ok with Statistics

Eric smith

From: Goodell, Barry
Sent: Wednesday, December 07, 2011 4:28 PM
To: Smith, Eric
Subject: Re: Conditional permissions for use of COS courses?

Dear Eric,

I know that this is busy time of year, and I apologize for making this request now. I have heard back positively from two other COS department heads on the use of this conditional permissions language suggested by Jill Sible. Would you be willing to provide the same conditions permissions approval for our use of the STAT 2004, 3615 and 3616 courses as listed below in the degree proposals? Thank you for your help.

Barry Goodell

From: -- <goodell@vt.edumailto:goodell@vt.edu>
Date: Fri, 2 Dec 2011 14:19:12 -0500
To: "Schmittman, Beate" <schmittman@vt.edumailto:schmittman@vt.edu>, "Smith, Eric" <smith@vt.edumailto:smith@vt.edu>, "Tanco, James" <tanco@vt.edumailto:tanco@vt.edu>, "Winkler, Brenda" <winkler@vt.edumailto:winkler@vt.edu>, "HaskellMath.vt.edumailto:HaskellMath.vt.edu>, "HaskellMath.vt.edumailto:HaskellMath.vt.edu>, "Smith, Eric" <smith@vt.edumailto:smith@vt.edu>
Cc: "Sible, Jill" <sible@vt.edumailto:sible@vt.edu>, "Stauffer, Dean" <staufffer@vt.edumailto:staufffer@vt.edu>
Subject: Conditional permissions for use of COS courses?

Dear Brenda, Jim, Peter, Eric and Beate,

As some of you are aware, the department of Wood Science and Forest Products has three degree proposals moving through University Governance review. Two of the proposals are being considered within the Committee on Undergraduate Curricula (CUC) but currently they have been tabled because of the need for permissions from the home departments for our use of these courses. These proposed degrees are: 1) Sustainable Materials and Innovation and 2) Packaging Systems and Design.

I have listed the COS courses below by department for the two proposed degrees, and I am seeking permissions from each of you for use of the courses in our proposed curricula. The maximal number of students in each course from this degree would be 20 students/year.

Our Associate Dean, Dean Stauffer, has communicated with Jill Sible in COS, and Jill has suggested the language below that may be acceptable to you as a means of providing conditional permission, dependent on the availability of resources. If you are willing to provide the needed permissions, the use of language similar to this would be appropriate:

Permissions for use of the course/lab will be available to students in the proposed degree provided there is sufficient enrollment support to meet course demand.

Please let me know if you would be willing to provide permission to allow our future students in these degrees access to your courses. Thank you.

Sincerely yours,

Barry Goodell
Head, Department of Wood Science and Forest Products

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Support for Accounting and Information Systems Department courses in the degree

AGREEMENT for the USE of ACIS 2115

Dear Barry,

Yes, that should work.

Thank you and best wishes,
Reza

Reza Barkhi
Head, Accounting and Information Systems
Virginia Tech

From: Goodell, Barry
Sent: Wednesday, September 28, 2011 7:59 PM
To: Barkhi, Reza
Subject: Permission for ACIS 2115 course

Dear Reza,

Thank you for the discussion this morning. As you know, we would like to add your Department’s course into our newly proposed degree program that is currently going through University Governance review. The name of the proposed degree is Sustainable Materials and Innovation and one of the four Tracks that we have proposed in this degree would list "ACIS 2115 Principals of Accounting" as a required course. We anticipate that, within 3-4 years after approval of the degree, that our department would have approximately 5 students per year in this one Track. (This is 1/4 of the total number of students in the degree per year, given that there are 4 Tracks).

Please let me know if you would be willing to grant permission to allow the students in this proposed degree to take this ACIS 2115 course. I appreciate your help with this matter. Thank you.

Barry

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Professor Barry Goodell, PhD
Head, Department of Wood Science and Forest Products