

**NATURAL RESOURCES DISTANCE LEARNING PROGRAMS  
IN THE UNITED STATES AND CHINA**

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## **Abstract**

This paper reviews the status of natural resources distance learning program in the United States and China and discusses the feasibility of educational cooperation between the two countries. By identifying and comparing computer-based learning programs offered at 300 American and 7 Chinese institutions of higher education, I found that only a small number of schools in both countries currently provide natural resources courses via distance learning. Although great opportunities exist for cooperation between the two countries, challenges must be overcome. Some of these challenges include expanding the existing distance learning curriculum to offer more natural resources courses, providing greater flexibility for faculty members who must adjust to a new teaching role, and improving the English proficiency of Chinese students for more effective international distance learning.

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## **Introduction**

Rapid growth of computer technology throughout the world and ongoing evolution of the World Wide Web, a powerful global communication vehicle, have helped to facilitate the expansion of web-based distance education in this decade (Dirr 1999). Distance learning is an emerging concept that utilizes both the new features of higher education and recent advancements in computer technology. It helps to extend education far beyond the rigid walls of traditional classrooms by providing a greater flexibility for learning through online access to educational materials in a manner that is convenient for students who, because of family or work commitments or distance from a university, cannot attend classroom-based courses at a fixed time. Distance learning does not necessarily entail a long distance separating the student from the location where the educational materials are distributed. In fact, the student could be next door to the distribution center. Distance learning empowers all learners to easily satisfy their diverse needs at their convenience. Therefore, more academic subjects have increasingly been added to the educational programs that are supported by information technology.

### **About Web-based distance learning**

Distance learning has two basic delivery methods: synchronous and asynchronous. Synchronous delivery requires satellite transmission for one-way video and audio, or two-way or multiple-site video and audio conferencing. Asynchronous delivery uses pre-recorded course materials (on a variety of media, including compact disc, video and audiotape or web materials) for students who are in remote places or are

physically unable to attend the classes. Web-based distribution can be synchronous, asynchronous, or both.

This paper focuses on the web-based delivery method that can reach a large number of students, whether or not they can get to classrooms or video conferencing centers. The web-based approach to distance learning delivery in university and college educational systems provides individual courses to students both in classrooms and in remote places. They can even take the courses at their homes. Currently, three types of web-based distance learning are used in university and college educational systems:

*Web-supported* courses provide students with access to limited online materials and resources beyond traditional classroom teaching. This type of online course is likely to be a minor component for distance learning. It is structured to supplement lectures, workshops, tutorials and other learning sessions. Some functions, such as e-mails and announcements, are designed to support students enrolled in distance learning courses who cannot physically attend a class.

*Web-enhanced* courses incorporate the use of web-based instructional software programs that link online and in-class learning activities in an effort to enhance student learning, and to meet individual learning and learning support needs. Students are expected to access online materials and resources. This access is likely to make a major contribution in enhancing distance learning, for example, assignments and reading materials.

*Web-based* courses are provided completely online. This type of course requires students to access the accompanying online materials and resources. Access is essential,

as online participation is the only way to complete distance learning in this instance.

Web-based courses are delivered through the World Wide Web (www) via Internet.

## Background

Numerous colleges and universities throughout the world are developing various types of distance education programs. Some examples are listed in Table 1 below.

Country	University	Website
United State	Stanford University	<a href="http://www.stanford.edu">www.stanford.edu</a>
	University of Phoenix	<a href="http://onl.uophx.edu/degrees/default.aspx">http://onl.uophx.edu/degrees/default.aspx</a>
England	Oxford University	<a href="http://www.online.ox.ac.uk/">www.online.ox.ac.uk/</a>
	Open University	<a href="http://www.open.ac.uk">http://www.open.ac.uk</a>
Canada	University of Victoria	<a href="http://www.uvcs.uvic.ca/distance.cfm">www.uvcs.uvic.ca/distance.cfm</a>
	University of Guelph	<a href="http://www.open.uoguelph.ca/online/">www.open.uoguelph.ca/online/</a>
Australia	University of Canberra	<a href="http://www.ce.canberra.edu.au/flexmasters/tm.htm">www.ce.canberra.edu.au/flexmasters/tm.htm</a>
	University of New England	<a href="http://online.une.edu.au/info/public/shes.html">http://online.une.edu.au/info/public/shes.html</a>
Japan	Waseda University	<a href="http://www.waseda.jp/top/index-e.html">www.waseda.jp/top/index-e.html</a>
China	Tshinghua University	<a href="http://www.tsinghua.edu">www.tsinghua.edu</a>
	Zhejiang University	<a href="http://www.zju.edu.cn/english/site/zdweb.htm">http://www.zju.edu.cn/english/site/zdweb.htm</a>

Table 1. Examples of universities offering distance learning programs

Distance learning in the United States and China, the two most influential countries in the world from the perspectives of economic strength and the urgent need for natural resources conservation, are the principal focus of this paper. With its fast economic development and rapid population growth, China faces both opportunities and challenges in natural resources conservation. A partnership with China is good for the United States in assuming overall world leadership (Chow 2004). Furthermore, China's management of its natural resources has great impacts and important implications not only for China but for the whole world. For example, the 2002 dust storm from western

China (Brown 2003a, Chao 2004) left the people in Korea literally gasping for breath. Schools were closed in Seoul, and airline flights were cancelled.

The present study reviews the application of distance learning in support of natural resources education and explores the feasibility of cooperation between the United States and China. This paper is intended to be only a preliminary discussion of the topic of natural resources distance learning. It does not necessarily suggest that natural resources distance learning will ultimately replace the traditional natural resources education. Distance learning is a fast growing educational method for various disciplines in many countries. It can also extend traditional education internationally.

### **Objectives**

By comparing the computer-based online learning programs at 300 colleges and universities in the United States and 7 higher education institutions in China, this paper discusses potential cooperation between the two countries to promote natural resources education via international distance learning. The paper also explores the potential of the newly established Natural Resources Distance Learning Consortium to expand the frontier of natural resources distance learning programs into the international arena, with the primary focus on China.

## Method

According to the National Center for Education Statistics (NCES 2002), there are 4,197 two-year and four-year education institutions in the United States. About 56% of these institutions have distance learning programs (Tabs 2003). In an attempt to evaluate the feasibility for the colleges and universities in the United States to provide natural resources distance learning programs to students in China, or the opportunity for Chinese students to take natural resources courses offered in either country, a sample of institutions in United States was taken from the China Education and Research Network (CERNET Website a), which lists 1,544 U.S. institutions with hyperlinks to their websites. The survey was also undertaken to determine the number and type of courses offered online and the amount of tuition charged by various colleges and universities for distance learning courses in both the United States and China.

To select the random sample, the aforementioned 1,544 institutions were listed in alphabetical order and numbered accordingly. Random numbers were generated on the Internet (Random.org) to select institutions for this investigation. Following the order of the random numbers, 300 colleges and universities, approximately a 20 percent sample, were chosen from the numbered list. To determine if the sample size was adequate, the samples were divided into 10 groups with 30 institutions in each group, and the cumulative frequencies of occurrence of natural resources distance learning programs were examined graphically. After reviewing the data for about 120 institutions in the sample of 300, a pattern of data consistency was observed, as shown in Figure 1. The frequency of natural resources distance learning courses provided by institutions ranges from 3.3% to 5.6%. The mean was about 4.5%, with a standard deviation of 0.01 (Appendix 1). These results confirmed that the sample data were adequate for making

some general inferences. The sample size of 300 was therefore deemed to be adequate to make inferences about distance learning programs in the United States.

The first step in the study was to determine the percentage of colleges and universities providing accredited distance learning courses in the sample (DL in Univ).

The second step was to determine, within the sample set, the number of colleges and universities providing natural resources courses in distance learning (NRDL in Univ).

Figure 1 shows the cumulative frequencies for distance learning programs for these institutional groupings. Two percentages were calculated:

$$\text{DL in Univ (\%)} = \text{Number of DL} / \text{Sample universities}$$

$$\text{NRDL in Univ (\%)} = \text{Number of NRDL} / \text{Sample universities.}$$

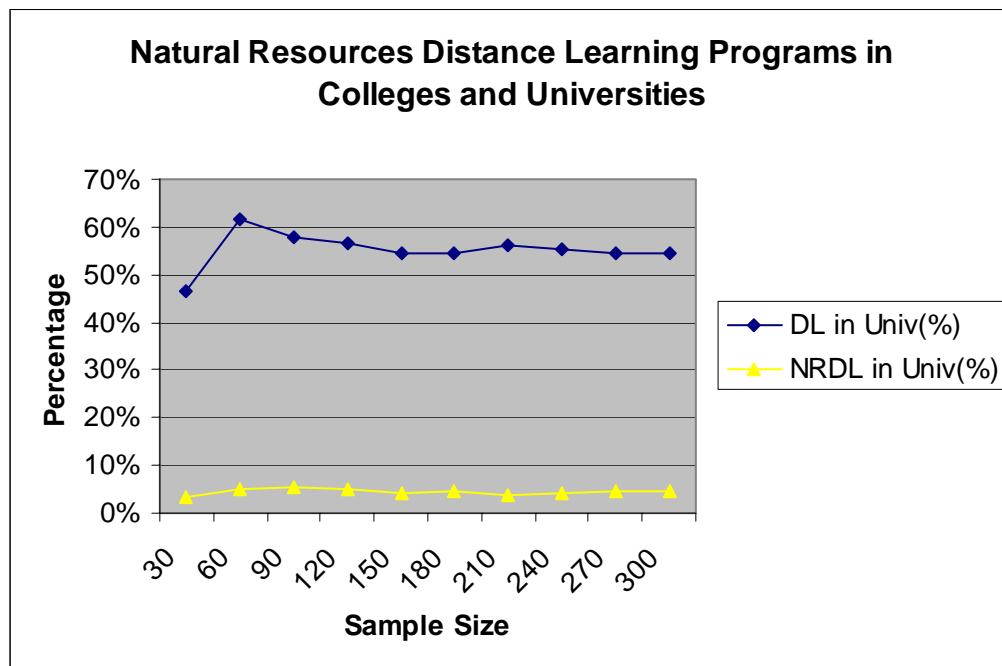


Figure 1 Natural Resources Distance Learning Programs in Sampled Colleges and Universities

Criteria for defining natural resources courses were developed with input from faculty members at the University of Idaho, Northern Arizona University, and Virginia

Tech, all members of the Natural Resources Distance Learning Consortium. A composite list of key words was used in the Internet search, such as forest, natural resources, range, wildlife, environmental science, fisheries, recreation/tourism, soils, conservation biology, ecotourism, watershed, water resources, wildland fire science, meteorology, statistics-natural resources, environmental education, GIS, conservation studies, and human dimensions of natural resources.

Among the 300 sampled colleges and universities, 13 (4.5%) offer natural resources distance learning programs that include a total of 78 courses. If this finding is extrapolated to the entire sample of 1,544 colleges and universities, an estimate can be made that 67 institutions offer natural resources distance learning programs and provide a total of 401 natural resources courses via distance learning. If the finding is further extrapolated to the 4,197 two-year and four-year higher education institutions in the United States, there might currently be as many as 1,091 natural resources distance learning courses available in this country.

Due to the lack of adequate information regarding China's natural resources education and the difficulty of accessing Chinese universities' websites, I conducted a short fact-finding trip to Beijing and Lanzhou to understand the status of distance learning programs developed in some of the leading institutions in China. This trip started on November 15 and ended on December 5, 2003. The data collected in China were compared with similar data for U.S. institutions offering distance learning in natural resources conservation. Other information was obtained from individuals while visiting in China or accessed Chinese websites (Appendix 2).

## **Natural Resources Distance Learning Programs in United States**

### **Distance learning**

The sample of 300 higher education institutions revealed that 164 colleges and universities (about 55.3%) offer accredited online courses. The 55.3 % of sampled universities and colleges offering distance learning courses is close to the national average obtained by the National Center for Education Statistics (Tabs 2003). The national study found that 56% of two-year and four-year degree-granting institutions offer distance learning courses (Tabs 2003). Online courses provided by the sampled institutions are mostly in business management, computer technology, education, health care, marketing, nursing, and social science. For example, Stanford University ([www.stanford.edu](http://www.stanford.edu)) offers several master degree programs, including a Master of Computer Science, Master of Electrical Engineering, and Master of Mechanical Engineering. The University of Phoenix (<http://degrees.uofphx.info/programs.jsp>), the most popular online university, provides several master and doctoral degree programs, including a Master of Arts in Education, Master of Business Administration, Master of Science in Computer Information Systems, and Doctor of Health Administration. However, none of them provides natural resources courses online.

### **Natural resources distance learning**

As previously discussed in this paper, the number of institutions with natural resources distance learning programs is comparatively low (about 4.5%). This is a lower percentage than business management and administrative service, computer technology and information science, health professions, engineering technology, and liberal arts disciplines (NCES 2002). The reason for having a lower percentage of natural resources

distance learning may be the natural resources management and conservation are not in as high demand as business management, computer technology and other disciplines. The online natural resource courses are found mainly in the following subjects: environmental law and policy, environmental science, environmental ethics, water management, biodiversity and conservation, energy, environmental education, environmental health, natural resource economy, wildlife management, land use and planning, and recreation. There are a total of 78 courses offered by 13 institutions in the sampled colleges and universities (Appendix 3).

### **Tuition**

Tuition for distance learning varies from school to school. Students are charged on a per-credit-hour basis at most of the schools. Tuition ranges from \$127 to \$776 per credit-hour. Out-of-state tuition rates are waived in some institutions (He 2003a).

Additional technical fees may apply as specified by the program. These fees range from \$25 to \$145 per course. Institutions with multiple campuses may have different tuition rates for these campuses because each sponsoring campus has its own course requirements, fee structures, registration procedures, academic calendar, and admission policy.

### **Programs**

The United States Department of Agriculture (USDA) Forest Service started a distance learning program in the 1980s jointly with Colorado State University. The program expanded in 1996 when it was realigned with George Mason University (GMU).

This program continued at GWU until it was terminated in 2002. According to the student records (USDA/GMU 2002), the program provided 11 courses in areas of land management, recreation, and planning subjects. During the seven years since the realignment of the GMU program, more than 700 students enrolled in the Natural Resources Distance Learning Program (Appendix 4).

To meet the continuing education needs of natural resources managers dispersed throughout the United States and elsewhere, the USDA Forest Service in 2003 initiated a Natural Resources Distance Learning Joint Venture Agreement with Virginia Polytechnic Institute and State University (Virginia Tech) (Evans 2003). The primary goal of the program is to provide academic degree and professional development programs and other education opportunities for employees of USDA Forest Service, and other state and federal natural resources management agencies throughout the nation.

Since many managers, administrators, and workers are dispersed among field and office sites around the country, distance learning provides an opportunity to improve their expertise at convenient times and locations. The Natural Resources Distance Learning Consortium, led by Virginia Tech, is developing a national program. Collaborative agreements with several other colleges and universities will provide high quality natural resources courses to meet educational standards and curriculum needs for natural resources education. In the future, the consortium will involve non-governmental organizations and professional societies (Evans 2003).

Currently, Virginia Tech's Natural Resources Distance Learning Consortium has five stakeholders: USDA Forest Service, Virginia Polytechnic Institute and State University, Northern Arizona University, the University of Idaho, and the University of Montana. Each of the four universities has its own unique specialization in its natural

resources distance learning program. For example, Virginia Tech plans to focus mainly in federal land management; the University of Idaho offers courses primarily in restoration ecology such as fire ecology and aquatic ecology; Northern Arizona University focuses on eco-tourism and wild-land recreation courses; the University of Montana will offers courses in wildlife management and geographic information system courses (Evans 2003). This consortium organizational structure enables member universities to share resources in problem solving, and to cover more natural resources courses than any single university may be able to offer.

Course specialization depends on a member university's commitment to scientific and technological requirements of natural resources education, as well as on the practical situation of its discipline and the interest of its teaching staff. To develop adequate curricula for its member universities, the Consortium decided to perform a "gap analysis" by reviewing the natural resources courses currently offered within the consortium in order to identify course and tuition gaps. This "gap analysis" is intended to provide guidance for developing a comprehensive natural resources program. Tuition differences between member universities are large within the Consortium because of academic policies in the various states. Tuition ranges from \$219 per credit hour at Northern Arizona University to \$575 at the University of Montana. Usually, the tuition charge depends on school policy and cannot be changed by one department within any member university. The consortium might be able to simplify the tuition issue by establishing a "base campus rule" to maintain the differences between universities. This policy provides that a student may register for any online course in any of the member universities with the condition that the student must register in the base campus from which he or she will graduate. The tuition for each course that the student takes will depend on the tuition rate

of the university in which the course is taken. Under the “base campus rule”, each member university will build its own specialty structure but will coordinate its efforts with other member universities. The shared resources and information in the consortium will expand the scope of natural resources distance learning in terms of discipline, teaching, research, administration, and enrollment of programs. This structure will help the Consortium develop interdisciplinary curricula and effective continuing educational programs. The detailed information and courses offered by member universities in the Consortium can be found in Appendix 5.

Many other universities also offer natural resources distance learning programs. For example, the Oregon State University grants online bachelor degrees in Environmental Sciences and Natural Resources, while Colorado State University, Texas A & M University, the University of Wisconsin, Stephen F. Austin State University, and North Carolina State University also provide a variety of natural resources related programs through distance learning (He 2003a). These institutions could become potential partners with Virginia Tech’s Natural Resources Distance Learning Consortium in order to provide additional concentrations that may be cost-prohibitive for one single university to offer.

## **Distance Learning in China**

For a better understanding of distance learning in China, I conducted a short fact-finding trip to Beijing and Lanzhou in Gansu Province: six universities and one research institution were visited (He 2003b). I also visited the Chinese Ministry of Education in Beijing. These universities were targeted as primary contacts because they are the leading universities with distance learning in China. They started distance learning programs between 1999 and 2001, but they are still at a developmental stage of distance learning practices (Li 2003a). Most universities and colleges in China use web-based distance learning methods for in-class and off-campus learning (Li 2003a). Institutions in the Chinese Academy of Science system mostly use satellite one-way or two-way video/audio distance learning methods to convey courses to students (Huang 2003).

### **Government Policy on Support for Distance Learning**

China is beginning to place a greater emphasis on distance learning. The Chinese government and the universities in China believe that distance learning will enable interactive teaching and learning at any time and place in a network environment, provide easy and efficient access to education resources, and improve the quality of education (Li 2003b). Developing distance learning programs may provide more people with diversified educational opportunities, allocate educational resources more efficiently, and accommodate the real demands of socioeconomic and cultural developments in China.

In 1998, the Ministry of Education officially authorized Tsinghua University, Zhejiang University, Beijing University of Post and Telecommunications, and Hunan University to pioneer distance learning in China. Distance learning has grown rapidly

since then. In 1999, the Ministry promulgated the “Comments on Developing Advanced Distance Learning in China”, which provides guidelines for the “Overall planning, demand driving, expanding deregulation and improve quality” for distance learning development (CERNET Website b). According to Ping Li (2003b), an official of China’s Ministry of Education, China has listed distance learning as an important goal of its education development blueprint for the 10<sup>th</sup> Five-Year Plan (2001-2005). China has 1,062 colleges and universities (Li 2003a), and most are located in big cities and urban areas. In an attempt to extend higher education to rural areas, the Chinese Government has urged colleges and universities to develop distance learning programs in order to provide continuing education opportunities to more people by using new technologies. The poor and inhospitable conditions and teacher shortages in China’s central and western regions are critical factors that would make distance learning a highly desirable means of bringing education to those who wish to learn. Furthermore, since these regions face natural resource and environmental challenges such as deforestation, erosion, water shortage, pollution, and desertification, natural resources conservation education would be most important to these areas. However, the Chinese Government has yet to formulate a formal policy supporting natural resources education for the rural area.

### **Factors affecting Chinese students studying abroad**

China has a long history of sending students abroad for education (Dai 2003). In spite of the growing national pride in some local educational institutions, many people still consider education in the West to be better than that available in Chinese colleges or universities. Since the rapid economic growth of the 1980s, the Chinese government has been sending more students abroad both for short-term training or long-term education at

all levels in order to accommodate the nation's educational needs. Individuals are now better equipped to pass the Test of English as a Foreign Language (TOEFL), an international standard required English proficiency test for admission into a university in an English-speaking country (ETS Website), and people are also in a better financial situation to study abroad. According to a news article from the Chinese Embassy's website, an official of the Chinese Ministry of Education said that there have been more than 700,000 Chinese students studying abroad since 1978 (Chinese Embassy Website). These students attended universities in developed countries such as the United States, Canada, England, Australia, Japan and Singapore (JSJ Website). Since there are still many Chinese students who for various reasons are unable to study abroad, an international distance learning program could be an alternative for satisfying the growing demands of these students for western education. Some students perceived that a joint academic degree or special certificate from an American university and a Chinese university will give them sufficient prestige to find a better-paid job in China. For example, the University of Wisconsin and the Graduate School of the Chinese Academy of Science jointly provide an international EMBA program in technology innovation for governmental, institutional, and corporation decision-makers (GSCAS Website).

### **Distance Learning Systems**

Different educational systems use different types of distance learning delivery methods (Li 2003a). The first distance learning system started in China in 1978. The China Central Radio and TV University began to use radio and television to deliver pre-recorded courses. The Radio and TV University is growing rapidly today with a huge and powerful network system, which integrates TV, Internet, and satellite systems together

with a multi-center system to distribute courses and lectures. It has 44 centers in all provinces, and most of these learning centers are located within universities. According to its website, China Central Radio and TV University have a total of 36 disciplines with 1.46 million enrollments by the end of 2003 (CRTVU Website). Since 1978, the TV University has graduated 160,000 students from its part-time programs, most in career-oriented programs such as accounting and computer sciences. The University has cooperative programs with the United States, England, and 12 other countries in the world. The rapid growth of the TV University shows that there are great needs for distance learning programs in China today. However, these programs offer only a few natural resources courses.

The second distance learning system was developed to serve all institutions under the Ministry of Education's guidance and administration. This distance learning system is now evolving from a traditional education model to web-enhanced and web-based distance education. Web-based distance learning is used for on-campus teaching and for continuing education and vocational training.

The third distance learning system is sponsored by the Chinese Academy of Science. The Graduate School of Chinese Academy of Science has over 100 distance learning centers in all institutions within the Chinese Academy of Science system. These learning centers are not affiliated with the Ministry of Education system, but are administered by the Chinese Academy of Science. The distance learning system has a main distribution center, which is located on the main campus of China Science and Technology University in Anhui Province, with the Shanghai Education Center being a sub-center. Furthermore, there is a two-way satellite distribution center at in Changchun, along with 42 satellite receiving centers covering 66 institutions (Huang 2003). Most of

their courses are delivered through a satellite. The Internet is also used as a teaching and learning support tool for both instructors and students. Students in the Graduate School are affiliated with institutions in the Chinese Academy of Science system, which provides financial support (GSCAS Website).

## **Programs**

In developing the distance learning programs, most of the universities in China are taking into consideration the realities of the job market and the future employment potential for their students (Li 2003a). The current distance education programs offer courses in such popular fields as finance, management, marketing, law, business, computer technology, and language art. However, natural resources related courses are not widely offered by the universities that I visited in China (He 2003b). China appears to be offering similar distance learning courses as the United States.

Based on my search of websites in China, natural resources disciplines are mostly offered in forestry universities. There are four forestry universities in China, i.e., Northeast Forestry University, Beijing Forest University, Southwest Forest University and Central Forest University, which are located respectively in the northern, northeast, southwest and central regions of China. By using web searches, I was able to find natural resources courses via distance learning for Northeast Forest University and Beijing Forest University. However, the websites for Southwest Forest University and Central Forest University could not be easily accessed from the United States.

## **Tuition**

In China, traditional education system is totally funded by the Chinese Government. Students, once accepted by a college or university, do not pay tuition. Colleges and universities are administered, funded, and regulated by the affiliated agency, for example, the Ministry of Education, the Chinese Academy of Science, or local governments.

On the other hand, distance learning programs which are more oriented toward adult or continuing education are funded partially by the government, with the students paying tuition. Since the 1990s, the Ministry of Education has allowed universities to accept more students with lower comprehensive test scores by collecting full tuition from them. Most distance learning students have been accepted for continuing education with lower comprehensive test scores. Tuition at visited universities for distance learning ranges from 100 Yuan (\$12.5) to 200 Yuan (\$25) per credit hour (Li 2003, Huang 2003, Gu 2003).

## **Trends and Issues**

Distance education in China is growing rapidly. According to Li Ping (2003b), out of a total of 1,062 colleges and universities, only 11 institutions were approved as distance learning experimental universities in 1999. By the end of 2002, 67 universities qualified for providing distance education experimental programs. These schools serve a total of 1.35 million students enrolled in 140 disciplines including computer science and technology, law, business administration, English, accounting, and finance. Along with the development of distance education information systems, all universities with

experimental distance education programs have installed high-speed network cables and developed a framework for online teaching. This framework includes a digital library, digital museum, online course development, online registration, and online student service programs. Shanghai Transportation University, XiAn Transportation University and Zhejiang University have also established a distance education consortium which allows member universities to share courses, student credits, and other resources (Li 2003b).

Major issues identified for distance learning in China include the lack of financial resources, faculty resistance, and questionable quality of the courses offered (Li 2003b). Some universities with experimental distance learning programs have lowered their enrollment requirements and standards to satisfy students' needs. In an attempt to overcome these challenges and to improve the quality of distance learning, the Ministry of Education has issued a series of regulations and standards, such as "Modern Distance Learning Extended Learning Center Regulation," "Modern Distance Learning Extended Learning Center Management Methods," and "Modern Distance Learning Extended Learning Center Management Roles" (Li 2003b:43).

## **Discussion**

### **Importance of Natural Resource Education**

Natural resources education is essential for conservation and management of natural resources to achieve a sustainable society in the future (Bowers 1997). Today, the world is facing natural resources challenges along with issues of global population growth, global warming, climate change, land degradation, deforestation, habitat deterioration, air and water pollution, and desertification (Brown 2003b). These indicators are evidence that the human race is having tremendous impacts in causing global environmental changes by an over-consumption of natural resources (Goudie 2000). Global environmental changes are occurring at an accelerating pace (Cain et al. 2002). Numerous authorities (Bowers 1997, Brown 2001, Raven and Berg 2004) stated that education is the key to increasing awareness of environmental problems, to change attitudes toward the environment, and to help overcome ecological challenges that humans are facing. Orr (1992:90) stated, “All education is environmental education.”

Universities and colleges are responsible for educating future natural resource managers and scientists, as well as keeping natural resources professional current in their knowledge and management skills (RNRF 2004a). For example, by taking courses like conservation ecology, urban forestry, ecosystem management, and Global Issues at the Virginia Tech National Capital Region, students understand how ecosystems work, what services ecosystems can provide to us, and the importance of using natural resources in a sustainable manner. Therefore, natural resources education becomes a solution to the growing ecological crisis and leads toward ecological sustainability.

In China, natural resources education is even more critical for its natural resource management. After 20 years of industrialization, China is now facing huge energy demands (Klare 2002). The Chinese Government has already begun the construction of the world's largest dam on the Yangzhi River in order to generate more electricity to satisfy the energy needs in the southeast part of China, an area of rapid economic growth. Also, the accelerating expansion of the automobile industry will make China the second largest oil consumer in the world, right behind the United States (Flavin 2004). These significant developments will not only raise the level of oil consumption, but also reduce the amount of agricultural land by expanding the network of roads and highways, which is usually followed by the construction of new business and residential buildings. Eventually, new towns will appear as more people and industry move into the area. As a result, these developments will add more pressure to the country's environment, increase air and water pollution, and create such environmental crises as land degradation, water shortage and deforestation. With rapid population growth and limited forest resources, China will have to rely on wood importation to support its development. As Steven Johnson, a statistician of the International Tropical Timber Organization, predicted, China will surpass the United States, Japan, and the European Union as the world biggest importer of logs (Pomfret 2001). To avert potential problems, the concepts of natural resources conservation and sustainable development must be recognized and given high priority by all levels of government, as well as educators, teachers, administrators, natural resources managers, activists, company leaders and individuals.

## **Challenges to natural resources higher education**

To prepare an adequate natural resources workforce in science, engineering and management for a sustainable society in the future, higher education must use evolving technology, provide life-long learning opportunities, recognize changing student needs, cope with declining budgets and decreasing financial support from state governments, understand changing faculty roles, and meet the increasing demands for training more natural resources managers (RNRF 2001). These challenges are discussed below.

### *Challenges for international distance learning*

The advances in telecommunications technology have opened the possibility of interstate or international interaction in distance learning. The pressure is increasing for educational institutions to compete by offering more international online courses (Robertshaw 1999). Providing distance learning courses to international students would be a very attractive source for generating additional revenues from tuition and fees for those institutions facing funding challenges.

For any institution that wishes to extend its web-based education system internationally, there are relatively few insurmountable obstacles from a technical standpoint. However, some non-technical obstacles need to be overcome, such as language and cultural barriers, national pride, and market competition. Although English is now a required course in most Chinese elementary and secondary schools and universities (CERNET Website b), many students, especially those who are part-time or older, still have a problem in learning the language. This obstacle will need to be overcome. However, with English practically becoming the unofficial universal language, one can expect that the language barrier may eventually vanish as more international

students are able to learn English. In China, the English proficiency for college students has improved to the point where some universities begin to use American textbooks and English as the language for instruction for certain courses (Dai, 2003). With respect to national pride and cultural barriers, it will be important that the educational institutions that wish to extend distance learning internationally become more sensitive to these issues. These institutions should be perceived by the country receiving the online education program as their equal partners who are willing to share information with them. These are the challenges that must be faced by educational institutions wishing to extend distance learning internationally.

#### *Student profile changes*

The average ages of the student population in graduate programs in the United States have increased from 18-24 to about 24-49, with some students over 50 years old (Dirr 1999). This means that the student profile has changed from in-school study to more professional education in working environments. Students in ages 24-49 are usually employed and have family obligations and other competing demands in their lives. Unlike students who attend traditional educational institutions, they need a more flexible learning environment. Although older students are usually more established at work, some may wish to advance in their own field or may even contemplate a career change. Therefore, while some students may need more creative and interdisciplinary courses to meet the new requirements in natural resources conservation fields in order to find a better job, others may simply wish to enroll in basic courses so that they can start a new career. According to the assessment of “Federal Natural Resources Agencies Confront an Aging Workforce and Challenges to Their Future Roles” conducted by Renewable

Natural Resources Foundation (RNRF), “curricula and teaching methods must change to reflect these new needs” (RNRF 2004a:21).

### *Need for a flexible program*

Flexibility is another challenge for traditional education. Gropp (2004:16), in an article entitled “Developing the Federal Natural Resource Workforce”, said that “Master’s degree programs tend to include coursework and research experience designed to prepare students for doctoral training. The impression students get from these programs is that to get a good job, one must have a doctorate.” This new graduate-training model may discourage some students from pursuing careers in natural resources fields. Natural resources educational institutions need to provide more flexible programs, which would focus on a combination of short courses, professional training certificate, and multidisciplinary graduate programs in addition to traditional degree programs.

### *Declining budgets*

Although tuition and fees for public colleges and universities are generally much lower than those charged by private schools, the lack of state and local government funding support has become a great challenge to most public colleges and universities in the United States. According to the National Education Association (NEA 2003), the mean tuition charged by public schools was \$4,836 in the 2000-2001 school-year, as compared to \$16,065 for private institutions. State and local government appropriations cover the majority of the costs at public institutions with a smaller share of revenue coming from students in the form of tuition. In recent years, however, the political emphasis on lower taxes has led to a decrease in state support for higher education. A survey showed that state and local government contributions to colleges and universities in the United States decreased during 2002 (NEA 2003). Declining financial support has

significant impacts on many colleges and universities in operating budgets, constructing new facilities, upgrading obsolete computer and communication systems, and improving the quality of teaching (NEA 2003). That explains why most universities and colleges have rushed to develop such popular online programs as business, law, finance, computer science and technology, nursing, and public health to satisfy the emerging needs of the students and gain revenues from tuition (NEA 2003).

*Demand for natural resources managers for federal workforce*

Natural resources management agencies will be facing a workforce crisis in the near future. The Government Accountability Office found that over 40 % of the employees in the various federal science and natural resources agencies are over 50 years old, with only 6% being under 30 years old (RNRF 2004b, Gropp 2004). In fact, pending retirements of an aging federal workforce will soon create a critical need for new natural resources and environmental professionals. Recently, Mike Leavitt, Administrator of the U.S. Environmental Protection Agency (EPA), said that 35% of EPA's staff would become eligible to retire in four years (Shogren et al. 2004). These trends challenge educators to come up with new strategies to prepare a new generation of natural resources managers to meet the growing needs for government service (Gropp 2004, RNRF 2004b). As RNRF's report stated, "universities have a new responsibility to ensure an adequate cadre of natural resources professionals with desired skill sets, and to assist in providing support for essential natural resources programs" (RNRF 2004a:20).

## **Benefits natural resources distance learning**

To overcome some challenges that natural resources educational institutions are facing, distance learning may be the best method for delivering some natural resources courses. Distance learning provides natural resource professionals with flexibility for life-long learning and enables teaching institutions to more easily cope with budget and financial issues.

### *Flexibility*

Distance learning is an instructional delivery system that connects learners with educational resources by delivering learning materials to remote (off-campus) sites anywhere in the world, via audio, video (live or pre-recorded), or computer technologies, including both synchronous and asynchronous instructions (Tabs 2003). Distance learning can be used in traditional education systems to enhance instruction by the use of interactive multimedia, personal computers, Web and/or Internet, and learning management systems for delivering instruction and tracking learner results and other key training-related data (Atkinson 1999). It can also be used in informal education systems, for example, extension and outreach programs. Distance learning provides a more flexible learning environment and puts students' needs first. It provides lifelong re-entries in learning modes and goals for upgrading knowledge or retraining professional skills as circumstances change for each student. Distance learning allows intermittent learning with its application in the real workplace, using acquired knowledge and skills by part-time students who may be full-time employed and away from academic institutions (Brescia et al. 2004).

## *Technology*

Technology is the essential component of a successful online program. Distance learning simulates a real classroom setting for those learners who for various reasons cannot physically attend classes at a fixed place and time. A dramatic recent example was provided by National Park Service. Education coordinator Amy Garrett (2003) conducted a distance learning course regarding the study of prescribed burning at Homestead National Monument of America. In this special distance learning course, firefighters and resource managers discussed the prescribed burn situations, and students remotely viewed firefighters using hoses and drip torches during the annual prairie burn at Homestead. Using interactive communication technologies, students were able to ask questions at the same time events were unfolding in the field. Firefighters and resource managers were also able to answer their questions. Through a distance learning cart equipped with computer and camera, it became possible for learners to experience a real fire situation while they were in the safety classrooms (Garrett 2003).

## *Budget consideration*

Centralized learning centers, such as colleges and universities, require expansive buildings and grounds, including classrooms, laboratories, and massive, library holdings at central campuses. Distance learning usually reduces these costs by utilizing already existing physical facilities for distributive purposes to students near and far.

## *Student benefits*

Online courses encourage collaboration, which has been shown to be a major factor in effective learning (IHEP 2000, Muirhead and Juwah 2004, Wills 1995). Although early critics (Galusha 1997) thought that students would become more isolated

by working on computers, subsequent studies showed that teamwork and shared discovery have actually been enhanced (McIsaac and Gunawordena 1996, Moore 2001). From my own experience, distance learning is forgiving and patient, and allows me to progress at my own pace without the feeling of embarrassment as in class. For distance learning, class materials and course instructions are available online from the beginning to the end of the course (Atkinson 1999). Also, online discussions can be extended over a period of days or weeks, thus allowing the student sufficient time to be fully prepared to make considerable contributions. Furthermore, with the use of personal computers becoming more popular, older students will eventually be able to overcome this obstacle and become more computer-literate. In fact, traffic to adult education sites has increased by 60% since 1997 (Fulcrum Analytics 2002).

### *Faculty roles*

As technology becomes a means for future educational delivery, a new role for the faculty is developing. Rather than transmitting information in person, the instructor will play the role of a facilitator who functions as a bridge between the student and the learning source. The instructor must be proficient at both delivery of content and the operation of technology (Beaudoin 1990, DeVires and Talle 1998). Sources noted that distance education moves education and faculty away from a faculty-centered approach to one which is learner-centered. Indeed, distance education emphasizes an adult learning theory where the student is a true partner in the teaching and learning arena, as compared to the traditional classroom that is more likely teacher oriented. Students are more self-directed, thus making distance education more demanding on both the faculty and students. The student-centered model is a hallmark in adult education. As Beaudoin

(1990) pointed out, distance education means the faculty member is no longer the font of knowledge, but rather the facilitator of and mentor for learning.

### **Feasibility of cooperation with China**

Today, experimental distance learning in China is forming its teaching and learning model by using school networks and the Internet to deliver synchronous or asynchronous courses within a university system, satellites to deliver asynchronous one-way or two-way teaching among different universities, or videoconference technology to deliver real-time two-way teaching. The China Education and Research Network (CERNET) Company, a contractor of the Ministry of Education, is cooperating with American Blackboard Information Technology Company (CerBibo) (Aurora Fund Website) in creating a 2003 joint venture company to meet distance learning needs of the Chinese education system throughout China. CERNET is China's first nationwide education and research computer network. The CERNET project is funded by the Chinese Government and directly managed by the Ministry of Education. It is constructed and operated by Tsinghua and other leading universities. CERNET itself was initiated by the Ministry of Education in 1994, and over the last decade it has developed a network linking more than 1,000 universities in China. Currently, it is the second largest Internet network and serves more than 15 million registered users.

Cyber-language is a limitation in distance learning programs (Robertshaw 1999). Although most Internet materials and websites of institutions are using Chinese, the three major Chinese-speaking regions, i.e., Mainland China, Taiwan, and Hong Kong, use slightly different Chinese character sets for Internet activities. Although some disciplines,

such as computer science, are using English as the language of instruction (Dai 2003), most institutions are still teaching in Chinese. In recent years, a few universities are starting to use American textbooks for certain courses and to offer these courses in English (Dai 2003). During my fact-finding trip to China (He 2003b), I found that Chinese students who attend traditional education institutions generally have a relatively better command of the English language than older students who must take courses online. The language barrier could be a potential obstacle for older students who wish to take international online courses. However, with China's rapid opening to the outside world and English becoming a universal language, the language barrier should eventually become a much lesser problem for Chinese students.

Currently, there are several U.S.-based distance learning programs in China. These are the University of Wisconsin's Executive Management program with the Graduate School of the Chinese Academy of Science (GSCAS 2003); Open University's graduate program with China Renmin University (CRU 2003); and a Global Seminar that involved eight countries/regions, including the United States, China, Peru, Mexico, Italy, Philippines, Germany, and Taiwan. Virginia Tech's College of Natural Resources participated in the Global Seminar. This program, which is a real-time videoconference course, offers students around the world an opportunity to examine, discuss, and formulate positions to case studies on sustainability issues concerning population, the environment, natural resources and food systems. The seminar relies heavily on the use of modern information and communication technologies such as the Internet, video, satellite and telephone to provide students the opportunity to interact with their global classmates and professors. During the seminar, there were six synchronous videoconferences, and continuous asynchronous discussions using an online discussion

board and email (IDDL Website). These examples have demonstrated that it is feasible to use a combination of information and communication technologies to distribute international distance learning courses to China.

### **Recommendations for Natural Resources Distance Learning**

To further expand and promote natural resources distance learning both within the United States and internationally, I would like to present the following five recommendations for consideration of those higher education institutions offering natural resources distance learning programs.

#### *To expand natural resources distance education*

Distance learning for mid-career professionals provides opportunities beyond traditional education for employee retraining, so that they can assume a new leadership role (RNRF 2004b). Due to the advancement of science and development of technologies, as well as demands for more qualified professionals for natural resources management, greater emphasis will need to be placed on the training of managers and other technical specialists who will have innovative and creative thinking abilities, broad interdisciplinary knowledge, and exceptional communication skills (RNRF 2001:23). Although the existing traditional undergraduate and graduate degree programs in the United States have the capacity to train more natural resources professionals, adult students who are full-time employed or those with family obligations may find it difficult to attend classes as typical college students. For these students, the flexibility of natural resources distance learning gives them a hope for an education that will better equip them for accepting new or additional responsibilities.

Curriculum development is the key to achieve the goal of preparing qualified natural resources professionals. According to RNRF (2004b), natural resources managers will require a broad knowledge base, as well as more technical training and skills than ever before. The necessary qualities will include “intelligence, adaptability, flexibility, and dynamism” (RNRF 2004b:21). My survey of colleges and universities offering natural resources distance learning programs found courses are mostly in scientific base subjects, such as biology, ecology, and natural resources management. The new curriculum should include communication skills, natural resources law and policy, and technical skills across all subjects related to natural resources. The curriculum should ensure the education and training of professionals with multidisciplinary skills for natural resources management.

*To promote the quality of distance learning*

The Institute for Higher Education Policy (IHEP 2000) produced “Benchmarks for Success in Internet-based Distance Education,” which includes twenty-four benchmarks in seven categories to ensure the quality of distance learning. These seven categories include criteria in Institutional Support, Course Development, Teaching/Learning, Course Structure, Student Support, Faculty Support, and Evaluation and Assessment, that are applicable to all types of distance learning. For example, the IHEP survey showed that the most important institutional support for quality distance learning is “Electronic security measures are in place to ensure the integrity and validity of information;” the most important course development benchmark is “Guidelines exist regarding minimum standards for course development, design, and delivery” (IHEP 2000:14). Indeed, for higher education institutions to be able to ensure the quality of

distance learning, it will be important that they incorporate these benchmarks into their policies, practices, and procedures for their education programs.

*To improve the structure of natural resource distance learning consortium*

A distance learning consortium takes advantage of sharing faculty, knowledge, facility, technology, and personnel resources, thus making distance learning program more cost-effective. There are many distance learning consortia in the United States. For example, the four top universities in the world - Yale, Oxford, Princeton, and Stanford, formed the University Alliance for Life-long Learning (ALL Website). With each university providing \$3 million, the Alliance launched a distance learning consortium in 2001. The Alliance offers non-credit courses in arts and sciences to their combined 500,000 alumni through interactive seminars, multi-media programs, and topical web sites with links to research information, as well as live and taped coverage of campus speakers, exhibitions, and other events. These programs provide alumni and others convenient access to their schools' extraordinary resources. The member universities and their faculties maintain control of the content of the courses and other educational products offered, thus ensuring that the courses meet the highest academic standards.

Although there are many other distance learning consortia (Appendix 6), Virginia Tech's Natural Resources Distance Learning Consortium is the only such partnership with concentration on natural resources education programs. I recommend that to develop natural resource distance learning programs. Virginia Tech should cooperate with additional universities throughout the United States. To facilitate the expansion of natural resources distance learning programs to China, Virginia Tech should take the lead in promoting Natural Resource Distance Learning Consortium, to advance academic short

courses and other programs in natural resources of interest to Chinese resource managers and student.

*To advance academic cooperation with China*

The United States and China should work together to address the natural resources and environmental protection issues that are confronting both countries. Specifically, careful consideration should be given to expanding natural resources distance learning in China by taking advantage of communication technology to overcome the distance barriers for delivering natural resources education to Chinese students.

As previously discussed in this paper, there are potential barriers for American universities to extend natural resources distance education to China. These barriers, including technical incompatibilities, language and cultural barriers, as well as international politics, may not be quickly overcome. I recommend that a special task force be formed to evaluate these barriers and to formulate strategies and procedures for potential collaboration with China on natural resources distance education. Although only a few Chinese universities currently offer natural resources education, this collaboration should not attempt to replace any of the existing natural resources educational programs in China. Rather, initial collaborative efforts should be focused on providing technical assistance to Chinese universities in setting up their own natural resources programs when such assistance is needed, and on offering special training and short-term courses to both graduate students and natural resources professionals in China via distance learning. The special training and short-term courses should focus on such topics as new technologies and methods for natural resources conservation, application of these technologies in China, ecological modeling, computer environmental simulation, new

analytical methods, and international environmental law and policies. The task force should include people from the government, academia, and the private sector. The task force should work with the Chinese Ministry of Education to understand and evaluate the needs for international natural resources distance education in China and to determine the best mechanism for U.S.-China collaboration.

## Conclusions

Extending natural resources distance education to China may improve sustainable management of its resources. Although potential barriers such as technical incompatibilities, as well as language and cultural barriers must be first overcome, cooperation between the United States and China may have substantial mutual benefits for natural resources conservation.

Currently, only a few universities in China offer courses address natural resources. American universities may collaborate with their Chinese counterparts by assisting them in setting up natural resources educational programs and by extending certain natural resources distance learning courses to Chinese students. Collaboration does not necessarily mean that China will adopt the American program in its entirety. Rather, initial collaborative efforts should be focused on providing special training and short-term courses with emphasis on such subjects as new conservation technologies and methods, case studies, environmental modeling, and international law and policies on conservation. The Natural Resources Distance Learning Consortium at Virginia Tech should take the lead in working with the Chinese Ministry of Education to identify areas of potential collaboration and to determine how such collaborative efforts can be successfully implemented.

## Summary

This paper reviews the status of natural resources distance learning programs in both the United States and China and evaluation of the feasibility for American higher education institutions to extend such programs to students in China. Computer-based learning programs were reviewed for a random sample of 300 American colleges and universities. A short fact-finding trip to China was conducted to visit 7 Chinese to obtain information.

Unlike traditional education, distance learning offers students greater flexibility to learn. Students do not have to come to classes at a fixed time. Students can access the learning materials online anywhere at any time, and they can have online interaction with the instructor and the other students. As the composition of the student population is changing and the need for more natural resources professionals is increasing, growing demands for natural resources training can no longer be fully met by traditional teaching conducted within the rigid walls of an educational institution. Although traditional education has the capacity to provide more natural resource programs, students want more flexibility in learning. Educators must therefore reach out to potential students, especially those who for various reasons cannot attend regular classes at a certain time. Distance learning, which distributes knowledge to students far and near; would provide the flexibilities needed to meet new demands of the changing student population.

While many colleges and universities in the United States already provide courses in various disciplines via distance learning, only a small number of these institutions currently include natural resources education in their distance learning curriculum. The lack of adequate natural resources distance learning programs will make it more difficult

for adult learners to receive the education they need for either job advancement or career change. Furthermore, higher education institutions must overcome a number of potential challenges including the need for new technology, new learning requirements, the changing role of the faculty, and the lack of adequate funding. For these reasons, higher education institutions should consider the feasibility of establishing more natural resources distance learning consortia to overcome some of these challenges. The Natural Resources Distance Learning Consortium at Virginia Tech could be used as a model for the formation of additional consortia.

China faces serious challenges in developing natural resources distance learning programs. Although distance learning has been given high priority attention by the Chinese Government, this new learning concept is still at a developmental stage in that country. Furthermore, few natural resources courses are currently being offered via distance learning. Because of its rapid economic growth, China faces even greater challenges than the United States in natural resources management and conservation. Although the Natural Resources Distance Learning Consortium at Virginia Tech could potentially be an effective model for developing a cooperative natural resources program with the universities in China, several technical and non-technical barriers must be first overcome, including language and cultural barriers, national pride, and potential technological incompatibilities. A special task force chaired by Virginia Tech should be established to further evaluate the feasibility of U.S.-China collaboration in natural resources distance education.

Since the United States, the world's most industrialized nation, and China, the country with the fastest economic growth, together consume a significant amount of the earth's natural resources, the two countries should begin working together to address

some of the global environmental issues. Such collaboration will be mutually beneficial to both countries if a mechanism can be established to extend natural resources distance learning from the United States to students in China. In any case, despite the aforementioned barriers, globalization of educational programs will likely be an inevitable outcome of technological trends.

## References

ALL Online. Alliance for Lifelong Learning. [www.alllearn.org](http://www.alllearn.org). Accessed November 10, 2004.

Atkinson, Roger. 1999. Going online: Infrastructures and services for Internet delivered vocational education. Bolton Institute.

Aurora Fund Website. [http://www.aurorafunds.com/news\\_events.asp?newsID=111](http://www.aurorafunds.com/news_events.asp?newsID=111)

Beaudoin, Michael F. 1990. The instructor's changing role in distance education. *The American Journal of Distance Education*; 4(2), 21-29.

Bowers, C.A.1997. *The culture of denial: Why the environmental movement needs a strategy for reforming universities and public schools*. State University of New York Press. Albany, New York.

Brescia, William, Michael Miller, Poda Ibahima, John Murry. 2004. Orientation practices for effective distributed learning coursework: Students speak their minds. *Online Journal of Distance Learning Administration*.  
[www.westga.edu/~distance/ojdla/fall73/brescia73.html](http://www.westga.edu/~distance/ojdla/fall73/brescia73.html).

Brown, Lester. 2001. *Eco-Economy*. Earth Policy Institute, W. W. Norton & Company, New York, London.

Brown, Lester. 2003a. China losing war with advancing deserts. Earth Policy Institute  
<http://www.earth-policy.org/Updates/Update26.htm>

Brown, Lester. 2003b. *Plan B*. Earth Policy Institute, W. W. Norton & Company, New York, London.

Cain, Michael L. Hans Darmman, Robert A. Lue, Carol Kaesuk Yoon. 2002. *Discover Biology*; 2<sup>nd</sup> edition. W.W. Norton & Company. New York. London

CERNET Website a. China Education and Research Network.  
[www.njnet.edu.cn/education/foreign\\_edu/University/America/AmericaA.htm](http://www.njnet.edu.cn/education/foreign_edu/University/America/AmericaA.htm). Accessed May 20, 2003

CERNET Website b. China Education and Research Network. Education policy. [www.edu.cn/20010926/3002911.shtml](http://www.edu.cn/20010926/3002911.shtml). Accessed October 23, 2003.

Chao, Julie. November 8, 2004. China battling desert's sprawl. The Washington Times. World. Page A17.

Chinese Embassy Website. <http://www.china-embassy.org/chn/xsjl/t114269.htm>. Accessed July 14, 2004.

Chow, Gregory. 2004. Knowing China. World Scientific. New Jersey.

CRTVU Website. Central Radio and TV University. [www.crtvu.edu.cn/English\\_crtvu/index\\_en.html](http://www.crtvu.edu.cn/English_crtvu/index_en.html). Accessed January 8, 2005.

CRU. 2003. Introduction of China Remin University. China Remin University.

Dai, Xianyuan. 2003. China Higher Education. P.56.

DeVries, Jusri, and Seppo Tella. 1998. The Role of Distance Education Instructor: Attitudes, Skills, and Strategies. Media Education Publication 8. <http://www2.uiah.fi/~jdevries/role.htm>.

Dirr, Peter J. 1999. Distance and virtual learning in the United States. The Development of Virtual Education: A global perspective. The Commonwealth learning.

ETS Website. English Test Standards. <http://www.ets.org/toefl>. Accessed July 14, 2004

Evans, Gary R. 2003. Business Plan. Virginia / USDA Forest Service University Consortium Distance and Distributed Learning Project. College of Natural Resource, Virginia Polytechnic Institute and State University. Virginia.

Flavin, Christopher. September 22, 2004. Hearing on Asia's environmental challenges. United States House of Representatives Committee on International Relations, Subcommittee on Asia and the Pacific Economic Policy.

Fulcrum Analytics. [http://www.nua.com/surveys/index.cgi?f=VS&art\\_id=905357660&rel=true](http://www.nua.com/surveys/index.cgi?f=VS&art_id=905357660&rel=true). Accessed September 2, 2003.

Galusha, Jill M. 1997. Barriers to learning in distance education. University of Southern Mississippi. The Infrastructure Network. [www.infrastructure.com/barriers.htm](http://www.infrastructure.com/barriers.htm). Accessed March 6, 2004.

Garrett, Amy. 2003. Distance learning and a prescribed burn at Homestead National Monument of America. Natural Resource Year in Review. National Park Service. [http://www2.nature.nps.gov/YearinReview/04\\_H.html](http://www2.nature.nps.gov/YearinReview/04_H.html). Accessed October 17, 2003

Goudie, Andrew. 2000. The human impact on the natural environment, 5<sup>th</sup> Edition. The MIT Press, Cambridge, Massachusetts.

Gropp, Robert. January 2004. Developing the federal natural resource workforce. BioScience. Vol.54. No. 1.

GSCAS. 2003. Introduction to Graduate School of Chinese Academy of Science.

GSCAS Website. Graduate School of Chinese Academy of Sciences. <http://www.dc-edu.ac.cn/GSCASEng/GSCASEngInfoShow.ycs?GUID=18549>. Accessed August 4, 2004.

Gu, Zonglian. November 8. 2003. Interview. Executive Deputy Dean, Online Education College, China Remin University.

He, Xiaohui. May, 2003a. The survey of natural resources distance learning in United States. Natural Resources Program, Natural Capital Region, Virginia Polytechnic Institute and State University. Virginia.

He, Xiaohui. 2003b. Trip to China Report. Independent Student. Virginia Polytechnic Institute and State University. Virginia.

Huang, Jun. 2003. Interview. November 9, 2003. Dean, School of Distance & Continuing Education Graduate School of Chinese Academy of Science. Beijing, China.

IDDL. [www.iddl.vt.edu](http://www.iddl.vt.edu) . Institute of Distance and Distributed Learning. Virginia Tech. [www.vto.vt.edu/sitemap.php](http://www.vto.vt.edu/sitemap.php). Accessed May 15, 2003.

IHEP. April, 2000. Quality On the Line. Benchmarks for Success in Internet-Based Distance Education. The Institute for Higher Education Policy.

JSJ Website. Jiaoyu Shewai Jiandu Website. [www.jsj.edu.cn/mingden/004.html](http://www.jsj.edu.cn/mingden/004.html) . Accessed July 14, 2004.

Klare, Michael T. 2002. Resource Wars. The New Landscape of Global Conflict. Henry Holt and Company. New York.

Li, Ping. December 2, 2003a. Interview. Ministry of Education, Beijing, China.

Li, Ping. 2003b. The new structure if distance learning in China (in Chinese). China Higher Education. Vol. 296, No. 15-16. Page 43. Ministry of Education, Beijing, China.

McIsaac, Marina S. and Charlotte N. Gunawardena. 1996. Distance Education. D.H. Jonassen, ed. Handbook of research for educational communications and technology: a project of the Association for Educational Communications and Technology. 403-437. Simon & Schuster Macmillan. New York.

Moore, Michael G. 2001. Distance Education in the Unite States: the State of Arts. Series Lectures on the Educational Use of ICT and Virtual Education. 6<sup>th</sup> June, 2001.

Muirhead, Brent. Charles Juwah. 2004. Interactivity in computer-mediated college and university education: A recent review of the literature. Educational Technology & Society. 7(1), 12-20.

NCES 2002. Digest of Education Statistics. 2002. Chapter 3 Postsecondary Education. National Center for Education Statistics. <http://nces.ed.gov/programs/digest/d02/tables/dt258.asp>. Accessed August 18, 2004.

NEA. June 2001. Tenure. Update, vol 7, no 3, National Education Association Higher Education Research Center.

NEA. December, 2003. Why are college prices increasing and what should we do about it? Update, vol 9, no 5. National Education Association Higher Education Research Center.

Northern Arizona University. <http://www.nauathletics.com/>. Accessed May 29, 2003.

NUA.com. [www.nua.com/surveys/how\\_many\\_online/asia.html](http://www.nua.com/surveys/how_many_online/asia.html). The World's learning resource for Internet trends and statistics. Accessed June 10, 2003

O'Corner, Lisa. And Michael Corry. 2004. Faculty Preferences for Course Delivery: Distance and Traditional Settings. International Journals of Instructional Technology and Distance Learning. [www.itdl.org/Journal/Aug\\_04/article02.htm](http://www.itdl.org/Journal/Aug_04/article02.htm). Accessed February 5, 2004.

Open University. <http://www.open.ac.uk/> . Accessed August 9, 2003.

Orr, David. 1992. Ecological literacy: Education and transition to a postmodern world: State University of New York Press. Albany, New York.

Oxford University. <http://www.online.ox.ac.uk/> . Accessed August 15, 2003.

Pomfret, John. 2001. China's lumbering economy ravages border forests. Logging industry taps unregulated markets for woods. Washington Post Foreign Service. March 26, 2001; Page A19.

Random.org. [www.random.org](http://www.random.org). Accessed May 29, 2003.

Raven, H. Peter, Linda R. Berg. 2004. Environment. 4<sup>th</sup> Edition. John Wiley & Sons, Inc.

RNRF. Spring 2001. Evolving role of resources professionals. Renewable Resources Journal. Renewable Natural Resources Foundation. P23.

RNRF. 2004a. Educational Institution Responsibilities and New Skill Sets. Renewable Resources Journal. vol.21, no 4. Page 20. Renewable Natural Resources Foundation.

RNRF. 2004b. Federal natural resources agencies confront an aging workforce and challenges to their future roles, Renewable Resources Journal. vol.21, no 4. Renewable Natural Resources Foundation.

Robertshaw, Michael, 1999. Virtual institutions in East and Southeast Asia. The Development of Virtual Education: A global perspective. The Commonwealth of Learning <http://www.col.org/virtualed/index2.htm>. Accessed November 28, 2003.

Shogren, Elizabeth. Kenneth R. Weiss. 2004. Bush's vision: a new environment.  
[http://seattletimes.nwsources.com/html/politics/2002088889\\_environment12.html](http://seattletimes.nwsources.com/html/politics/2002088889_environment12.html).  
Accessed November 23, 2004.

Stanford University. [www.stanford.edu](http://www.stanford.edu) . Accessed August 15, 2003.

Tabb, E.D. 2003. Distance learning education at degree-granting postsecondary institutions: 2000-2001. National Center for Education Statistics. U.S. Department of Education.

Tsinghua University. [www.tsinghua.edu](http://www.tsinghua.edu). Accessed November 4, 2003.

University of Canberra, [www.ce.canberra.edu.au/flexmasters/tm.htm](http://www.ce.canberra.edu.au/flexmasters/tm.htm). Accessed May 23, 2003.

University of Guelph [www.open.uoguelph.ca/online/](http://www.open.uoguelph.ca/online/). Accessed July 25, 2003.

University of Idaho, [www.uihome.uidaho.edu/uihome/](http://www.uihome.uidaho.edu/uihome/). Accessed May 25, 2003

University of Montana, [www.umt.edu/](http://www.umt.edu/). Accessed May 25, 2003

University of New England. <http://distance.une.edu/>. Accessed July 25, 2003.

University of Phoenix, <http://degrees.uofphx.info/programs.jsp>. Accessed May 27, 2003.

University of Victoria, [www.uvcs.uvic.ca/distance.cfm](http://www.uvcs.uvic.ca/distance.cfm). Accessed July 25, 2003

Virginia Tech website, [www.vt.edu](http://www.vt.edu). Accessed May 26, 2003.

USDA / GMU. 2002. USDA Forest Service Distance Learning Program in GMU Students records. 1996-2002.

Waseda University, [www.waseda.jp/top/index-e.html](http://www.waseda.jp/top/index-e.html). Accessed July 25, 2003.

Wills, Barry, 1995. Distance education at a glance. University of Idaho.  
[www.uidaho.edu/eo/distglan.html](http://www.uidaho.edu/eo/distglan.html). Accessed October 13, 2003

Waseda University. [www.waseda.jp/top/index-e.html](http://www.waseda.jp/top/index-e.html). Accessed July 26, 2003.

Zhejiang University. <http://www.zju.edu.cn/english/site/zdweb.htm>. Accessed November 12, 2003.

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## Appendix 1

Cumulative mean frequencies of occurrence of distance learning programs and natural resources courses at sampled colleges and universities in the United States

Sample size	DL in Univ.(%)	NR in DL (%)	NRDL in Univ (%)
30	0.47	0.07	0.033
60	0.62	0.08	0.05
90	0.58	0.1	0.056
120	0.57	0.09	0.05
150	0.55	0.07	0.04
180	0.54	0.08	0.044
210	0.56	0.07	0.038
240	0.55	0.08	0.042
270	0.54	0.09	0.048
300	0.55	0.09	0.047
Average	0.553	0.082	0.0448
Standard Deviation	0.04	0.01	0.01
X = .0853 (SD+-.01)			

## Appendix 2

### Interviewed universities and people in China

Tsinghua University, The School of Continuing Education  
Wang Aimei, Vice Director

China Renmin University, Online Education College  
Gu Zonglian, Executive Deputy Dean  
Peng Heping, Assistant President of Renmin University  
Zeng Yinchu, Vice Dean, Dep. of Agriculture Economics  
Gu Xin, Senior Engineer, Dep. of Agriculture Economics  
Zhou Li, Associate Professor, Dep. of Agriculture Economics

Zhejiang University, College of Environmental Science  
Wang Lihong, Vice Dean

Lanzhou University, School of Network Education  
Liu Yajun, Deputy Dean

Beijing Normal University, School of the Environment  
Qi Ye, Professor

Chinese Academy of Science, Graduate School  
Zhao Zhensheng, Vice President  
Huang Jun, Dean, School of Distance & Continuing Education  
Wang Ye, Director, Administrative Office  
Li Li, Program Assistant.

The Cold & Arid Regions Environmental and Engineering Research  
Institute, Chinese Academy of Science  
Wang Tao, President  
Chen Hui, Graduate Student Office  
Zhang Ying, Administrative Office

The Ministry of Education, Department of Distance Learning  
Li Ping, Vice Director

## Appendix 3

The 300 colleges and universities with 78 NRDL courses.

### 1. Bowling Green State

- PHIL 332 Environmental Ethics
- RTD 215 Introductions to Travel & Tourism
- RTD 315 Program Planning in Travel & Tourism
- RTD 384 Organization and Administration of Leisure Service
- RTD 484 Contemporary Issues in Tourism
- RTD 487 Practicum: Supervision & Administration

### 2. Cornell University

- BEE 332 Sustainable Development

### 3. Drury College

- EVNR 220 Introductions to Ethical Environmental Issues
- ENVR 315 Environmental Law and Regulations

### 4. Eastern Oregon State

- HIST 410 Environmental History
- GEOG 317 Land Use and Environmental Planning

### 5. Mesa State College

- ENVS 101 Environmental Science

### 6. Pennsylvania State University

- EGEE 101 Energy and the Environment
- ENVS 530 Rocky Mountain Field Ecology

### 7. Texas A&M University

- BSC 106 US Human Ecology Man & Environment
- ENVS 305 Environmental Hydrology
- AG 336 Wildlife Management
- ENVS 410 Environmental Monitoring & Waste Management
- WFSC 301 Wildlife and Changing Environment
- WFSC 417 Biology and Fishes
- WFSC 420 Ecology for Teachers
- WFSC 604 System Analysis & Simulation in Ecology
- WFSC 611 Estuarine Ecology
- WFSC 616 Physiological Ecology of Vertebrate
- WFSC 621 Aquatic Ecology
- WFSC 422/622 Behavioral Ecology of Vertebrate
- WFSC 640 Human Dimension of Wildlife and Fishery Management
- MARS 660 Marine Environment
- OCNG 676 Marine Policy
- WFSC 689 Wildlife Law and Ethics
- FRSC 406 Forest Policy
- FRSC 614 Economic Analysis for Forest Resources Management
- AGEC 604 Natural Resource Economics
- RENA 662 Environmental Law and Policy
- RENA 664 Coastal Resources Management
- RLEM 612 Restoration Ecology
- RPTS 489 Integrating Nature and Heritage Tourism

### 8. University of California

- ENSC 002 Introductions to Environmental Science
- ENSC 003 Contemporary Issues in the Environmental Science
- ENSC 017 Environmental Impacts of Urbanization

- ENSC 172 Principle of Environmental Impacts Analysis
- ENSC 174 Law, Institutions and the Environment
- ENSC 202 Principle and Applications of Environmental Modeling
- ECON 143B Natural Resource Economics
- ENSC 134 Soil Condition and Plant Growth
- SWSC 120 Soil Ecology
- SWSC 225 Watershed Biogeochemistry
- ENSC 101 Water Resources
- ENSC 142 Water Quality
- ENSC 172 Principle and Applications of Bioremediation
- 9. University of Maryland University College Europe /Bowie State University**
- BEHS 361 Global Environmental Change
- BIOL 101 Concepts of Biology
- BIOL 102 Laboratory of Biology
- BIOL 181 Life in the Ocean
- ENVM 650 Land and Water Resources Management
- ENVM 651 Watershed Planning and Management
- 10. University of Tennessee, Knoxville**
- ENVS 550 Environmentally Sensitive Spray
- EE 590 Special Problems in Environmental Engineering
- ESS W462K Environment Climatology
- FISH 550 Fish Physiology
- WFS 493/566 Re-circulating Aquaculture
- FOR 590 Forest Resource Issues of Tennessee
- AgEc 570 Advanced Natural Resource economics
- EE 535 Ground Water Hydrology
- 11. University of Wisconsin, Green Bay**
- NRES 558 Biodiversity and Conservation Biology
- ECON Natural Resource Economics
- HIST 594 American Environmental History
- NRES 310/510 Environmental Education Teaching Methods
- NRES 410/610 Fundamental of Environmental Education
- NRES 530 Environmental Health
- NRES 679 Natural History, Resources, Culture and Ecosystem
- NRES 704 Ecological Lifestyle
- NRES 733 Energy Education: Concept and Practice
- GEOG 101 The Physical Environment
- NRES 600 Wisconsin Environmental Studies
- NRES 715 Plant Resources and Humans
- 12. West Texas A&M University**
- PSES 7325 Soil-Plant-Water Relationship
- 13. Worcester Polytechnic Institute**
- CE 574 Water Resources Management

## Appendices 4

Table 2

<b>Forest Service Distance Learning Program George Mason University, 1996-2002</b>	
<u>Courses</u>	<u>Number Of Student</u>
American Indian Rights and Interests	<b>44</b>
Foundations of Public Domain Management	<b>155</b>
Land Status, Boundaries, Claims, and Withdrawals	<b>61</b>
Liability and Risk Management	<b>5</b>
Linear Uses and FERC Licenses on Federal Lands	<b>55</b>
Natural Resource Recreation Planning	<b>11</b>
Recreation Special Uses and Appeals	<b>102</b>
Right-of-Way Acquisition	<b>70</b>
Special Uses Management on Federal Lands	<b>181</b>
Valuation and Land-Ownership Adjustment	<b>60</b>
Visitor Services	<b>3</b>
<b>Total Courses</b>	<b>11</b>
Total students enrolled	747

## **Appendix 5**

## Courses offered by the NRDL universities

### *Virginia Tech*

Forest Biology and Ecology for Educators,  
Foundations of Federal Land Management,  
Frameworks for Federal Land Management,  
Global Issues in Natural Resources,  
Modern Wildlife for Management,  
Partnerships and Volunteerism,  
Public Ecology

### *University of Idaho*

Aquatic Restoration Ecology,  
Fire Ecology,  
Introduction to Environmental Science,  
International Environmental Issues,  
Human Dimensions in Restoration Ecology,  
Hydrologic Application of GIS & Remote Sensing,  
Natural Resource Ecology,  
Natural Resource Policy, Natural Resource Ecology,  
Politics of Environment,  
Practicum in Restoration Ecology,  
Restoration Ecology,

### *Northern Arizona University*

NAU offers courses as part of a joined professional certificate programs in a consortium including Northern Arizona University, University of Arizona, and Arizona State University.

Camp Counseling,  
Ecotourism,  
Environmental Chemistry,  
Environmental Crime,  
Environment and Society,  
Experiential Practice in Outdoor Recreation,  
Inclusive Recreation  
Interpretation for Parks and Recreation.  
Introduction to GIS,  
Introduction to Park Management  
Introduction to Park and Recreation,  
Outdoor Leadership Certification  
Park Protection,  
Practice in Parks and Recreation Management,  
Program Planning,  
Recreation Leadership and Supervision  
Special Event Planning,  
Wildland Recreation Management

### *University of Montana*

UM is offering three levels of geographic information system Arcview courses online.

## Appendix 6

### Distance Learning Consortiums

Arizona Regents University [www.arizonaregentsuniversity.org](http://www.arizonaregentsuniversity.org)

Colorado Community Colleges and Occupational Education System  
<http://www.cccs.edu/>

Connecticut Distance Learning Consortium [www.hpcnet.org/cgi-bin/global/a\\_bus\\_card.cgi?SiteID=166417](http://www.hpcnet.org/cgi-bin/global/a_bus_card.cgi?SiteID=166417)

Consortium of Open Learning (*COL*) [www.distlearn.com](http://www.distlearn.com)

EDLearn Consortium <http://www.edlearn.org/>

Florida Distance Learning Consortium <http://www.distancelearn.org/>

Kentucky Commonwealth Virtual University [www.kcvu.org](http://www.kcvu.org)

LDS Church Education System <http://www.ldsces.org/>

Natural Resources Distance Learning Consortium <http://cnr.iddl.vt.edu>

North Dakota University System <http://www.ndus.nodak.edu/>

Northeast Texas Consortium <http://www.netnet.org/>

Oregon Network for Education <http://oregonone.org/>

Southern Regional Electronic Campus <http://www.electroniccampus.org/>

Southwest Consortium for the Advancement of Technology in Education  
<http://www.ed.gov/pubs/AchGoal5/appb.html>

The American Distance Education Consortium (ADEC) [www.adec.edu](http://www.adec.edu)

The Globalwide Network Academy <http://www.gnacademy.org>

The University Alliance (UA) [www.onlinecollegedirectory.com](http://www.onlinecollegedirectory.com)

University of Maryland University College  
Consortium [www.ed.gov/programs/disted/washconsortium.html](http://www.ed.gov/programs/disted/washconsortium.html)

United States Open University [www.open.ed](http://www.open.ed)

Washington State University and Washington Community Technical College Online  
<http://www.50states.com/college/washingt.htm>

Western Governors University [www.westgov.org](http://www.westgov.org)

Western Nebraska Distance Learning Consortium <http://dl.esu13.org/>

Yale Alliance [www.yale.edu/opa/v29.n5/story1.html](http://www.yale.edu/opa/v29.n5/story1.html)

## **Vita**

### **Xiaohui He**

Xiaohui He completed undergraduate studies at Zhejiang University in China and received an Associate degree in Civil Engineering in 1986. Then, she came to the United States and received a Bachelor of Computer Information System's degree from Strayer University in 2002. She received a Certificate of Natural Resources from Virginia Polytechnic Institute and State University (Virginia Tech) in 2003, and she plans to complete her Master of Natural Resources degree from Virginia Tech in 2004.

Xiaohui grew up in a small town in southeastern China and came to the United States in 1989. She was the Communication Director in an environmental NGO group, International Fund for China's Environment, and worked mainly with Chinese and other international NGOs in the environmental community. After working in an environmental NGO for several years, she recognized a need to expand her knowledge of natural resources conservation and management. Virginia Tech's Natural Resources Program provided an ideal opportunity to gain some professional training in natural resources. In 2003, she joined the College of Natural Resources as a Program Assistant in the Natural Resources Distance Learning Consortium. She believes that environmental education is the most important way to spread understanding of conservation concepts. She is interested in promoting the sustainable natural resources management nationally and internationally. She also holds several leading positions in Chinese community in the National Capital Region.