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THE INTERDEPENDENCE OF FOREST CONSERVATION AND FORESTRY EDUCATION

THE economic and industrial development of the western continent is comparatively recent. The abundance of the natural resources in the new world made the consideration of their exhaustion a subject of little public interest. The increasing rapidity in the depletion of these resources, particularly in the most populous and best industrially developed of the American republics, has within recent years emphasized the need of foresight in dealing with them.

The United States has been the foremost of the western nations in urging the conservation of national resources through better use and in enacting national and state laws regulating use. When a nation is new and sparsely populated the necessary encouragement for industrial expansion and increased population makes governmental regulation of forest and other natural resources less essential. There comes a time, however, in the life of every nation when future needs must be safeguarded from present private greed. When this time comes a change must be initiated in the method of handling these resources.

The recognition of this principle caused the United States in 1891 radically to change her policy regarding the unoccupied national domain and begin the establishment and organization of national forests. Prior to this time practically all of the forests in the entire country could be exploited without regard for a second crop, because nearly all timberland was

privately owned or else in the public domain open to sale or settlement. Fortunately, in the United States, when the policy of the public ownership of forest property was accepted, there were still large areas of public domain covered with timber from which national forests could be segregated without cost to the republic. Unfortunately these areas were chiefly in the western half of the country, consequently the national forests are, for the most part, located in the states west of the Mississippi River and remote from the best timber markets.

It is invariably the case that nations do not awaken to the need for forest conservation until too late to attain the best results without large expenditures of time and money. Thus, the United States in order to secure national forests in the eastern half of the country, where there is the greatest need for forest conservation and the orderly development of forest property, is forced to purchase from private owners timberland that never should have passed from public ownership.

The segregation of the national forests from the public domain during the past two decades has given us 162 national forests, having a total area of nearly 165 million acres. The more recent policy of purchasing timberland from private owners for national forests in the east has already resulted in the acquiring of nearly 386,000 acres in seven of the eastern states. About 900,000 acres additional have been approved for purchase. The fixed policy of the government relating to the management of the vast acreage in national forests is conservation through use, *i. e.*, the treatment of the property so that the yield will increase rather than decrease with use.

During the same period that the national government has been creating, organizing and developing national forests the state governments have been creating, organizing and developing state forests. At the present time, 14 states have a total of 147 state forests, which embrace an area of nearly 3,675,000 acres. New York with two large state forests of 1,825,882 acres leads all other states in the extent of her state-owned forests. Pennsylvania with 50 state forests of nearly 1,000,000 acres has done much more than the other states in the organization and development of them.

Counties, cities and towns have secured, chiefly within the past decade, communal forests varying from less than 100 acres in extent to more than 20,000 acres. Complete data relating to communal forests in the United States is not available. The states having the largest number of such forests are Massachusetts and New York. It is believed that there are, at the present time, from 200,000 to 300,000 acres of communal forests in the United States. These forests have, for the most part, been acquired for the purpose of protecting the watersheds from which potable water is obtained for the use of cities and towns. They are usually located in the vicinity of large centers of population where there is a demand for all classes of forest products, thus making the practise of intensive forestry possible.

The most interesting and far-reaching movement in forestry in the United States has been this movement toward public ownership of forest property. Approximately one fifth of the total area of the forests in the United States has been made into national, state and communal forests in the space of twenty years. The public has squarely faced the issue of forest conservation and has recognized the fact that it is not possible without the public ownership of forest property. Our forest policy is firmly anchored on the rock of public ownership that our forest resources can be made to continue indefinitely and not be-

come waning resources when increased population and industrial development make their need even more important than at the present time.

Four fifths of all the forests of the country are still in private holdings. They are in small holdings attached to farms or in larger holding in non-agricultural regions. The larger holdings contain more than three fifths of all the merchantable timber in the entire country. They are in the possession of individuals or corporations that have consolidated and brought together these large holdings in comparatively recent years, often at a large initial cost. This enormous body of virgin timber, because of the large carrying charges for interest, taxes and protection, must, from necessity, be forced on the market as rapidly as possible. This accounts for the small increase in stumpage values during recent years.

The quantity of standing timber in the hands of private owners is so large, the competition for a market is so keen, and the necessity for cutting is so imperative there is little likelihood for a marked advance in stumpage for many years to come. The inevitable result of this condition is the utter inability of the owners of more than three fifths of the merchantable timber to cut their stumpage in a manner that will insure a satisfactory second crop. The practise of forestry necessarily carries with it present expenditures far beyond those incurred in forest exploitation without regard for future crops. Only a small percentage of the private forests in the United States are so favorably located in reference to market that the value of all classes of stumpage is sufficiently high to make thinnings, reproduction cuttings, plantings and other operations concerned with the production of the crop profitable. For this reason forestry is not practised by private owners of timberland except on woodlots in strictly agricultural regions and in restricted areas of New England and elsewhere where there is an excellent local market for all classes of forest products.

Although, in most cases, the private owner can ill afford the present expenditures necessary to insure future crops and *will not make them,* the public can well afford to make such expenditures, and experience shows that *they do make them.* Thus, the administration of the national forests is spending on them nearly twice the present annual receipts. The public can well afford to make present expenditures in order to insure future crops of timber *because it is not only recompensed from the timber produced, but also by the indirect value of the forest to the entire community.* We should clearly appreciate the following fundamental truth. *It is the indirect value of the forest which accrues to the public at large that makes the practise of forestry economically possible by the public before it is possible by the private individaul.* The public can and should practise forestry, while the private individual seldom can economically, and will not. I, therefore, affirm that the practise of forestry in the United States really began with the creation of public forests. Its progress will be measured by the increase in area of such forests and the rapidity with which they are organized and orderly developed.

With this brief outline of our advance toward forest conservation, I now direct your attention to the intimate relation that forestry education bears to it. Forestry education was the fountain head from which sprang the beginnings of forestry in this country. Forestry education is the source from which flows all progress in forestry. It shapes and directs our forest policy and determines our methods of prac-

tise. Forestry education and forest conservation have moved forward together. Without the one the other would be impossible.

Forestry education began in the United States more than a century ago, but not in schools. It began with the first desultory efforts of a few far-seeing enthusiasts, who had a clear vision of the future, to interest the public in forest conservation. Little progress, however, was made until the early eighties when more systematic propaganda was undertaken. A forest commissioner was appointed by the United States Department of Agriculture. The importance of this office has steadily grown. In 1886 it became the Division of Forestry, in 1901 the Bureau of Forestry, and in 1905 the Forest Service. Practically all of the early work of this branch of the government service was educational in character, viz., *systematic propaganda showing the need for forest conservation.* Great assistance in this important movement was brought about in 1882 through the formation of the American Forestry Congress, which later became the American Forestry Association. The proceedings of this society contain the complete history of the progress in establishing our present forest policy. Its journal *American Forestry* has been a leading force in shaping public opinion favorable to forest conservation. Forestry commissioners were appointed in various states in rapid succession, and state and local forestry associations were formed.

All of the above forces working together so shaped public opinion that it became possible to enact legislation in 1891 making the public ownership of forests possible. Prior to this date New York and a few other states had begun the establishment of state and communal forests, but purely for the purpose of protection, recreation and sport. Up to this time forest conservation in the United States was not in the woods. It was chiefly educational propaganda—the shaping of public opinion in the desire for forest conservation. National forests were established in rapid succession after the above date. Many states began or continued the policy of acquiring forest property for state forests; and later, here and there throughout the country, but particularly in the east, counties, cities and towns began to acquire adjacent lands for communal forests.

The establishment of public forests has gone on until at the present time approximately one fifth of the forests in the United States are public forests, to be held for the production of timber and for protective purposes. During the long period of propaganda leading to the approval of, and the desire for, the public ownership of forest property in the United States, the burden of developing public opinion favorable to forest conservation fell upon the shoulders of a small number of men who were willing to contribute their time and money toward what they believed to be a great and pressing public need. As time passed, this small group grew into a vast army and public opinion favorable to forestry was the inevitable result. It is the writer's belief that no republic can reach even the beginning of forest conservation unless some of her citizens recognize the need and are willing to sacrifice their time and money for this public necessity.

I purposely place great emphasis upon the period of educational propaganda because without it our remarkable development in forestry during the past twenty-four years would have been impossible. *A great constructive movement in forestry can not be initiated in a republic without the people solidly behind it.* Our constructive work of the past two and a half decades rests upon years of organized edu-

cational prapaganda. Our sister republics in their efforts to place forestry upon a sound foundation must build the foundation out of public desire. Organized educational propaganda in the hands of national and local forestry associations, propagandist journals, and efficient press bureaus are the great forces in creating a public opinion favorable to forest conservation. When public desire has been created the practise of forestry becomes possible. It is not possible earlier.

Although educational propaganda favorable to forestry began in the United States more than a century ago, technical training in the science and art of forestry had its beginnings within the past two decades. The first forest school of collegiate rank was established at Cornell University in 1898. Two years later a professional forest school was established at Yale University. During the following decade and a half more than twenty schools or departments of forestry offering professional training and a degree in forestry after the completion of a prescribed course were established in various parts of the country, either as separate institutions or as departments of existing universities and colleges.

The question naturally arises, Why was technical training in forestry so long delayed and why has it met with such extraordinary expansion in the short space of seventeen years? The answer is found in the bringing of approximately 20 per cent. of all the forests of the United States under public ownership.

The establishment of public forests carried with it the necessity for their management and orderly development. This could not be attained without men trained in the science and art of forestry. The segregation of 162 national forests from the unoccupied public domain having an average area of more than 1,000,000 acres, within the space of twenty years has in itself called for the services of hundreds of technically trained men, and will call for many more men with the gradual increase in the intensity of management. The schools arose to supply this demand for trained men. There was no demand for professional schools until public ownership of forest property became the keystone in our forest policy, and there would be but little demand now were this keystone removed. Our whole structure of forest conservation, of forestry education, of forest practise rests upon the public ownership of forests. The economic situation relating to private forest property is such that, in the main, exploitation rather than forestry will be the basis for operation for many years to come. Pull down the keystone of public ownership and the splendid structure that has been erected with its great National Forest Service and the forest service of the several states will crumble, cobwebs will cover the windows of our professional forest schools, and the dark ages of forestry conservation will again prevail. The keystone must not be removed. It is believed that public opinion will not waver from the task that it has set, but will strengthen as time goes on *until at least 50 per cent. of the strictly non-agricultural lands capable of producing forest crops is publicly owned,* until at least this amount of our potential forests are back in the hands of the public who made the great economic mistake years ago in bartering them for a mess of pottage. If this optimistic view of forestry in the United States prevails, the efficiency and power of our forest schools will increase and they will gradually adjust themselves more closely than at present to the needs of the country.

The remarkable increase in agricultural research and education in the United States during the past half century has pro-

foundly influenced agricultural production. The vast sums spent annually by the nation, the states and lesser governmental units are returned a hundredfold by increased and diversified production. Our large number of agricultural colleges and experiment stations are living monuments to the public belief that the conservation of agriculture squarely rests upon the educational forces that direct and shape its progress. Our forest schools and research stations are just as essential in our scheme of education if the practise of forestry becomes a part of our national development and the future growth of forest crops adequate for our needs.

The superior position of Germany in forest conservation, whereby she produces nearly all of her wood requirements without lessening her forest capital through overcutting, is due to her many, long-established forest academies and other institutions where hundreds of young men are trained in the production and utilization of forest crops and in the principles which underlie a sound and economic forest policy. Her technical forestry education has been of slow but progressive growth, beginning with the "master schools" of Zanther, Hartig and Cotta nearly a century and a half ago. Each of these forest managers surrounded himself with young men and taught them the principles of forest practise on the forests under his charge. This early work gradually grew into the present educational system with the many forest academies and other institutions for the training of men in the science and art of forestry. The gradual development of forestry education in Germany has resulted in a healthy growth and has moved in the direction most useful for the needs of the country. A similar development of forestry education in the United States was impossible, due to the establishment of more than 165,000,000 acres of public forests in less than two decades, all awaiting organization and orderly development and for which the public was willing to pay. Hundreds of trained men were wanted at once to assume responsible positions as district chiefs, inspectors, investigators and supervisors. This call for a large number of professionally trained men at one time has resulted *in a remarkable growth in forestry education in the United States.*

Forestry education in the old world has developed around two general types of schools, viz., the university schools and the better type of forest academies, which are strictly professional in their training, and the ranger or practise schools, which are vocational in training. The former are scientific, and the preparatory and technical courses are equivalent to five or six years of collegiate work in this country. The latter are primarily concerned with the recognized art of forestry in the particular region where the men are trained to practise. The course is usually but one or two years in duration and is based upon a common school education. The men trained in the first of these two classes of schools after a year or more of apprenticeship under a practising forester are in line for gradual promotions to the highest positions which the profession has to offer. The men trained in the second are equipped for the vocation of ranger, woods foreman, and similar positions concerned with the oversight of labor in producing and harvesting the forest. The purpose of the latter school is entirely different from that of the former. Its aim is to train men for subordinate positions.

In the organization and orderly development of forest property there is need for many more men trained in the vocational schools than there is for men trained in the

professional schools. In forestry, scores of foremen, guards and rangers are necessary for every professionally trained forester. Where one man trained in the science of forestry will find a position suitable to his attainments, many men vocationally trained in the local art will find work.

A hard and fast line can not be drawn in this country between these two classes of schools, although, in the main, there has been an abnormal development of the professional schools and an underdevelopment of the vocational schools. The reason for this one-sided development of forestry education in the United States is found in the demand for professionally trained men in the decade between 1902 and 1912, which is the period during which nearly all the professional schools were established. The transfer of the national forests to the Department of Agriculture in 1904 and their organization under the Forest Service created positions for a large number of trained men. During the same period a rapidly increasing demand for professionally trained foresters was created through the establishment of departments of forestry in many states. All of these positions, with the possibility of rapid promotion, were highly attractive to college men. How rapidly the educational machinery of the country responded to this demand for technical training is shown in the number of schools now offering degrees in forestry and the facilities for technical training that are in the process of development.

The following is a list of the institutions in the United States that offer technical courses in forestry leading to a collegiate degree. This list shows the number of degrees granted by each institution prior to December, 1915, and the number of graduates actually employed in the profession in April of the same year.

Institution	No. of degrees granted prior to Dec., 1915	No. of graduates engaged in forestry, Apr., 1915
Colorado College School of Forestry	10 F.E.	
Colorado Agricultural College	1 M.F.	8
Cornell University	4 B.S.F	3
	17 F.E.	
	16 B.S.F.	
	11 M.F.	35
University of California	0	
Georgia State College of Agriculture	3 B.S.F.	—
Harvard University	53 M.F.	50
University of Idaho	8 B.S.F.	
	1 M.F.	5
Iowa State College	37 B.S.F.	25
University of Maine	50 B.S.F.	30
Michigan Agricultural College	97 B.S.F.	48
University of Michigan	103 M.S.F.	71
University of Minnesota	83 B.S.F.	
	1 M.S.	63
University of Missouri	6 B.S.F.	2
University of Montana	1 B.S.	—
University of Nebraska	60 B.S.F.	
	1 M.F.	46
Ohio State University	80 B.S.F.	47
Oregon Agricultural College.	28 B.S.F.	16
Pennsylvania State College.	106 B.S.F.	68
Syracuse University	31 B.S.F.	
	4 M.F.	11
State College of Washington	2 B.S.F.	—
University of Washington	23 B.S.F.	
	8 M.S.F.	22
Yale University	340 M.F.	253
Totals	1,185	803

In the space of fifteen years 1,185 men have been granted degrees in forestry in the United States. About one half of the degrees granted have been undergraduate degrees given for four years of collegiate work. Advanced degrees in forestry are offered by ten institutions. These schools have large faculties of more mature and experienced instructors and are better equipped for instruction in both the science and art of forestry.

In April, 1915, out of 1,037 men who had then received degrees, 803 were reported as actually engaged in forestry. The tremendous influence of the United States Forest Service in shaping forestry education in this country is shown in the fact that from 1899 to 1915 there were 591 forest assistants appointed to that service

through civil service examinations, as shown in the table below. Of this number 273 were appointed through competitive examinations from among the graduates of a single professional school. The position of forest assistant is the lowest technical position in the service and new appointments to this position are determined by civil service examinations.

FOREST ASSISTANTS APPOINTED IN THE U. S. FOREST SERVICE FOR THE PERIOD BETWEEN 1899 AND 1915 INCLUSIVE

1899	2	1908	52
1900	2	1909	48
1901	8	1910	73
1902	13	1911	72
1903	19	1912	72
1904	42	1913	31
1905	57	1914	26
1906	35	1915	9
1907	30		
		Total	591

The universities and colleges in the United States that offer professional training in forestry granted degrees to 147 men in June, 1915. From the number of men now attending courses in forestry in these institutions it appears that a larger number will complete their training in 1916 and a still larger number in 1917. Four years ago 72 forest assistants entered the National Forest Service under civil service appointments. Since then the number of appointments has decreased with startling rapidity. Only 9 appointments to the position of forest assistant through civil service examinations were made in 1915. From 1900 to 1910 the number of yearly appointments increased from 2 to 73. It was during this period that the many schools arose and secured equipment and faculties to supply this rapidly increasing demand for professionally trained men. Although the schools are far better equipped than formerly, the rapidly decreasing demand in the public service, due primarily to the completion of the preliminary organization of the public forests, is forcing nearly all of the graduates in forestry during 1915 to seek employment in the forests under private ownership or to find places on the public forests that are also open to those without a professional training, hoping to be promoted to better positions later on. From now onward, the annual appointment of technically trained men to new positions in forestry under the national, state and lesser governmental units depends upon the rapidity with which additional public forests are established and the subdivision of present public forests into smaller and more intensively managed units. *We can not expect in the future a demand in public forestry for men with a professional training at all commensurate with the increasing supply of such men.*

Trained foresters must be willing immediately after graduation to do the work of ordinary labor and work for the same wages as ordinary labor. They must look upon this period of their life as a period of apprenticeship. Accepting this point of view, the whole question of its desirability rests with the probability of promotion after a reasonable apprentice period has passed. In the main, it must be considered a mistake for a man who has spent from four to six years in collegiate and professional training to accept a position either in governmental or private work unless it leads towards a field that will enable him to practise his profession at a remuneration somewhat proportionate to his technical ability.

The permanent labor employed in our public forests, including the position of guards and rangers, is usually recruited from among residents of the states where the forests are located and from men wholly without technical training, but with a more or less intimate knowledge of local conditions. The examination required is not technical in character. These men are

employed in large numbers and at first are, without doubt, more useful than professionally trained men unfamiliar with the locality and conditions when employed at what is ordinarily considered guard or ranger work. From amongst this army of men without professional training, many are later promoted to the position of supervisor and to other places in the higher branches of the service. These promotions are made without further examinations. There is no doubt but that qualities that lie wholly outside of technical efficiency are of fundamental importance in the appointment to the lower places in public forestry and in later promotion. When these other qualities are acceptable, however, appointment and promotion should center upon thorough technical preparation, upon an intimate knowledge of the science of forestry which can seldom be obtained except by a series of years of systematic training. Rule-of-thumb methods picked up in the woods seldom prepare a man for justifiable promotion to positions that deal with the organization and orderly development of forest property. Were this fundamental distinction between technical training and woods experience adequately appreciated in promotion, the college man with technical training could better afford at the outset of his professional career to take his place with ax and saw by the side of his non-technical competitor.

The largest present field for men immediately after completing their professional training is in private work, but here a man must prove his worth before he is given more than a workman's wage. Although four fifths of our forests are privately owned, the economic conditions that control timber prices are such that professionally trained men can rarely be employed under adequate salary, and money can seldom be expended by private owners for the sole purpose of employing scientific methods in the production of forest crops. When employed, their work must deal with methods of better and closer utilization rather than forest production. Although this field is unlimited for professionally trained men who are willing to begin at the bottom and offers the highest financial prizes for those having the requisite qualifications, *the qualifications based upon full professional training are secondary to other more fundamental ones which combined form business efficiency and business sense.* It is bad foresight to train so many men in the scientific production of forest crops that the larger proportion are later forced into farming or various commercial callings.

Although full professional training is essential in national, state and communal forestry where present expenditures are possible through public appropriations for the organization and orderly development of the forest, I seriously question whether at present it can find adequate scope in private forestry, *because the organization and orderly development of the privately owned forest can seldom be attempted under present economic conditions.* What private forestry in the United States needs is more vocational training and less professional training. A few instead of many strong professional schools, well equipped for both teaching and research, whose graduates can find adequate scope for their attainments, *should rest upon a much broader foundation of public and vocational training in forestry* than we have at the present time. It is the duty of these schools to lead in forestry investigation, the publication of technical books on forestry, and the support of technical journals.

Agriculture and forestry have close kinship. They both have to do with the production, harvesting and marketing of crops grown from the soil. They differ

chiefly in the time required for the crop to mature. Why should we not have state, county and town institutes that impart public instruction in forestry as well as in agriculture? Why should we not have instruction in forestry in certain high schools and other institutions as we now have in agriculture? Why should we not have field demonstrations for the public in forestry as well as in agriculture? Not only have we, in our heroic efforts to erect many professional forest schools, been *negligent in supplying the educational machinery for educating the public in the scientific treatment of woodlands, but we have been equally negligent in supplying the machinery for vocational training.* Although more than fifty institutions in the United States have within the past fifteen years developed more or less work in forestry education below the grade of full professional training, it has largely been without definite aim and has been poorly suited to the real needs of the country. Very little of it even approaches the requirements of the ideal vocational school. As reported by the committee on forestry education at the Fifth National Conservation Congress:

> The vocational forest school should bear the same relation to professional training that the woodshop bears to research in technology or the business school to university instruction in economics and commerce. It is analogous to the trade schools or a system of apprentice training whereby men are equipped for the skilled trades. The vocational school must, therefore, aim to teach the art or trade of forest practise, not the science of forestry.

In order best to serve the purposes of forestry education in the United States at least two thirds of the money now expended on professional training could be better spent in the instruction of the public through the organization of institutes, field demonstrations and similar methods that have been found so effective in agriculture, and in the organization of vocational schools for the training of young men in the art of forestry practise.

What does the experience of the United States in forest conservation and in the development of forestry education teach that can be useful to her sister republics? The writer believes that it teaches the following fundamental truths:

1. *The possibility of forest conservation in any republic which has for its foundation the orderly development of forest property and a sustained yield rests squarely upon organized propaganda which has for its purpose the creation of public opinion favorable to forestry*—a public opinion that is willing to make present expenditures for future welfare.

2. *The keystone in organized propaganda must be centralized in public ownership, i. e.,* absolute forest lands must, so far as present economic conditions permit, be owned by the public and managed by and for the public.

3. *Organized propaganda must continue as an indispensable part of forestry education,* even after the beginning of forest conservation has been effected through public ownership. A strong public sentiment favorable to forest conservation is the only effective weapon for keeping public forests from exploitation by those who consider public property their just prey and await every opportunity to pounce upon it.

4. *Forestry education beyond that attainable by organized propaganda for the purpose of molding public opinion should result in putting the actual practise of forestry into operation upon both public and private forests to the fullest degree consistent with economic conditions.* It can attain this end only by welding together and giving emphasis to each of the following: (*a*) Forestry education when the training is secondary to other work. (*b*)

Vocational training in forestry. (c) Professional training in forestry.

The overstimulation of professional training whereby a much larger number of men of high educational attainments and thorough technical preparation are trained than are able to find professional employment is a waste and detrimental to forest conservation. On the other hand, secondary and vocational training can scarcely be overstimulated. It is the writer's opinion that the progress made in the actual conduct of forestry operations in the woods must center in a vast army with some training rather than full professional training, whose knowledge of forestry is chiefly confined to the art of forestry so far as it concerns their own locality and who do not look for, and should not expect, a wage beyond that which the operations justify.

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ON CERTAIN RELATIONS OF THE LOWER ANIMALS TO HUMAN DISEASE[1]

ONE of the striking tendencies in modern medicine has been an increasing apprecia-

[1] Read at the Quarter-Centennial of the University of Chicago, Departmental Conference in Pathology, June 6, 1916.