

Resistance to Integrating Management and Economics Courses Across the Natural Resources and Agricultural Curricula

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Abstract

Many natural resource, forestry, environmental and agricultural curricula at U.S. universities and colleges include a sequence of courses in economic, managerial and policy, foundations. These curricula share a commonality in the development of a microeconomic/managerial economic foundation for decision making, with a natural resources emphasis. Many of the courses in these curricula are presented in a linear or sequential format and are only partially integrated, while a few university programs have integrated much of the coursework, with economic, managerial and policy foundations being included throughout many courses. We investigated successful forest management curricula used in accredited programs in terms of courses used as the economic foundation, level and methods of integration of management/economics/policy into all course work in the major, specific non-integrated management/economics courses required in the junior/senior years and logistical tools used to accomplish the integration. A comparison to the curricula currently used by programs in forestry, environmental and natural resources, horticulture and other majors at Clemson University, a typical land-grant university, was conducted. Our goal was to develop a set of economics-based integrated courses, with the intention of increasing curricula efficiency by reducing credit hours in curriculum and duplication in courses. Clemson's forestry program was specifically addressed. We describe integration opportunities within the forestry curriculum and a process to actually implement varying levels of integration until the faculty feels comfortable with the new curriculum.

Introduction

Forestry, natural resources and agricultural education have undergone major changes over the last

few decades. Curricula in these areas share a common need for a foundation in economics, management and policy. We will use the forestry curriculum to address this common need for an efficient integrative management/economics foundation in the typical land-grant agricultural college curricula. Forestry, along with other natural resource management disciplines, is often an integral part of a College of Agriculture and this discussion of economics issues applies across the typical College of Agriculture.

While forestry has always stressed sustained production of forest outputs and more recently sustained multiple-use outputs, the concept of sustainable forest management is relatively new. The professional judgment of foresters was rarely challenged until public perceptions of forestry evolved into broader definitions of sustainability, changing expectations of what constitutes stalwart forest stewardship and developing methodologies to enhance decision making (Sample et al., 1999). One of the founders of the field of forestry economics, William A. Duerr, suggested restructuring the subject as early as 1990. He observed revolutionary changes in the forest products markets, globalization of forestry, changes in forest products themselves and most importantly, a changing culture where the public and not foresters, dictated forest management goals and objectives (Duerr, 1990).

Forest economics is mostly taught at public land-grant universities in forestry schools or departments. Generally the same few textbooks are used across the United States. Much of forest economics is applied microeconomics or macroeconomics with forestry applications. There seems to be flexibility in how the course is taught, even how it might be taught in combination with other economics courses (Flick And Dunn, 1998). There

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is a general flexibility that forestry economics faculty provides to forestry and natural resources programs. Flick and Dunn (1998) point out: *“Forestry economics faculty offer forestry schools one important attribute that is often overlooked and that bears on the time a forest economist has for research. Forest economists can be used flexibly, for a variety of things, because most are trained in both forestry and social science. They can help out in statistics, biometrics, management, policy, capstone courses, research methods, recreation, industrial forestry, courses in consulting and others. This is generally not true of other forestry professors. Forest biologists, for example, are less often asked to teach outside their specialties, while forest economists seem to bear such requests routinely.”* This same flexibility allows forest management/economics faculty to be the primary instructors in the areas of forest management, forest economics, forest valuation, forest policy, forest management plans and the forestry capstone course.

While our focus is heavily on natural resources and forestry programs, the discussion and results apply equally to agriculture programs. Natural resources and forestry programs are often located within agricultural colleges and the background economics courses discussed apply to fundamental curriculum requirements across these colleges. Basic agricultural or natural resources economics and management course are common prerequisite courses within agricultural colleges. Thus, our suggestions on course integration and curricula efficiencies should be applied broadly across all curricula in the agricultural colleges.

What is the forest economics/management core curriculum area? Natural resources management and forestry programs (and most agricultural college majors) have some sort of required skill set in economics. The trend is to integrate these skills into a set of major courses that will enhance competency, literacy and fluency. Depending upon program direction, this might mean courses in basic economics or ecological, environmental, natural resources, or forest economics. Each of these disciplines, while highly correlated, offers specialization for the managerial processes each type of professional might need in real world practice (Manning, 2008). Outside pressures from legislators who want to reduce program costs, employers who want to hire new graduates with relevant skill sets, as well as inside pressure to maintain academic quality combine to foster an environment for integrated course work in areas like forest economics and management (Sample et al., 1999).

The changing demands of forestry and natural resources curricula are much broader than the sequence of management and economics courses. Integration across the curriculum involves many issues that impact management and economics components, but also impact the relationship of all courses. There are simple issues like integrating tools within the curricula (Andreasen, 2004). Spatial information technologies

are now a foundation of forestry and natural resources management programs (Drape et al., 2013; Hess and Cheshire, 2002). How are tools like these best integrated into curricula? The active involvement required in cooperative learning in natural resources education has been shown to improve academic achievement (Etchberger, 2011). The integration of problem-based learning and web-based multimedia can also enhance academic achievement (Strivelli et al., 2011). Some curricula embrace an international (Pellek, 1989), ethical (Lewis et al., 1999), or multi-objective (Lakshminarayan et al., 1995) focus. These types of innovation are valuable modifications to curricula that produce a broader based education. They do impact curricula and certainly combine with other integration efforts to affect the academic experience. Our focus will be limited to integrated forest and natural resources education, specifically within its managerial, economics and policy areas.

There is no question that an expanding set of managerial and economic skills are necessary to meet the changing demands of foresters and natural resource professionals (Boland et al., 2001; Tombaugh, 1998; Sample et al., 1999). In particular, today's curricula are required to “provide the breadth in natural resources to meet complex management issues and is representative of the major changes in forestry education in recent decades” (Erven, 1987; O'Hara and Redelsheimer, 2012). Forestry and natural resources curricula tend to be have weak requirements in social sciences in general (Vonhof, 2010). This is not just an American problem; the importance of a broad set of managerial and economic skills is recognized internationally (Leslie et al., 2006; Vanclay, 2007). That forestry educational standards keep up with the changing social and political requirements is critical and integration of skill sets will be necessary (Radhakrishna and Bruening, 1994; Tombaugh, 2001). The economics and management foundation we propose meets these broad-based integrative curriculum needs for not just forestry (Beck, 1990; Larson, 1996), but most of the curricula in a typical agriculture college (Franklin, 1986; Heiman et al., 2002).

What is the Integrated Curriculum Approach?

An integrated curriculum approach is nothing new and has been applied across many disciplines (Ward and Waller, 1988). Rather than discuss the approach in general, we will concentrate on forestry and natural resources management curricula and how integration might be applied there. Vaux (1975) discussed the topic almost forty years ago, starting with the definition of integration as “combining to form a more complete, harmonious, or coordinated entity.” Using his definition, the thing being integrated is the program of study with a goal of providing the professional educational framework to produce a forester or natural resources manager. He recognized that one form of integration was incorporating

Resistance to Integrating

new knowledge into the curriculum. That is, keeping the subject matter “current.”

A second kind of integration is the one that is relevant here. It is based on identifying commonalities between and within the curriculum disciplines. An example might be silvicultural practices, forest management and forest economics. Each is a separate discipline. The curriculum might recognize that silviculture and forest management must interact to form management alternatives and forest economics might provide the criteria that allows for selection of the optimum alternative. Vaux (1975) notes that integration of areas that are biological, soils, growth and ecosystem based are not that difficult. However, integration of those that are social science based is difficult to accomplish. The social science areas are people-based. Culture, personal preferences and values come into play.

Vaux was clearly correct. Since he wrote that article, forestry and natural resources management issues have become of great concern to the general public (clearcutting, endangered species and loss of forest land). Today’s forest managers need grounding in ecosystem management, interdisciplinary thinking and planning, landscape ecology and adaptive management (Gilbert et al., 1993). When forestry leaders were asked in 1991 to identify the critical elements of a forestry curriculum the results were integrative, not discipline-focused and stressed basic competencies (rather than traditional courses), education (rather than training), a balanced natural resource perspective (rather than a timber focus), global awareness, social responsibility, knowledge of the political process and ability to navigate in it, theory and practice, increased program flexibility to allow for minors and other options, current issues focus and the ability to work in teams (Gilbert et al., 1993). To develop the broad skills and capabilities necessary to meet those critical elements, an integrative approach is almost mandatory (Schneider et al., 2005). Our focus is on integrating a portion of a curriculum. Thus, our discussion on integrated programs will be brief. Obviously, integrating a discipline area or two closely allied discipline areas is not as challenging as integrating an entire program. However, the same types of problems arise and the same advantages can be accomplished, just at a more modest level. To provide insight into integration of curricula a few examples will be briefly discussed.

Washington State University developed a new integrated curriculum in 1990. Traditional fields of forestry, wildlife management, range management and wildland recreation management were merged into a department that offered a B.S. degree in natural resource management (with majors in forest management, range management, wildlife management, or wildland recreation management) or natural resource sciences majors in plant or wildlife sciences). All students start out taking the same educational foundation courses. They also take a set of natural resources core courses,

including Introduction to Natural Resources Management I, II, III and IV. These are broad integrative courses, so a student could easily switch majors at this early stage. Next, the forestry students move to a set of forestry core courses, but at the same time also complete other natural resource core courses. These natural resource core courses often cover topics that were traditional forestry courses, but from a broad landscape management viewpoint. Finally, there are courses that offer forestry options in business, wildlife, management and directed study (Gilbert et al., 1993).

The best example of an integrated forestry curriculum is likely Northern Arizona University. It first adopted this approach in 1972. Their professional program is divided into three integrated 16-credit courses, referred to as Semesters A, B and C. In 1996 the program was entirely revamped with an emphasis on adaptive curriculum management where the three semesters are continually reviewed (for issues like delivery methods, prerequisites, academic content and emphasis of subdisciplines). Courses use a strong team teaching approach (Fox et al., 1996; Sample et al., 1999; Covington et al., 2000).

The University of Vermont’s School of Natural Resources provides a program where goals are met through interdisciplinary exchange. No courses were added to its existing curricula; instead, the School developed an integrated core curriculum for use by all six of its B.S. programs (including its then Society of American Foresters accredited forestry program). Their approach was retrospective: first, by setting goals for student achievement and then, second, by developing a core curriculum that met those goals. The key was use of a process that encouraged interdisciplinary exchange and avoided departmental fragmentation (Ginger et al., 1999; Sample et al., 1999).

Auburn University adopted a new forestry curriculum about 20 years ago (Flick et al., 1995). They identified four types of forestry programs: (1) “forestry in a larger whole” where forestry becomes part of a larger comprehensive environmental, ecological, or natural resources identity, (2) “many forestries” with multiple curricula in timber management, wildlife, recreation and such, (3) “integrated forestry” where traditional forestry’s subdivisions and disciplines are abandoned for a holistic approach and (4) “bulging forestry” where more and more courses are added to the traditional forestry curriculum. They claim all four approaches are unsatisfactory as the first abandons forestry, the second defines forestry as timber management, the third breaks “with historical continuity concerning subjects and academic disciplines, making it difficult to understand what is happening,” and the fourth is undisciplined. The Auburn University approach was one that focused on core principles and placed forestry at the center—“not subjugated to natural resource management, environmental management, or another concentration.”

The Auburn University faculty recognized that “the theory of forestry involves primarily three disciplines:

biology, economics and measurements. Biology includes soils, ecology, silviculture and protection. Economics includes policy and managerial sciences. Measurement includes land and forest measurements as well as sampling and growth and yield (Flick et al., 1995). Integration does occur in their curriculum, but between courses, to make up the traditional whole of forestry. Their definition of economics would include the traditional forestry courses of forestry economics, forest management, forest valuation, forest policy, forest management plans and planning, forest operations and procurement and business. While the key question is how to integrate within and across the three disciplines, we will focus our discussion on how best to integrate solely within the economics discipline, while recognizing that the other two disciplines have the same integration problems (Kobziar et al., 2009; Temesgen et al., 2011).

Integrating the Economics Discipline into the Forestry/Natural Resources Curriculum

Integration within or across disciplines can be viewed in terms of both breadth and depth (Ginger et al., 1999). There is a perceived tradeoff between producing graduates with skill sets needed to perform professional work (depth) and those with broad foundations able to solve complex social and technical problems (breadth), but this does not have to be the case (Hoch and Dougher, 2011; Hosner, 1993; Perry et al., 1994). Integration can help develop both breadth and depth across “cross-discipline and cross-value natural resource management” (Jensen et al., 1998; Torres and Cano, 1995). Our discussion on integrating the economics discipline into forestry and natural resources management courses will focus on both depth and breadth in recognizing that single disciplines are now expected to have some level of integration within and across other disciplines. Forest valuation is no longer totally concerned with wood value and forest management; it is now impacted by social and political pressures that did not exist a few decades ago (Fisher, 1996).

The management/economics discipline in forest and natural resource management programs usually consists of introductory economics courses (either an economics concepts course, principles of microeconomics, principles of macroeconomics, or an applied economics foundation course). Using the Clemson University Catalog as representative of a land-grant university, these courses would be ECON 200 – Economics Concepts, a general course that introduces both microeconomics and macroeconomics, not intended for economics majors; ECON 211 – Principles of Microeconomics, a foundation course for economics majors; ECON 212 - Principles of Macroeconomics, a foundation course for economics majors; and AP EC 202 – Agricultural Economics, an applied microeconomics course similar to ECON 201, but with agricultural applications (Clemson University, 2012). Two other general natural resource economics

courses are offered at Clemson University: AP EC 257 – Natural Resources, Environment and Economics and AP EC 357 – Natural Resources Economics. These two courses could relate to any environmental, natural resources, or forestry curriculum. In addition, there are many applied economics courses that relate to specific agricultural situations.

Many of the majors in Clemson University’s School of Agricultural, Forest and Environmental Sciences use these foundation courses in the economics/business components of their curricula. Agricultural Mechanization and Business requires ECON 211 or APEC 202; Environmental and Natural Resources requires AP EC 257 or ECON 211; Forest Resource Management requires AP EC 257 or ECON 200 or ECON 211 or ECON 212; Soils and Sustainable Crop Systems requires either AP EC 202 or ECON 211; and Wildlife and Fisheries Biology requires AP EC 257.

This would be typical for a land-grant university: many of the curricula have business or economic components and most of them require either principles of microeconomics/macroeconomics or applied principles of microeconomics/macroeconomics course as the foundation for additional economics work. That applied microeconomics course is usually applied agricultural economics for the general agricultural fields and usually applied natural resources economics for the natural resources fields. An upper level general natural resources course is also common for the natural resources fields.

The Sequential Model

Though some variation is bound to exist within the forestry programs of each university, those that share a more sequential commonality tend to have a similar trend in class progression. In order for a school’s curriculum to be grouped in the sequential category, a clear succession of courses must be present.

The general flow of courses begins with a fundamental economics course which is usually taken in the sophomore year. The economics requirement is typically microeconomics, macroeconomics, or an introductory applied economics course. Other combinations exist within different curricula. Most universities only require that one foundational economics course be taken, but other programs require a more intensive study of economics with two courses. Juniors will then take a forest economics course which applies economic principles to forestry related dealings such as investment theory, resource supply, economics of conservation and taxation principles. The function and structure of forest product markets are also examined. The purpose of forest economics is to narrow the broad field of microeconomics into material that is more related to forest activities. The typical sequential program will then require seniors to take a forest management course as well as a natural resource/forest policy class. As stated before, each university presents different sequences of courses, but for the most part they each

Resistance to Integrating

follow a similar trend. Refer to Figure 1 for a diagram of a typical management/economics series of classes for the sequential model.

Classifying the Curricula of Society of American Foresters (SAF) Accredited Programs

After examining the curricula of the 46 SAF accredited universities, five different sequence models were constructed; sequential, quasi sequential, combination, quasi integrated and fully integrated. Because there was no existing formula for deciphering which curriculum series belonged to each model, personal judgment had to be used to decide what category each fit into. Because the same person investigated and placed each of the schools into the different models, there was no bias and results remained consistent. Examples of a sequential and fully integrated model are presented in Figures 1 and 2, but there are many programs that did not necessarily fit into either category. The curriculum pattern that falls within the quasi sequential model most often follows the sequential pattern closely, but may contain a class which combines two subjects such as forest economics and valuation. For a curriculum to be classified as quasi integrated, it typically exhibits a pattern that does not have the natural flow of succession such as a sequential approach or may contain some sort of capstone class which integrates multiple disciplines. It was necessary to create a combination model for those programs that did not fit the criteria of either sequential or integrated platforms. While it is easier to classify programs which fall into one extreme or the other, the

grey area in between is often harder to categorize. Refer to Figure 3 for an illustration of how many schools fell into each of the five categories.

Figure 2 illustrates the structure of a fully integrated forestry curriculum. Just as with the sequential model, the students gain a basic understanding of economic principles by taking an introductory microeconomics course in their second year of study. During the spring term of their junior year, the students experience the integrated approach to learning forest management. The management sequence draws from prerequisites such as ecology and silviculture and also has corequisites that must be taken in concurrence with other integrated classes. In addition to the 13 units of integrated forest management, the students have the option to take an additional 3 units of liberal studies, diversity elective, or a certificate course.

Of all the SAF accredited universities, most require some form of basic economics class. The majority of forestry programs allow the students to choose which economics course they wish to take. Nineteen schools (41%) had the option to take microeconomics/macroeconomics/ or a basic agricultural economics course that is micro/macro based. Though microeconomic principles and theories are more relevant to the field of forestry, there must be an underlying reason why different universities allow other economics courses to be taken. One explanation for the variance might be that incoming transfer students may have already taken an outside economics course and the flexible requirements allow their coursework to be accepted. Thirty percent of the schools do require that students take microeconomics.

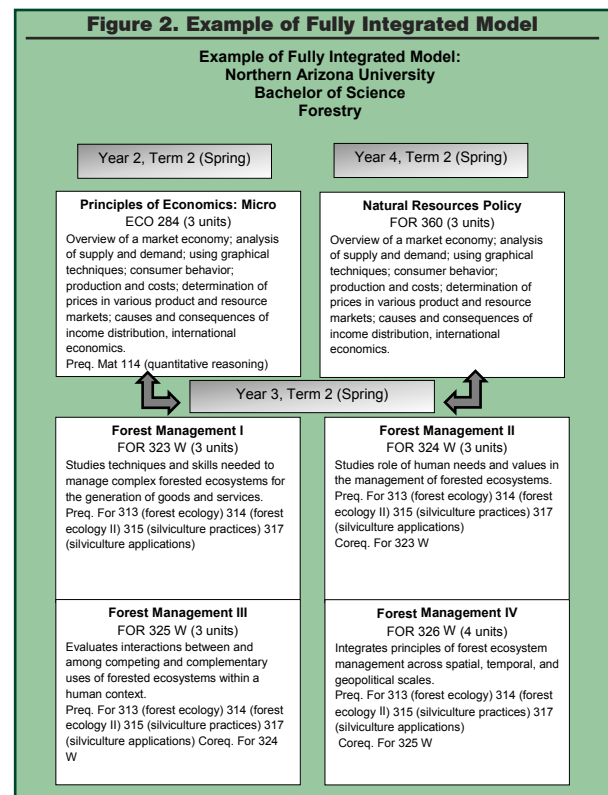
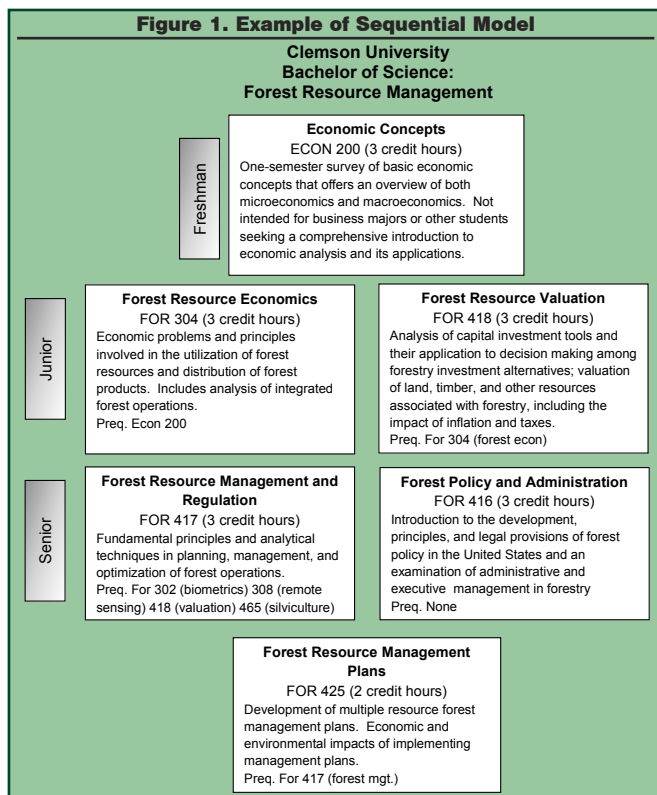
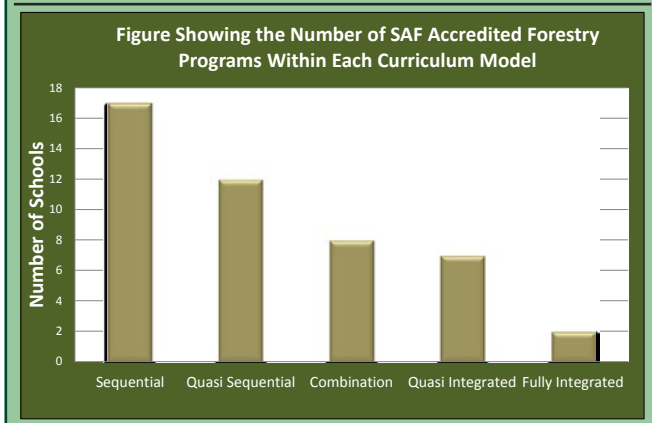


Figure 3. Graph Representing the Number of Schools Whose Curriculum Fall Into Each of the Five Models



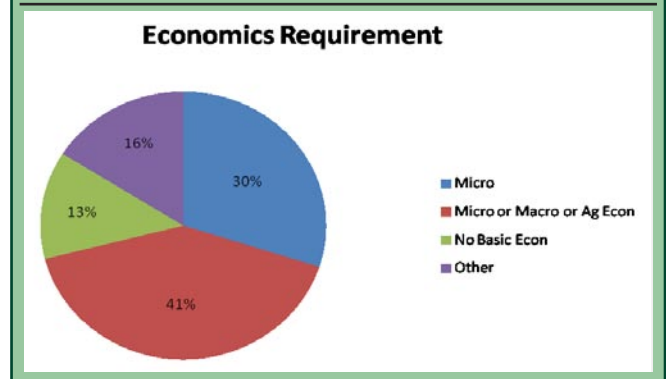
At 13%, there were a surprising number of programs that did not require any basic economics classes. Of the eight remaining programs, different combinations of requirements existed; two schools required their students to take macroeconomics, three required both microeconomics and macroeconomics and three schools required a basic agricultural economics course. This is shown in Figure 4.

Conclusion

The changing perception of the forestry profession demands that a broader view be taken rather than just the input and output of forest products (Gering et al., 2012). While the foundational scientific courses of forestry practices such as dendrology, ecology and silviculture will always be fundamental in any forestry program, so too will social sciences such as economics and policy. The fact that the overwhelming majority of SAF accredited forestry programs require some form of foundational economics course proves this notion. Another avenue that universities take to present the “big picture” to students is by requiring a forest policy class. Coursework in this field provides a background from both a current and historical standpoint on how many resource related policies came to be. Finally, there must be an adequate managerial approach to any natural resource program. Many universities are able to adopt subject matter from a broad range of topics such as planning and optimization of forest operations into their management class in order to bring multiple subject matters together. The management class will also often include financial matters that are pertinent for the professional forester to use in the decision making process.

The integrated approach to curriculum has gained popularity in recent times. Though it has been illustrated that the majority of universities are tending towards a sequential approach, the integrated curriculum is here to stay and many programs have adopted a partially integrated platform in some of their coursework. The capstone course that many universities offer is a prime

Figure 4. Graph Illustrating the Economics Requirement of the 46 SAF Accredited Programs



example of bringing together multiple disciplines into one class to bridge the gap between subject matter.

The slow adoption of the integration may be due to internal issues within the particular university. When each course is individualized within the sequential model, the professor teaching each is typically specialized in that particular field. In order to integrate various material into one class, the course must be team taught or be led by an instructor with a vast and varied knowledge in an array of different fields.

Another challenge to converting to an integrated curriculum is the slow adoption of faculty members to a new way of presenting information. The classic sequential approach is a condensed, “cut and dry” process of teaching. Often, professors will not have to stray too far out of the breadth of each course’s particular subject. If an integrated model were to be adopted, the entire structure of each course would have to be altered. If the course is to be team taught, a deal of synergy would have to exist amongst the faculty. Varied opinions on how to present topics, what content is important and countless other issues could become a point of friction between instructors.

The sequential approach is the time-tested, most popular way of presenting different subjects. Each course can be taught by someone who has a particular specialty in that area without having to be versed on many different subject matters. This is an advantage to the students because they can learn from someone who is an expert on that focus. The students learn about one particular topic and then move on to the next in the series laid out before them based on what courses constitute as prerequisites for the next course. Though each different class within a forestry curriculum stresses different topics, there is often an overlap of material in certain courses. Often, content within courses such as forest economics, management and valuation can be markedly similar, if not the same. Because the different instructors have similar programs to teach and stress what they deem important, the student may see a redundancy in content. While it is not necessarily bad to be refreshed on past topics, taking a more integrated approach may be more conducive to the student’s learning.

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