Forest Biometrics Research Institute (FBRI) Doctoral Fellowship at the University of Idaho

The purpose of the Forest Biometrics Research Institute (FBRI) Doctoral Fellowship is to facilitate the education of forestry professionals toward an advanced understanding and application of forest biometric principals and methods. Fellows are expected to become proficient in nonparametric statistical methods as related to forestry and forest management technologies. FBRI supports and provides the Forest Projection & Planning System (FPS), which is the industry standard for managing forest ownerships. In addition to providing financial assistance, FBRI is offering access to a large database of field research installations and felled-tree measurements encompassing six western States and over two dozen tree species.

The FBRI Fellowship objective is to provide financial support to graduate students to pursue graduate studies without associated teaching or research responsibilities (as in an assistantship). This Fellowship is an external award from FBRI to support a PhD student in a full-time course of study. The FBRI Fellowship is a three-year commitment to the selected student. The student is expected to complete all coursework and a dissertation leading to a PhD in the three-year time frame. The candidate must hold a Bachelor of Science degree in Forest Management from an SAF-accredited forestry program and be operationally familiar with the silviculture and tree species of the western United States.

The selected FBRI Fellow will join a larger cohort of Masters and Doctoral graduate students pursing advanced knowledge in the fields of Forest Biometrics and Silviculture. FBRI Students will be located in graduate student space within the College of Natural Resources. The FBRI Fellow's doctoral committee will include one Ph.D. Biometrician from the Forest Biometrics Research Institute. The student's doctoral committee has the responsibility to approve the courses and credits it considers essential for the education and development of the candidate. The committee's objective is to ensure that the student is properly trained and prepared to conduct doctoral-quality research in forest biometrics upon completion of this PhD degree.

Prior to each semester the student is responsible to consult with the committee advisor to ensure that a graduate academic plan has been developed and is being followed. The graduate academic plan must be initially approved by the student's doctoral committee. The FBRI Fellowship doctoral student must provide a progress report each year in November at the FBRI Annual Meeting (travel expenses provided by FBRI). All FBRI Fellowship doctoral students are required to participate in at least a one-month internship with FBRI or with an FBRI-affiliated forestry organization prior to completion of coursework. The internship will be tailored to match the student-selected doctoral dissertation topic.

This FBRI PhD graduate program is also open to participants not receiving a FBRI Fellowship. The program accepts interested individuals seeking Masters or Doctoral degrees with independent funding. The program also welcomes interested individuals seeking to attain a graduate degree while remaining employed in the forest industry or other land management organizations. Applicants to the FBRI program with independent funding are only required to pay Idaho resident tuition and fees (detailed on following pages).

FBRI Graduate Research Program – Topics

Understand, explore and evaluate basic principles:

a) Growth model architecture – strengths & weaknesses (Monro, 1974)
    a. Whole Stand Models – DFSIM
    b. Individual-Tree, Distance-Independent Models – FVS, ORGANON
    c. Individual-Tree, Distance-Dependent Models – FPS
b) Nonparametric statistical methods – sampling & regression
    a. Balanced orthogonal sampling designs
    b. Weighted Y-estimates at equal intervals of X
    c. Pascal smoothing techniques and assumptions
c) Only calibrate Growth Models on trees with both Dbh & Height
    a. Understanding lag effects of past density
    b. Exploring the effects of Shade Tolerance ranking
    c. Ranking and Quantifying growth dynamics by Order of Impact
d) Understand and Calibrate 10-meter flexible site curves
    a. Differences between macro-site and micro-site
    b. Relationships of soil, climate and growing season days
    c. Moisture balance between incoming and stored precipitation
e) Silvicultural Growth Dynamics from establishment (CASH Card)
f) Understanding Clumpiness and Spatial parameters in Inventory for Growth
    a. Tree-based Density versus Stand-based Density Measures
        i. Stand Density Index, Curtis Relative Density, Crown Competition Factor
        ii. Competitive Stress Index
    b. Stem-mapped Research plot designs versus Traditional designs
        i. Nelder plot designs
        ii. Fixed-area plots
        iii. Prism variable plot designs
    c. Experimental Unit – Tree versus Stand
        i. Calibration of Growth Models
g) Design and Calibration of Tree Taper Class System
    a. Trends in Stem Form – Larson (1963)
    b. Relationships between live crown, shade tolerance and taper class
    c. Nonparametric fitting of taper profiles
h) Understanding and Applying Growth Steps in Height, not Age
    a. Field precision – signal versus noise relationships
i) External Species Parameter Libraries with Certification
    a. Development, Application, Calibration, Verification

Background Leading to the Formation of FBRI

James D. Arney has a Ph.D. in Forest Biometrics. He has over forty years of experience in research, development and implementation of forest inventory, forest growth projection and forest planning technologies. Dr. Arney owns a forestry consulting business, Forest Biometrics, LLC.

Most private forestry companies have long ago down-sized their technical support departments in favor of a leaner organization. The USFS Experiment Stations have all but curtailed further development in biometrics tools to assist forest managers. This is especially true in the development and support of forestry software. The result is that high quality, robust forest management and planning software is difficult to find. Learning how to develop Environmental Impact Statements (EIS), Sustained Yield Plans (SYP) or Habitat Conservation Plan (HCP) documents is beyond many landowners. This scarcity of forestry software and methods has become the single most limiting constraint to development of sound forest management programs within the private forestry sector.

Forest management and long-range planning has evolved since the 1980s from general guidelines in an annual report to location-specific treatment regimes overlaid on a geographic information system at the beginning of each year. This rush to specificity is the result of a trend in State-mandated forestry regulations. These regulations are becoming increasingly detailed and complex in all western States with the objective to protect riparian zones around streams, wildlife habitat and wildlife travel corridors.

Private and public land owners are finding that every acre has its own set of constraints. These depend on the current development of the existing vegetation, the type of soil, topographical stability, proximity to roads and to streams, constraints on the watershed basin within which it resides and on the matrix of other owners that may make up the entire basin of interest.

Many public land management agencies and private forest companies have developed EIS, SYP and HCP documents to provide written commitments to stated levels of forest stewardship. The difficulty is that the methods are undefined, constraints un-quantified and databases incomplete. As a result, each land manager is expending a significant portion of time and energy in *developing* methods, constraints and databases to be used as a basis for planning. However, the time and energy was anticipated to have been expended on *evaluating* silvicultural alternatives and the impacts of these alternatives. As a result, time runs out and the land manager is left with less than expected results and many times, with less than the best forest management range of options.

The Forest Biometrics Research Institute (FBRI) attempts to provide a robust suite of decision-support tools and methods for forest management and planning. FBRI continually strives to provide accurate assessments of growth and yield for all forest types and silvicultural approaches. No other organization has taken on this mission in service, education and research. FBRI approaches are highly dependent on robust biometric methods and skill-sets. Therefore, FBRI has launched an aggressive program into graduate forestry research to ensure an ongoing high level of service to the forestry profession for decades to come.

The National Research Council Report

As evidence of this situation, the National Research Council formed a Committee on National Capacity in Forestry Research. The Committee's report was completed in 2002 and approved by the National Academy of Sciences for publication and distribution. The following statements have been quoted from that report:

> "In the past decade, the forestry sector and the research capacity in that sector have seen substantial changes. The U.S. Department of Agriculture's Forest Service asked the National Research Council Board on Agriculture and Natural Resources to conduct a study that focuses on the nation's capacity in forestry research. Forest Service leaders recognize the necessity for improving forest productivity and stewardship of all the forests in the United States, including the national forests, urban forests, non-industrial and industrial private forests, and tribal, state, and community forests. Continuous research findings must inform the management and protection of the forests. However, our national capacity in forestry research appears to have waned even as the demands placed on our forests and the need for enhanced technical knowledge has increased. We must have better information on the status of forestry research and future research priorities if we are to identify critical research needs and we need to identify the types of scientists and disciplines required to produce knowledge about our nation's forests."
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> "This study of our nation's capacity in forestry research was conducted to review the expertise and future needs of forestry research organizations and to review the current approaches and capacity of natural resource education to address shortfalls of scientists expected in selected disciplines in the next 10 to 15 years."
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> "In brief, this report suggests that our current forestry research capacity is neither adequate now, nor poised for success in the coming years. This report identifies significant declines in real research capacity, fragmented cooperation and poor communication among the principal providers and users of forestry research, inadequate support of both foundation and emerging disciplines, and little strategic planning to address future forestry research needs."
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> "The forestry research sector is indeed at a crossroads. If left unchanged, its future will entail a steady erosion of intellectual and institutional capacity, and dwindling capacity and impact. Alternatively, forestry research could renew its commitment to innovation, cooperation, relevance, and extension in order to prosper and enhance the practice of forestry in this century. This latter vision will require levels of cooperation, support, real exchange of financial and technical support, and stakeholder support that do not currently exist."

The Forest Biometrics Research Institute was formed precisely to fulfill this need documented by the National Research Council report. The formation of FBRI was initiated by Drs. James D. Arney. The report is available from the National Academy Press in Washington, D.C. as International Standard Book Number 0-309-08456-3 and contains 144 pages.