### Learning Objectives and Outcomes for

### B.S. in Forest Operations, Bioproducts & Bioenergy

July 2011

The goal of the Forest Operations, Bioproducts & Bioenergy program is to produce professionals with strong abilities to assess and communicate the technical foundations and life-cycle impacts associated with how forest-based materials can be sustainably produced for a variety of applications ranging from traditional wood products to emerging bioproducts, and bioenergy systems. Our students will apply the principles of forest operations, materials science and processing, and business management to manage and operate a variety of systems and facilities within the traditional forest products industry as well as within the emerging bioproducts and bioenergy industries. Students graduating in this major will be prepared for careers as managers, entrepreneurs, and technical specialists. This professional degree will be accredited by the Society of American Foresters and the Society of Wood Science and Technology (SWST).

#### Learning Objectives

Students graduating from the Forest Operations, Bioproducts & Bioenergy program will be able to:

1. Manage production operations in emerging forest bioproducts and bioenergy facilities as well as traditional forest products industries, including all harvesting, transportation, procurement, processing, and marketing aspects for a wide range of forest products organizations.
2. Manage operations related to emerging bioproducts and bioenergy industries, as well as traditional forest products industries;
3. Conduct comparative analyses of alternative wood-based materials based on physical, chemical, mechanical, and biological characteristics, as well as product systems using life cycle assessment/industrial ecology methods.

#### Learning Outcomes

At the end of the program, graduates will be able to do the following:

With respect to **Forest Operations and Production Systems**, our students will be able to:

1. Describe fundamental processes for biomass supply including harvesting, comminution, transportation, drying, and storage;
2. Describe fundamental processes for the production of bioproducts and bioenergy including traditional wood and timber production, composite products, biorefineries, and biomass energy operations;
3. Assess the effectiveness of forest road transportation systems with particular emphasis on field location, safety, hydrology, erosion, sedimentation, and stream ecology;
4. Conduct life cycle assessments of biomass, bioproduct, and bioenergy production systems.
5. Describe the impact of environmental policies on value added supply chains with particular emphasis on certification, compliance, and chain of custody.

With respect to **Materials Science**, our students will be able to:

1. Compare and analyze wood-based materials from physical, chemical, mechanical, and biological perspectives.

With respect to **Forest Science and Forest Management**, our students will be able to:

1. Identify tree and shrub species common to this region using principles of taxonomy; and
2. Measure land areas and conduct spatial analysis using geographic information systems;
3. Design and implement pre-harvest assessments and inventories using appropriate sampling methods to compare post-harvest stand and tree conditions;
4. Explain ecological concepts and principles including the structure and function of ecosystems, plant and animal communities, competition, diversity, population dynamics, succession, disturbance, and soil nutrition, and nutrient cycling.
5. Describe the effects of environmental factors such as climate, fire, insects, disease, and nutrient availability, on forest health and site productivity;
6. Develop site specific management plans with multiple objectives and constraints including silvicultural treatments to establish and influence the composition, growth, and quality of forests, and understand the long-term impacts of those plans.

With respect to **Business Management, Markets and Forest Policy**, our students will be able to:

1. Assess operations and systems from a business and financial management perspective;
2. Understand the fundamentals of entrepreneurship as well as corporate enterprise;
3. Write a business plan or a project proposal and demonstrate project management skills, tools, and techniques; and
4. Describe how federal, state, and local laws govern the forest products industry.

With respect to **Professional Competency** **and Communications** our students will be able to:

1. Recognize professional responsibilities in making decisions on behalf of employers, clients, and the public;
2. Adhere to professional ethical standards as defined by the Society American Foresters and the Society of Wood Science and Technology;
3. Prepare and deliver effective oral presentations;
4. Prepare reports, articles, and essays to effectively communicate to both technical and general audiences; and
5. Comprehend and critically evaluate information presented in a variety of writing styles.

With respect to **biological sciences**, FBB graduates will be able to:

1. Interpret and explain the components, patterns, and processes of biological and ecological systems across spatial and temporal scales,
2. Explain basic concepts of molecular biology, cells, organisms, populations, species, communities, and ecosystems.

With respect to **physical sciences, mathematics, and computers**, FBB graduates will be able to:

1. Understand physical and chemical properties, measurements, and states of matter.
2. Apply basic approaches and applications of mathematics, linear programming, and statistics for analysis and problem solving.
3. Use computers and other technologies for communication, measurement, analysis, and problem solving.

With respect to **social sciences and humanities**, FBB graduates will be able to:

1. Evaluate moral and ethical questions by using critical reasoning skills.
2. Understand social and economic structures, processes, and institutions across a broad range of human experience and culture.