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WARFARE AND NATURAL RESOURCES[1]

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THE current literature of the day is replete with vivid pictures of the tremendous struggle in which our nation is involved. Our magnificent isolation between two great oceans has vanished like a dream of the night. What our school books have called a continent is after all only an island, nearer to Europe and Asia than England was to Napoleon.

We are forced to ask ourselves, What of the future? Can we meet the demands of a new era or must we face the realization of the historian's vision that saw the decline of western lands and the passing of power to new nations?

As nation after nation fell into the hands of the plotter, we waited and watched with fatuous confidence that such things could not happen here. Rudely awakened from our dream we are bewildered by vast and urgent demands of a war front that girdles the globe and involves all nations. Confusion is the order of the day. The conflict allows of no compromise, and we are committed to the defense of our freedoms. We must win the war. Every activity, every interest must be subjected to the acid test that will decide its relations to our purposes.

Among the topics which have loomed large in public discussion, no one has demanded in recent years more general attention than that of our natural resources. What then could be more appropriate for the annual conference of the Texas Academy of Science than your program with its discussion of the relations of natural resources to war, the foremost obligation of this nation to-day.

[1] Invitation lecture at the annual meeting of the Texas Academy of Science, November 13, 1942.

The concept of natural resources has often been far too narrowly interpreted. Writers list a few things in the environment which man uses profitably and have been content to rest the case there. The nomads who ranged over these plains of Texas before the white man came might have listed its resources—if they ever cherished such a concept—as fish, food and furs. From these resources they could eke out a precarious existence and develop a simple culture for a scanty population. From those same lands the Texans of to-day have built up wealth, are supporting in comfort a large and growing population, and have a highly developed culture that is founded on resources of which the red man had no intimation. Not only that. From the record of the past fifty years, one may predict with reasonable certainty that in another half century the state will support a much larger population, with greater comfort, security and happiness than it does to-day. The student of science sees definitely that advances in the past open the way to greater achievements in the future.

Natural resources really include all the many and varied types of things found in the world about us, the living and non-living materials that nature furnishes in the vast and little understood complex we call environment. Even imperfect acquaintance with the North American continent compels one to acknowledge that it is remarkably well supplied with natural resources. Few items are entirely lacking, and most of those regarded as of vital importance are present in large amounts.

The amount of non-living resources is definitely limited. When the supply fails substitutes alone can relieve the need. No such limitation affects the supply of biological resources. The power of reproduction present in living things makes it possible under proper conditions to produce a new supply and thereby make good the inroads of the past. This power of life is immensely valuable, for it affords the only chance for future increase in the amount of resources available. At the same time it is also dangerous. Living things are easily destroyed and once a particular type has been exterminated, it can not be restored. Furthermore, when the supply of a given type of life has been reduced to low terms, the process of recovery is slow at best and to restore the type may prove impossible.

In considering the effects of war on biological resources their characteristics are all of serious import. In nature such resources are favorably or unfavorably affected by changes in the environment and as the result types of animal or plant life are held in balance, become dominant or are wiped out. Natural recovery is slow. When man enters the picture, losses are speeded up. Modern man has been called the great destroyer and in the present machine age effects marvelous changes in brief time.

Men talk in various ways about values and basic resources; but after all there is only one measure of value. Life alone counts. Without life, a world of air, water, soil, metals, fuel and all else would be meaningless to us. Natural resources acquire value only because of life and in the present world for man primarily and ultimately.[2] Conservation must be defined in terms of *human use* and that is in values for present and future needs of man. Too often in the past we have put our eyes to a microscope and focused that on the details of a tree. We have been so absorbed in such details and their analysis that we have never once thought of the forest as a living thing.

The world about us is a unit, its parts bound together by life in an all-embracing complex and so intimately related that interference at any point effects changes often unpredicted in extent and character. By the discovery of new natural resources man advantages himself and his age. He has also been able to devise more effective methods and even to create new substances. Ultimate success in the handling of natural resources demands vision as well as ability and energy.

Fate of Resources in War

The general effect of war on the natural resources of the regions and nations involved is unmistakably clear. War is a carnival of waste. The impoverishment of ancient fertile soils in Northern Africa by prolonged warfare has created the desert of to-day in which a scanty population of destitute nomads ekes out a hand-to-mouth existence. War started the process of destruction and ignorance and carelessness promoted it. Destruction of water control systems by violence, loss of fertile soils by consequent erosion, laying waste of forests, farms and cities by continued strife completed the general ruin of a once beautiful and resourceful region. History is full of such records. Conservation even in wartimes is an absolute essential.

During wars the destruction of natural resources is redoubled. Protective measures are neglected and constructive work is abandoned. Even the victor in the struggle is heavily penalized, for warfare is in fact doubly destructive. Each contestant strives to reach and destroy the most and best in the resources of his opponent, while at the same time he is expending without stint his own possessions. These expenses have grown apace as man's capacity to construct and operate machines has developed.

The fighting forces must be provided with food and

[2] This point of view has been more fully set forth in my recent book on "The Foundations of Conservation Education."

equipment no matter how the rest of the population fares. This is the correct policy; we all agree for we must win. But how tremendous the drain on the nation's resources. Even nations which firmly resolve to keep aloof from war and remain at peace may suffer none the less heavily, as witness the fate of Norway and Holland to-day.

CONDITIONS IN THE UNITED STATES

The general conditions just outlined represent in varying degree the experiences of all nations but especially those which in the Old World have been entangled in strife for centuries. It was from those peoples that men and women sought the freedom of the New World. They saw in the rich virgin territory and in the lands across great oceans relief from the ever impending destruction of lands and crops as well as homes and lives. This is our first national experience in a struggle which calls for total devotion of ourselves and all we have to the defence of our freedom. As we survey the past record of this land and its resources what do we see?

The bold adventurers who first landed on the eastern shores found dreams of wealth and ease fade fast as they fought long and hard for a victory that at times seemed none too certain. At every forward step in the conquest of the continent the pioneers paid a heavy price for their advances. Nor did they know much of the abundant resources existing in lands over which they won control. It was left for later generations to dig the mines, exploit farms and forests, harness the waters and reap rich harvests in the domain that the pioneers had bequeathed to them. For two hundred years the pioneers toiled and pinched and saved. Those who came after them have talked and promoted and wasted.

In the last century the record of our nation in handling its natural resources is a sorrowful tale. Too many of us have been content to live an easy life, ever seeking new ways to find wealth and scatter it on pleasure with little thought of the nation and its future.

No continent is so richly supplied with all natural resources that it can meet every demand that may be made upon it. Confronted to-day by extraordinary demands for war purposes, we are startled to learn that the supply of certain resources is no longer "unlimited," as had often been asserted in the past. Science is at once called upon to solve the problem.

Substitutes may be found or new methods achieve the desired result. In all such work the immense mass of detail piled up by the research of past workers is invaluable. So the nation has called into service the best talent of university and technical laboratories and sets it to work on the problems of war. New methods and new products increase the supply of natural resources and the variety of functions which they can serve. From the partial reports which have reached the public ear it is already evident that the study of war problems has yielded discoveries and inventions of great value for human life.

New processes of diverse character use wood to replace metals. At the other extreme wood products are woven into garments for winter clothing or of the delicate character of my lady's sheerest stockings. The waste of paper and pulp mills becomes basic material for making rubber. In the hands of the scientific experimenter glass is spun into fibers for the daintiest of gowns; it becomes the lightest of foams in the life-saving suit of a shipwrecked sailor or in other form serve him as a bullet-proof shield.

The pressure of wartime demands has yielded countless such extraordinary products. Under conditions of peace all of them might have been produced sometime but surely in no such brief period. Warfare is terribly destructive of natural resources but it also raises the tempo of new production. Life after the war has ended will follow new lines: it will not be anything like that in the days before the war. The nations of the earth are paying a ghastly price for these reforms. But more than ever before the return will be larger because science has been put to work.

Warfare like other periods of social disturbance affords favorable opportunities for looting the public treasury. But the endowment of the nation includes other resources even more valuable than its cast. And careful attention has not been paid to the expropriation of natural resources. Careful students have estimated that more than one half of the natural resources that the continent originally possessed has disappeared within the first two hundred and fifty years of our history.

One conspicuous example, a bad habit characteristic of our country and serious even under peace conditions, becomes even more threatening in wartimes. I refer to the pollution of lakes and streams by municipal and industrial wastes. The practise has grown with increase in population and industrial plants until it threatens not only the welfare and health of our people but even their very existence. No other civilized nation in the world gives such license to these practises as we have. Public opinion here has been indifferent probably because of ignorance and failure to recognize the problem in its true light.

In World War I stream pollution flared up suddenly like an epidemic and spread like the plague. Whole rivers were loaded with poisonous chemicals such as the waste products from ammunition plants, and the streams became foul and lifeless. Such conditions are not "inevitable," as some have said. Since

the practise has been condoned for more than a century and despite the protests of conservationists tolerated during easy times of peace, it is too much to hope that it can be corrected in the strenuous days of wartime. Yet despite all excuses that are offered for the practise, pollution is *waste*. And the country will in some future day pay for to-day's bad habits and thoughtless waste.

WHAT OF THE FUTURE?

The greatest problem of the future we face to-day is not merely the winning of the war but the condition of the world at its close. The exhaustion of natural resources has proceeded at a stupendous rate. Nations have been drained of men, money and materials.

The fate of the natural resources, usually unmentioned if not unnoticed, has a profound bearing on the future of a people and on possibilities of postwar reconstruction. History furnishes many records of change in areas where once fertile lands, famous forests and abundant water supplies were the firm foundation of prosperous and highly developed national cultures. But the armies of conquerors scourged the people and laid waste the cities. It was not the slaughter of peoples that worked the final destruction, for remnants of defeated nations or new groups have at times wandered in and built new cities on the ruins of the old. Excavations on the site of ancient Troy have demonstrated that eight cities in succession were wiped out by ravaging hordes and rebuilt later on the ruins of the past.

Earlier warfare concerned itself little with the land and its natural resources, but as time went on destruction became more widespread and intimate. To-day totalitarian warfare not only destroys life and scatters the remnant of the people but makes levies on natural resources that provide for their exhaustion. The pace of destruction in Europe has already gone to an extreme which in the past has meant abject poverty for the postwar population.

In the present war the destruction in our own country is enormous, disastrous, but not annihilating. Wisdom commands not only maximum effort and devotion to promotion of the war but also obedience to the fundamental principles of conservation. To stop work inaugurated for the protection of our natural resources, to abandon well-planned measures for their conservation will open the way to unnecessary loss at the present time and leave us at the close of the conflict without organized means of guarding whatever of these resources is left for the future. The sacrifice of plans and trained leadership is both unnecessary and unwise. The foundation of conservation is biology; the bulwark of the cause is education. On teachers of biology rests the responsibility of rebuilding their courses to fit the needs of a new era. Dry-as-dust details must be eliminated; more of life, its relations, its meaning and its needs must be introduced. Courses overburdened with technical details will never train general students to be good citizens, to understand values, to fight fads or to detect political or commercial deceit. The success and permanent progress of our country must rest on well-trained and well-balanced public opinion. That can only come through the scientific attitude and good teaching.

THE NORTH AMERICAN RAGWEEDS AND THEIR OCCURRENCE IN OTHER PARTS OF THE WORLD

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THE pollens of the ragweeds (Ambrosia) are responsible for most of the so-called autumnal "hay-fever" discomforts which allergic persons in the United States experience during August and September. In the East, the giant ragweed, *Ambrosia trifida* L., and the low ragweed, *A. artemisiifolia* L., are the two species mainly responsible for these allergic troubles. Both were originally native to North America.

The flowering period of these ragweeds extends from early August into October, and farther south may even begin in late July in some instances. The author's studies, bearing on the relation of flowering to length of day, have shown that the flowering time of these plants, as in the case of many others, depends upon particular lengths of day. After the summer days have shortened sufficiently, the flower primordia are laid down, and the continued decrease in length of day as summer progresses causes anthesis of the staminate and pistillate flowers which, in the monoecious ragweeds, are borne on the same plant. In brief, these ragweeds withhold flowering until the days have shortened to their requirements, and they have been termed short-day plants for that reason.

Length of day appears to be one of the most important factors of climate concerned with the final stature and latitudinal distribution of these plants.