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RAW MATERIALS IN WARTIME

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SPEAKER--Dr. E. Dana Durand, U. S. Tariff Commissioner . . . .

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MR. BUTTS: General McKinley and gentlemen: The subject of our lecture this morning is "Raw Materials in Wartime." Dr. Durand, who is going to give us this lecture, is one of America's best-known statisticians and economists.

For many years Dr. Durand has been actively engaged in the international field, with particular reference to commerce and industry and its problems. Since World War I he has been very active in this field of international affairs. Leading up to this war, I remember in February of 1941, when the first interdepartmental committees were formed to study the vulnerability of Japan, in particular, and other potential enemies, Dr. Durand supervised the studies that were made by those committees.

Then, only a few months later, in May of 1941, the Armed Services asked the civilian agencies to prepare studies of evaluation of the potential enemies, particularly with reference to the raw materials that went into the manufacture of airplanes and of warships. The first meeting of that committee was held in the Tariff Commission. I remember distinctly Dr. Durand's participating in it. I did not see the reports on that. Probably about three hundred worked on it. I imagine all of their contacts and records had to be marked "Top Secret," so I did not get an opportunity to see the results.

It is my great pleasure this morning to introduce to you Dr. E. Dana Durand, U. S. Tariff Commissioner.

DR. DURAND: Gentlemen, I really do not know whether I should begin, as I have noticed they sometimes do in England, with naming the highest ranking officer first, then the next highest, and so on down, so I shall simply say, "Gentlemen and officers."

I am going to talk in a very broad way about raw materials in their relation to war. You probably would find it more interesting if I took up very major individual articles--petroleum, for instance--and discussed them. But you have had, or will have, special lectures from various experts on particular articles. I think it will be of some value, at least, if you try to look at the picture in a broad way. A good deal that I shall say is in the nature of the self-evident. Perhaps it will not contribute a lot to your knowledge, but it may help you a little bit in thinking along these lines even when you are thinking about some particular commodity rather than the general picture.

As you Army and Navy officers know far better than I, possible use of the atom bomb and of biological means of mass destruction may entirely change the nature of future wars, if wars there must be. Conceivably, the raw materials which will most concern us hereafter, from the standpoint of national defense, will be the fissionable materials. Interest in wartime supplies of commodities in general, both for the armed forces and for the civilian population, may wane. Despite these possibilities, it is doubtless still worthwhile to discuss raw materials in their relation to national defense, on the assumption that problems of supply in any future war will be at least somewhat similar to those encountered in the war just ended.

The major raw materials, with which we include raw foodstuffs, are so numerous, and the conditions surrounding their production and use are so complex, that any adequate discussion of the subject would require many hours. In the limited time of this talk, only very broad statements can be made, and many qualifications which strict accuracy would require must be disregarded. Even so, it is impossible to discuss significantly raw materials in general. If time will not permit one to take up separately the principal individual materials, one must at least group materials into classes which possess some degree of homogeneity as regards their economic and military aspects.

I suggest the following six groups:

1. Foodstuffs, including certain fats and oils which are extensively used for soap and other industrial purposes as well as for food.

2. Textile materials.

3. Wood materials.

4. Mineral fuels.

5. Other nonmetallic minerals.

6. Metals.

These six groups differ from one another in ways which are significant from the standpoint of national defense. Among other respects, they differ as regards (a) the extent to which war increases the national requirements, military and civilian combined; (b) the extent to which civilian consumption can be cut down in wartime in order to permit larger military consumption; (c) the geographic distribution of world resources, and the consequent extent to which any given country is able to supply its own requirements or is dependent on imports; (d) the rapidity with which

production can be expanded in case of necessity; and (e) the possibility of stockpiling. I shall take up the six groups one after the other and discuss them from these points of view. It should constantly be borne in mind, however, that certain of the groups, notably the foodstuffs group and the metals group, include a large number of individual commodities, and that some of these commodities differ materially from others in the group with respect to the points above mentioned.

A. Materials for food and related uses

By far the most essential one thing in the consumption of a nation, whether in peace or war, is food. If a country is largely dependent on imports for its food supply, it is extremely vulnerable in war. However, relatively few countries are dependent in any considerable measure on imports for their requirements of essential foods. This relative self-sufficiency has arisen during the long course of history from the fact that populations have naturally tended to settle principally in areas where food sufficient for their requirements could be produced. Lands with favorable soil and climate for agricultural production have been first settled and have continued to be the principal centers of population. However, a few countries, which possess good agricultural resources, sufficient to support a considerable population, have during the past two centuries--the age of mechanical power--developed great manufacturing industries, and have so expanded their population that they must import a large fraction of their food requirements, paying for them principally by exportation of manufactured goods. The most conspicuous of these countries is the United Kingdom. Among other leading nations which have become dependent to an important, but somewhat smaller degree, on imports of food are Germany, Belgium, Italy, and Japan. The United States is singularly self-sufficient in food supply. It is true that we import many millions of dollars' worth of foods, but most of these (coffee, for example) are not basic necessities.

Fortunately for any warring nation, the requirements for foodstuffs are increased relatively little by war. The armed forces consume appreciably more food per capita than civilians, but the armed forces are only a small part of the total population. Moreover, if a country's standard of living as regards food is high, as in the United States and the United Kingdom, it is possible to cut down the consumption of the civilian population materially in wartime, and particularly to lessen the consumption of luxury foods, thus making room for the expansion of the production of necessities. However, countries with lower living standards may be forced by war to cut down severely the civilian consumption even of the more essential foodstuffs.

The possibilities of expanding food production in wartime vary greatly in different countries, depending principally on the density of their population. The United States with its high ratio of agricultural resources to population is in a fortunate position from this standpoint. Germany, Japan, and Italy are major countries at almost the opposite extreme. The Soviet Union has immense agricultural resources, but, contrary to popular opinion, the ratio of those resources to the number of inhabitants is much less favorable than in this country.

Broadly speaking, animal products require both more land and more labor per unit of food value produced than the basic vegetable foods such as cereals and potatoes. A given quantity of vegetable products fed to animals will produce far fewer calories for human consumption in the form of meat, milk, butter, cheese, or eggs than the same vegetables eaten directly by human beings. It is for this reason that few important countries consume as much animal food as the United States; the only others comparable in this respect are Argentina, Canada, and Australia. The British are heavy eaters of animal products only because they are normally able to import them in large quantities. When war puts pressure on food supply, there is naturally a tendency to lessen the proportion of animal products in the diet. Moreover, the production of vegetable foods can be increased somewhat more promptly than that of animal foods, although the production of hogs can be expanded quite rapidly if the feed for them is available.

As far as I am aware, no country has ever attempted to build up large stock piles of food with a view to meeting war requirements and forestalling a possible shutting off of imports by military operations. Such cereals as wheat, rye, and rice (the same is less true of corn) can be stored for long periods, but many other vegetable foods, and practically all animal foods, are decidedly perishable, although modern methods make it possible to store frozen meats for considerable periods. At any rate, the United States has no occasion to be interested in the stockpiling of foodstuffs from the standpoint of national safety.

As already stated, one important group to be classed with foodstuffs consists of certain animal and vegetable fats and oils which are used largely for soap and other industrial purposes as well as for food. These fats and oils constitute the only important class of products in the foodstuffs group of which the United States in peacetime imports more than it exports. The late war largely cut off imports of these articles and resulted in a considerable shortage of both cooking fats and soap. We were able, however, to expand domestic production quite rapidly, particularly that of peanut oil and soybean oil. Some of the countries engaged in World War II, notably Germany, suffered greatly from shortages of fats and oils; soap became a very scarce article. This situation is as yet far from being fully relieved.

B. Textile materials

The principal natural, as distinguished from synthetic, textile materials are, of course, cotton and wool, although flax, jute, and those hard fibers used principally for cordage, twine, and related purposes are of considerable importance. Unlike foodstuffs, war brings about a very considerable increase in national requirements for textile materials, especially if the armed forces, as were our own in the late war, are supplied liberally, one may almost say extravagantly, with clothing and other textile equipment. It is, however, possible, to a far greater degree than with foodstuffs, to cut down civilian consumption of textiles; people can use their clothes and other textile articles longer and can cut out much unnecessary consumption.

The production of the principal textile materials is far less widely distributed in the world than that of foodstuffs. Cotton requires special climatic conditions. Only a few countries are large producers. Sheep can theoretically be raised in any agricultural area of temperate climate, but in practice land cannot profitably be devoted to this industry in densely settled countries or sections. Wool production is largely confined to the semi-arid range areas of the world, principally in western United States, Argentina, Australia, New Zealand, and South Africa. Most countries have to import a large part of the textiles which they use, in the form either of raw materials or of manufactured goods. Although the United States produces more wool than any other country except Australia, its consumption is so enormous that it is a heavy importer not only in wartime but also in those times of peace when prosperity is high. Just now four-fifths or more of the huge wool consumption of this country, which is far larger than before the war, is being supplied by imports. One of the difficult wartime problems of the United States was to keep open the shipping lanes for bringing wool from distant lands. A special problem of no little importance also arose in regard to the hard fibers, particularly, by reason of the inability to obtain abaca from the Philippines.

The textile fibers are substantially imperishable and lend themselves readily to stockpiling. It is probable that Germany built up large stocks of cotton and wool in anticipation of the late war. The United States, which normally exports a large fraction of its cotton crop, had in the pre-war years heavy Government-owned stocks of cotton which had been taken over by the Government as a means of supporting the price to the farmers. At present those stocks of cotton have been substantially exhausted because of the small crops of the past 2 or 3 years, but there is no reason to suppose that the United States Government will ever find it desirable to acquire stocks of cotton merely as a military safeguard, though it may do so as part of a price-support program. On the other hand, the situation with regard to wool may at some time in the future be such that a stock pile should be created as a defense safeguard. Just at present, however,

stocks of wool in the United States and in the world as a whole are very large, by reason of the stimulation of production by the United States and the British Empire during the war, and the problem is to liquidate these stocks without injury to the producers.

Modern research has developed synthetic textile fibers which can be produced from various raw materials such as wood pulp, coal tar, and casein (a byproduct of milk). These synthetic fibers, of which rayon is at present the most important, can be produced by a country which is shut off from supplies of natural fibers by war, provided it has the basic materials which enter into them. These synthetic textiles have been rapidly increasing in importance in the United States throughout the past two decades. During the war this country was under no pressure to expand their production more rapidly than would have occurred under peace conditions, but Germany, Italy, and probably also Japan were compelled to resort to far greater use of these substitutes. In any future war synthetic fibers may again be of importance as substitutes for natural fibers except in those countries which produce or are able to import adequate quantities of the natural fibers themselves.

C. Wood and its products

The principal products of the forests are timber and lumber and various forms of paper. During war there is a strong demand from the armed forces for timber and lumber for construction of cantonments and other buildings and for packaging. There is also strong military demand for cardboard and paper for packaging. In order to meet military requirements for timber and lumber a warring country is likely to find it necessary to reduce greatly the civilian consumption; the United States did so during the late war and the consequent deferment of residential and other construction is creating at the present time an abnormally great demand for these materials. It is also possible in wartime to restrict the civilian consumption of paperboard and paper, although comparatively little was done in that direction in the United States during the late war. In a country which has adequate quantities of standing timber, production both of lumber and of paper can be increased rather rapidly during wartime, provided manufacturing facilities already exist, but, of course, such expansion is at the expense of depleting future supplies. The cutting of trees in this country during the war was, and at the present time is, at a more rapid rate than is desirable from the conservation standpoint.

Although most important countries of the temperate zones are able to produce good forests, land in many of them is so much needed for agricultural purposes as to prevent self-sufficiency in the production of lumber and paper. Various countries, therefore, notably the United Kingdom, Germany, and Japan, are normally importers of these products, and war may so cut down imports as to necessitate sharp restriction of consumption. The United States has very large areas in forests but its consumption of forest products is so great that it is normally a heavy importer,

principally in the form of wood pulp and newsprint paper (four-fifths of our current consumption of newsprint is imported). Our imports of pulp and paper from the Scandinavian countries, which were considerable before the war, were shut off by it, but our neighbor and ally, Canada, always the largest source of imports of wood products, was able to maintain and perhaps somewhat to increase its shipments to this country. Shortage of wood products is a conspicuous feature of the present economic situation in the United States.

It would scarcely be economical to build up stockpiles of lumber or paper in anticipation of a national emergency. The best form of reserve is that of standing timber. From the economic standpoint, moreover, it would scarcely be profitable, merely for the purpose of forestalling a future emergency, to provide more capacity of sawmills and pulp and paper mills than is needed for peacetime requirements; as a matter of fact, however, our mill capacity in the past has been large enough to permit a material expansion of production in wartime.

Conservation in the methods of cutting forests and in consumption of wood products is obviously desirable in the interest both of meeting possible future emergencies and of maintaining adequate peacetime supplies of lumber and paper.

D. Mineral fuels

Next to the basic foodstuffs the mineral fuels are perhaps the most important raw materials from the standpoint of national defense. Expansion both of rail transportation and of manufacturing industry to meet a war emergency calls for abnormally large coal consumption. Still more imperative is the wartime demand for petroleum. Whereas before the war only a small fraction of United States consumption of petroleum was for military purposes, during the war nearly one-third of the much larger total consumption was for these purposes.

Fortunately there is much leeway for cutting down civilian consumption of mineral fuels, particularly petroleum, in wartime. People can do with less heat in their homes and with far less use of automobiles for non-essential purposes. Even in the United States, with its enormous output of petroleum, we found it necessary during the war sharply to restrict non-essential consumption. In such countries as the United Kingdom, Germany, France, and Japan civilian consumption was cut down far more than here.

As with most other minerals deposits of coal and petroleum are very unevenly distributed through the world. Some countries have abundant deposits and are normally exporters; others have very limited or no deposits and must rely mainly or wholly on imports. Coal is so bulky in proportion to its value that in peacetime the movement from one country to another is relatively limited, the most important exception

being the large shipments from the German Ruhr District to other European countries (formerly the United Kingdom was an important exporter, but this is no longer true). On the other hand the international trade in petroleum is normally of immense magnitude. The heaviest movements before the war were from Venezuela and the Middle East to Europe and from the Dutch East Indies to Japan. The United States at that time exported about one-tenth of its production, but it also imported considerable quantities, geographic convenience being the explanation of this double movement; at present imports roughly equal exports. The United Kingdom, which has practically no petroleum deposits, was able by strenuous efforts to maintain essential imports under war conditions. Germany, which also produces little natural petroleum, during the war expanded greatly its output of synthetic liquid fuels derived from coal, of which it has abundant deposits. Japan, by its seizure of the Dutch East Indies, was able for the time being to meet its wartime increase in petroleum requirements, but when the United States Navy gradually shut off the shipping lanes and destroyed the tank vessels Japan's shortage of petroleum was one of the major contributing factors in her defeat.

Both petroleum and coal are so bulky that to attempt to stockpile sufficient quantities to meet a prolonged emergency would scarcely be an economical procedure. Moreover, they both deteriorate in quality when stored for long periods. On the other hand, if a country has large deposits of these minerals, production can soon be increased considerably when necessary, although of course at the expense of depleting the supplies for future generations.

Army and Navy men are taking a strong stand as regards the conservation of the petroleum reserves of this country. Although the United States probably had at the outset larger deposits than any other country (Russia may have been a close second), and possibly possessed as large deposits as the entire group of countries which we call the Middle East (though this is doubtful), we have already dipped deep into those reserves. No one can foresee with any degree of certainty what new fields may be discovered in this country, but there is much reason to believe that the rate of discovery will be lower in the future than in the past. Meanwhile, Venezuela has still very large reserves, the Middle East has unquestionably enormous reserves, and various other areas of the world which have been explored but little for petroleum may become important producers in the future. It is for these reasons that Army and Navy men quite generally favor increased importation of petroleum into this country. The subject is a complex one from the economic and standpoint and one could well devote an entire lecture to it; moreover a frank discussion might involve some embarrassment in view of controversial political issues. Some of you may be interested, if you have not already done so, in reading the recent report of the Tariff Commission on petroleum.

As regards coal, the largest producing countries still have reserves for hundreds if not thousands of years, but wasteful methods of mining and wasteful use of coal should of course be carefully avoided.

E. Other non-metallic minerals

No other non-metallic mineral approaches the mineral fuels in military importance. One cannot generalize about this group, since the individual materials differ greatly as to conditions both of consumption and production. Some of these minerals, although total world production is small in quantity and value, are nevertheless highly strategic in character. Notable examples are mica and industrial diamonds. The production of most of the strategic minerals of this group is largely concentrated in a few countries which are distant both from the United States and from Europe; military requirements of the leading nations must, therefore, be supplied chiefly by imports. Mica and industrial diamonds are so high in value in proportion to their weight that they can be transported by air, a circumstance which lessens the possibility of interruption of supply by enemy action. Moreover, most of these strategic materials lend themselves readily to stockpiling.

F. Metals

Metals are of major importance in war equipment. Ships, airplanes, trucks, tanks, and ordnance are among the many articles which are made chiefly or wholly of metal. Expansion of factories making war supplies also requires great quantities of metals. For most, if not all metals, national requirements in wartime are much greater than in peacetime. Military consumption increases enormously. Fortunately, it is possible to cut down materially civilian consumption of metals greatly when this becomes necessary. People can get along with far fewer new "consumer capital goods" than they would buy under peace conditions. During the late war, the United States Government rigidly restricted consumption of metals for civilian purposes. The deferred civilian demand which resulted is now causing shortages of all the principal metals.

From the standpoint of war requirements, the most significant thing with respect to metals is the supply of ores. If a country has adequate facilities for smelting ores and manufacturing them into more advanced products, it can supply war requirements provided the ores are available. International trade in metals is normally large; since there is much waste in the conversion process the tendency is to import crude smelted metals, or metals still further advanced, rather than ores.

As in the case of the mineral fuels and other important nonmetallic minerals, the distribution of the deposits of metallic ores in the world is extremely irregular. No country has adequate deposits of all the

metalliferous ores; probably Russia outranks the United States in the variety of mineral deposits, and certainly the United States outranks any other country except Russia. Most countries, therefore, have to import several or many of the metals. War may interfere very greatly with such importation and create major problems for the warring countries. To a limited extent one metal may be substituted for another when shortages arise, but there are close limitations on such substitution.

The variety of deposits of metal-bearing ores in any given country naturally tends to be proportional to the area of that country. The United States has large deposits of most metals, but even of some of those of which it has deposits the domestic production during the late war was quite inadequate for the huge requirements. Consequently, we imported (largely on Government account and without duty) abnormally large quantities of copper, lead, and zinc. Moreover, there are several metals of material importance which are lacking in the United States or which can be produced here only at excessive cost. These include manganese (a necessary ingredient of steel), nickel, and bauxite. Of bauxite, the principal material used for aluminum, our deposits are approaching exhaustion, and the production of aluminum from various clays is unduly costly. During the late war the United States encountered considerable difficulty in obtaining manganese and bauxite, which are imported chiefly from overseas' sources, but its supplies of nickel, which come chiefly from Canada, were readily obtainable.

Army and navy men commonly lay great stress on the conservation of our metallic resources. There is little danger that this country will be short of iron ore for a long time to come, though it will doubtless have to resort more and more to the use of low grades of ore involving more expensive processing. On the other hand, our reserves of copper, lead, and zinc have already been so depleted that imports are likely to supply an increasing proportion of peacetime consumption in the future. It may be good public policy to favor imports of these metals rather than to speed the depletion of our own deposits. It should be borne in mind, however, that conservation is a complex matter. Undiscriminating restriction of domestic production, whether by compulsory measures or as a result of low prices brought about by the competition of imports, may result in wasteful methods of mining. Such methods may leave ores in the ground incapable of future recovery.

Practically all of the metals can readily be stock piled, either in the form of ores, or usually more economically, in the form of extracted metal. In instances where imports may be shut off by war and where domestic production cannot be promptly increased, even by Government subsidy or bonus prices, the building up of stock piles would seem to be a desirable safeguard of national security.