Burton, I. and R. W. Kates, 1964, "Slaying the Malthusian Dragon: A Review", Economic Geography, Vol. XL, No. 1, January, pp. 82-89.

SLAYING THE MALTHUSIAN DRAGON: A REVIEW

Ian Burton and Robert W. Kates

Ian Burton is Assistant Professor of Geography at the University of Toronto. Robert Kates is Assistant Professor of Geography at Clark University.

A NEW weighty triad of books[1] marks a culmination of ten years' work by the staff of Resources for the Future, Inc. A dominant theme of the work is the inapplicability of the Malthusian hypothesis to twentieth century America.

An attempt is made to answer three questions which are rarely raised by conservationists and never, to our knowledge, subjected to rigorous analysis. The three questions are as follows:

1. What can we learn from the record of the past about the amount of effort which has been necessary to make usable commodities out of natural resources? More specifically, how have the Malthusian and Ricardian doctrines of increasing resource scarcity been translated into increasing real costs of resource commodities?
2. In the light of the answer to question one, what economic theory of natural resource availability (scarcity or abundance) is appropriate to our own times and to the foreseeable future? More specifically, what are the implications of such theory for the broad problems of resource management?
3. What will be the nature of the future demand for resource commodities and what is the capacity of the resource base to meet such demands? More specifically, will Malthusian or Ricardian scarcity affect the United States in the remainder of the present century, and, if so, how and to what extent?

[1] *Trends in Natural Resource Commodities*, by Neal Potter and Francis T. Christy, Jr. ix and 568 pp., tables, graphs, sources. Johns Hopkins Press for Resources for the Future, Inc., Baltimore, 1962, $17.50. 13 x 9½ inches.

Scarcity and Growth: The Economics of Natural Resource Availability, by Harold J. Barnett and Chandler Morse. xv and 288 pp., tables, graphs, ills., index. Johns Hopkins Press for Resources for the Future, Inc., Baltimore, 1963, $5.50. 9¼ x 6¼ inches.

Resources in America's Future: Patterns of Requirements and Availabilities 1960–2000, by Hans H. Landsberg, Leonard L. Fischman, and Joseph L. Fisher. xx and 1017 pp., tables, graphs, ills., index. Johns Hopkins Press for Resources for the Future, Inc., Baltimore, 1963, $15.00. 10 x 7¼ inches.

The Lesson of Ninety Years

The Potter and Christy volume answers the first question optimistically. An examination of the prices of resource commodities (both in deflated dollars and in actual inputs of labor) reveals a downward rather than an upward trend. The Malthusian view is so "oversimplified" that it is completely wrong. The data presented do not prove, but do strongly support the notion that "technology can overcome increasing shortages of natural resources ad infinitum" (p. 1). The data include annual series of prices, employment/output ratios, output per capita, and consumption per capita for over a hundred resource commodities from anthracite to zinc, for the period from 1870 to 1957.

In general, the authors prefer to avoid

drawing conclusions from their data although the ideas reported above are strongly implied. They prefer to offer "statistics which have been ordered, simplified and clarified." This claim is relatively true. It should not be interpreted in any absolute sense. The statistics are ordered but they are not simple, nor in all cases are they clear. We found frequent use of a ratio scale confusing and we would have found greater use of bar graphs more appropriate to presentation of some of the data. Many graphs show trend lines between two points as a straight line, although there is evidence elsewhere in the book to the contrary.[2] The major achievement of Potter and Christy is to bring together from widely scattered sources (all documented in detail) a huge body of statistical information. The contradictory figures have been reconciled and gaps in data filled to present for the first time for any country a long-term series for the principal economic aspects of major natural resource commodities.

The volume should be one of the first places to check for the excellent sources and notes for anyone engaged in research in the geography of natural resource commodities.

THEORY OF NATURAL RESOURCE AVAILABILITY

Using the Potter and Christy work as a basis, Barnett and Morse have proceeded to erect a theoretical statement of the economics of resource availability. They examine in some detail the doctrines of increasing resource scarcity, and, in the light of evidence taken from *Trends in Natural Resource Commodities*, they reject them. It is concluded that, while "the struggle of man against nature . . . endures as a continuing reality" (p. 246) and problems increase in complexity with time, "no empirically supportable prediction of the outcome can be made" (p. 246). On the basis of theory, however, buttressed by the experience of the last ninety years, it seems that "output per capita . . . may conceivably increase into the indefinite future, and eventual overcrowding is by no means a foregone conclusion" (p. 246). This is an answer to the neo-Malthusian school of "gloom and doom" (W. Vogt, K. Sax, A. Stewart, Fairfield Osborn, and others). It is an answer qualified only by the limits and inadequacies of data, and by the theoretical assumptions made. It is a convincing and persuasive argument. Proof it is not, nor is it claimed to be. The prospect opened before us by Barnett and Morse is that of a progressive world where production and prosperity will continue to increase indefinitely. "Higher production today, if it also means more research and investment today . . . will serve the economic interest of future generations better than reservation of resources and lower current production" (p. 247); and thus there is "no need for a future-oriented ethical principle to replace or supplement the economic calculations that lead modern man to accumulate primarily for the benefit of those now living" (pp. 247–248).

Thus, the answer to the second question is that if we would take care for the morrow, we should not try to "create a better intertemporal distribution of welfare by deliberately transferring productive capacity and output from the present to the future" (p. 250). However, we should do the best we can for our own welfare and, in so doing, rest easy in the knowledge that we are also doing the best for our successors.

The foregoing conclusion is welcome as a serious refutation of the misuse and abuse of the diminishing-returns-to-

[2] For example, tobacco prices in Chart 4 (p. 4) as compared with Chart 56 (p. 23).

land argument that has been long used for a prop to much neo-Malthusian dialectic. However, as we take stock of world economic problems, we can think of no immediate situation, except in the case of some agricultural commodities, where decision-makers in economic planning advocate the curtailing of present production. The relevant argument as observed from the safety of our geographic corner seems to lie in the mix of production rather than the time path of its quantity. Most relevant for the underdeveloped world is the question of capital or producer goods versus goods for immediate domestic consumption. Here the question is very much one of postponing consumption today for increased future production. Even with the built-in capital-generating mechanisms of our own economic arrangements, we can ask with J. K. Galbraith, "How much should a country consume?" and take to heart his desire for the

> . . . shifting of consumption patterns from those which have a high materials requirement to those which have a much lower requirement. . . . Education, health services, sanitary services, good parks and playgrounds, orchestras, effective local government, a clean countryside, all have rather small materials requirements. . . . A variety of forces, among them the massed pressures of modern merchandising have forced an inordinate concentration of our consumption on what may be loosely termed consumer hardware. . . . A rationalization of our present consumption patterns . . . might also be an important step in materials conservation.[3]

Specifically, for resource management, a most relevant question is one that inquires as to the role of natural resources at various stages of economic development. It is well known that the role changes. A greater understanding of this would have profound implications both for investment in the development of natural resources in underdeveloped countries and for an assessment of conservation needs in developed countries.[4]

Barnett and Morse recognize that their data add little to our knowledge of the changing quality of life. The scarcity problem may be a myth, but there are problems associated with the quality of resources and the quality of the natural and cultural environments which cannot be viewed with complacency. They need study, improved social evaluation and decision-making procedures, and even more—clearer understanding of the value-judgments involved. The classical economists saw the main obstacle to the process of growth as residing in nature; Barnett and Morse see the obstacles now as principally residing in man. Success is not certain, but it is certain that failure cannot be ascribed any longer to forces extraneous to man. The burden on him is therefore that much greater. He is the master of his own destiny. Failure will always be deserved failure.

THE OUTLOOK FOR FORTY YEARS

With this background Landsberg, Fischman, and Fisher attempt to answer the third question: What of the future? As such, the book is a worthy successor to several other major efforts at assessing resource availability in the post-war period. Outstanding among these are the Paley Commission Report (1952)[5] and the Twentieth Century Fund Study by Dewhurst and Asso-

[3] J. K. Galbraith, "How Much Should a Country Consume?" in H. Jarrett, Editor, *Perspectives on Conservation: Essays on America's Natural Resources*, Johns Hopkins Press for Resources for the Future, Inc., Baltimore, 1958, p. 99.

[4] For an interesting discussion of the role of natural resources in economic development see J. J. Spengler, Editor, *Natural Resources and Economic Growth*, Resources for the Future, Inc., Washington, 1961.

[5] President's Materials Policy Commission, *Resources for Freedom*, 5 vols., Washington: G.P.O., 1952.

ciates (1947, revised 1955).[6] In addition, there is the earlier report issued at the inaugural conference of R.F.F., the Mid-century Conference on Resources for the Future (1954).[7]

The latest R.F.F. study does not attempt to make specific proposals for action. It does present evidence, make projections, and indicate where problems are likely to arise. The over-all conclusion is in agreement with *Trends in Natural Resource Commodities* and *Scarcity and Growth* in that it is again emphasized that "there is no general resource shortage problem for the balance of the century," although this conclusion is made only for the United States and "cannot be extended automatically to other countries" (p. 11).

Studies of this kind become more and more exercises in the art of graceful projections, and this one has its share (see below). Projections of population, labor force, and G.N.P. are used to indicate the general pattern of things to come. Current trends in consumption are then projected on a per capita basis, modified where appropriate by what is known about changing patterns of consumption and the progress of technology (see Table I of this review for examples of demand derivation). Future needs are thus estimated and related to future availability. In this way, future problems are recognized where demand seems likely to impinge upon or exceed supply. Here again an optimistic view is stressed. "The problems are not formed in fear of running out, or of not having enough to support a rising level of living. The idea is, rather, that through long-range demand and supply projections future resource problems can be anticipated and dealt with through policy and management in an orderly way rather than through emergency action later on" (p. 53).

TABLE I

TYPES OF RESOURCE DEMAND PROJECTIONS[a]

1960 = 100

Economic Projections

	Population		*Labor force*		*G.N.P.*	
	1980	*2000*	*1980*	*2000*	*1980*	*2000*
Low.....	126	149	134	167	191	333
Medium.....	136	184	140	194	210	436
High.....	155	240	149	240	240	653

Future Consumption Levels

	Wheat		*Apparel*		*Passenger miles*	
	1980	*2000*	*1980*	*2000*	*1980*	*2000*
Low.....	91	91	139	183	166	260
Medium.....	111	135	165	270	193	357
High.....	135	205	196	396	235	513

Derived Resource Demand

	Petroleum		*Lumber*		*Municipal water (withdrawal)*	
	1980	*2000*	*1980*	*2000*	*1980*	*2000*
Low.....	138	222	89	84	156	214
Medium.....	167	314	168	264	175	275
High.....	210	501	253	578	204	370

[a] Source: Various projections in *Resources in America's Future*, converted to index numbers from original commodity measurement units.

The book contains three major sections: over-all future consumption requirements, the demand projections by commodities, and a review of the adequacy of the resource base. These occupy the first 496 pages and include over 200 figures and tables. The second half of the volume comprises appendices to 17 of the 21 chapters, containing detailed tables, sources, and discussions of the projection techniques used.

[6] J. Frederic Dewhurst and Associates, *America's Needs and Resources*, Twentieth Century Fund, New York, 1947.

[7] Resources for the Future, *The Nation Looks at Its Resources. Report of the Mid-Century Conference on Resources for the Future*, Washington, 1954.

Without going into details on the projections for all commodities, we can nevertheless discuss some major findings of the study. In terms of land resources, there appears to be a surplus of cropland at least to 1980, and there is sufficient land which can be transferred from agricultural uses to satisfy the growing demands of non-agricultural land. In qualitative terms, the transfers are not likely to be of the most desirable kind. High quality cropland will be lost to urban sprawl in greater amounts than land which is now "idle" or used for low-yield, dry-wheat farming.

The demands on our water resources will increase at least as fast as our population. By the year 2000, irrigation may increase by one-half, municipal use may double, and industrial use quadruple. The East has sufficient potential water resources and here the major problem will be low-flow regulation for pollution abatement. The West will face in localized areas critical shortages that will require shifts both in use and supply. In this region, projected withdrawal depletions might average, by the year 2000, 60 per cent of the maximum available water supply and far exceed the present dependable flow.

The demand for energy from all sources is expected to triple by the end of the century. Through the seventies, the present mix of energy sources is viewed as adequate. Toward the end of the century the patterns of supply will include a major component of nuclear energy and a decline in oil and gas. However, no major difficulties are foreseen in meeting our energy needs over the next forty years.

Among the non-fuel minerals, the adequacy of the supply of metals is held in doubt, without access to the world's markets and improving technological recovery. As there is no reason to assume a situation of blocked access or limited technology, the long-run outlook appears hopeful.

The only major resource commodity for which the supply outlook is not good is that of timber products. According to past trends, real costs have risen over time. The outlook for the future does not foresee any reversal of this trend.

It is impossible to review adequately all aspects of such a massive study in a commentary of this kind. We can see only two ways in which justice can be made to appear to be done. The first is to compare the estimates made with those from similar projections. A second approach is to examine in some detail an area or areas in which the reviewers have specialized knowledge.

The authors themselves have largely pre-empted the first approach, and have in most commendable fashion inserted references and comparisons to relevant studies. Thus, there are comparative references to such earlier work as the Paley Report[8] and to other specialized studies of particular resources. In making comparisons of our own, we note that the population for the year 2000 is projected to a range from 268 million up to 433 million. Recent estimates by the Outdoor Recreation Resources Review Commission put the low and high figures at 295 million and 384 million respectively.[9] Highly regarded estimates by the National Planning Association, supplied to the O.R.R.R.C., foresee by the year 2000 a population of 350 million, a civilian labor force of 135 million, and a gross national product of 2,007 billion dollars.[10] These figures may be compared with the medium projection of the R.F.F. study of a population of 331 million, a labor force of 142 million,

[8] President's Materials Policy Comm., *op. cit.*
[9] Outdoor Recreation Resources Review Commission, Study Report No. 23, *Projections to the Years 1976 and 2000*, Washington: G.P.O., 1962, p. 10.
[10] *Ibid.*, pp. 120 and 132.

and a gross national product of $2,200 billion.[11] Details of the projections vary. For example, the medium projection of the R.F.F. study implies that a larger proportion of the population (43 per cent as opposed to 39 per cent) will be in the labor force. In general, however, the estimates are close. They foresee increases of the same order of magnitude. This is to be expected, for they make the same basic assumptions of no general war, no prolonged depression, and continued high employment. Such variation as exists is symptomatic of the art of projection making. Although some of the R.F.F. estimates on specific commodities are lower than those made elsewhere, this is by no means always the case. Estimates of the amount of cropland in 1980 range from 270 million acres (extreme low) through 368 million acres (medium) to 490 million acres (extreme high).[12] By comparison, the latest U.S. Department of Agriculture estimate of 326 million acres is low.[13] Problems in harmonizing figures from different assumptions, however, make comparisons of this kind difficult.

Typical of the contrasts in projections provided by the authors themselves is the projection for 1980 electric power demand (p. 280); here, R.F.F. is consistently below industry estimates by as much as 20–25 per cent; yet it is within 3 per cent of an independently made Federal Power Commission projection.

In turning to the second approach, we have examined some of the important assumptions underlying the estimated demand for water. Demand for this resource commodity is not to be interpreted in conventional economic terms. No one knows what the demand for water is, *i.e.*, the amounts of water that are demanded or would be demanded at various prices. Water "demand" for the base year 1960 is really an estimate of the amount of water actually supplied. Similarly, projected water "demand" for the year 1980 is really that amount of water expected to be supplied given various assumptions. These assumptions are highly significant in an interpretation of the findings. Six of the more important ones are as follows:

> To provide a meaningful comparison of demand with supply in the absence of a national market for water, we have for purposes of this study divided the nation into three major regions each of which has certain supply characteristics in common (p. 259).
>
> . . . projections of population and industrial growth have been allocated among the three water supply regions (p. 262).
>
> . . . technological and managerial advances would result in moderate increase in efficiency of water use for thermal-electric power and agricultural purposes. However, major technological breakthroughs have not been anticipated (p. 262).
>
> . . . no significant changes in public policy which would influence future use are assumed (p. 262).
>
> . . . the projections assume in general the present level of water supply costs. No effort has been made to take into account possible price elasticities of demand for water supplies (p. 262).
>
> . . . factors affecting depletion per capita (in municipal use) will about cancel out (p. 263).

The regional breakdown is most unsatisfactory as the authors recognize. The three regions are defined as the West (approximately the 17 western states excluding the Pacific Northwest), the Pacific Northwest, and the East. The authors have chosen not to compound the errors of their basic economic

[11] Landsberg, Fischman, and Fisher, *op. cit.*, p. 71.
[12] *Ibid.*, p. 349.
[13] U.S. Department of Agriculture, *Land and Water Resources. A Policy Guide*, Washington: G.P.O., 1962, p. 39.

projections by regional disaggregation, at the cost of obscuring substantial geographic variation in the patterns of water supply and demand. In so doing they reject the regional projections which Resources for the Future provided for the Senate Select Committee on National Water Resources.[14] Due to these limitations, there is clearly not much in this volume for the geographer concerned with the spatial aspects of resource commodities.

The assumptions made apply only to withdrawal uses of water for municipal, industrial, and agricultural use. The unknowns are so great that the authors discuss, but do not attempt to project, flow uses for power, navigation, sport fishing, waste dilution, or on-site uses for wildlife and land-use practices.

Even the limited range of assumptions confined to withdrawal uses provides major challenges for research into patterns of water use. One safe prediction that can surely be made is that most of these assumptions will have been proved invalid by the year 2000. Major technological developments will occur. Significant shifts in public policy will take place. Water costs for some uses will rise in real terms. There is even the chance that a price structure with elasticities will be evolved. The authors are aware of all this. They indicate at frequent points in the text their wide knowledge of future possibilities. They are caught in the prison of their own assumptions, however; these, in accord with common practice, are largely *status quo* assumptions. In other words, they assume that things will change, but only in the way and at the speed that they are now changing.

Of course, the authors really have no choice. If they rejected the *status quo* type of assumption, they would find themselves in the shifting sands of a land with no signposts to the future. Thus, if there are ten major technological innovations on the horizon, there is no way of detecting the reality from the mirage. Nor is it possible to know which one of a dozen major governmental policies will be changed, and for what uses costs will rise or fall. To make projections for all the possible combinations of such a wide range of possible assumptions would not only be prohibitively expensive, it would also be an exercise in futility in which the answer comprises a list of all possible answers.[15]

We have no solution to this epistemological *cul de sac* in making projections. We are concerned, however, about the possible consequences of *status quo* assumptions or the extrapolation of past trends. The danger which we foresee is that projections may become self-fulfilling prophecies. Hence, if the projections for water demand are made the basis for decisions, we will provide the storage necessary to meet the demand, and having the storage, will use the supply. As Luten points out, "The predictions of continued growth for California are themselves generating the growth."[16]

From a national standpoint, 45 million people in California by 2000 may not be the most desirable arrangement. Nor is provision of storage space for the projected water demand necessarily desirable. An important frontier for economies in resource use lies in regulating the affairs of men, rather than in attempting to regulate nature. If we exclude changes in men's actions from our assumptions and if we bar the effects of

[14] U.S. Senate Select Committee on National Water Resources, *Population Projection and Economic Assumptions*, Committee Print No. 5, 86th Cong., 2nd Sess., 1960.

[15] Resource systems analysis and simulation, while not solving this problem of projection, do provide a hopeful technique for exploring the range of possibilities.

[16] D. B. Luten, "Parks and People. An Exploding Population Needs Place to Explode In," *Landscape*, Vol. 12, No. 2, 1962–1963, p. 5.

applying new technologies, we may become committed to meeting the demands of present trends projected into the future. Our commitment is likely to be reinforced to the extent that we invest care, effort, and belief in our projections. The skeleton in the cupboard that will return to haunt the authors is that, being men who are devoted to the search for improvement in resources management, their very efforts will become incorporated into the system and help to make it more resistant to change.

We have expressed concern about this possibility, but we are not gloomy. Paradoxically, one reason we do not despair is that our society does not take its social scientists too seriously. Another is that the authors do not encourage blind faith in their projections. They are more concerned to use them as stepping stones to a wide ranging, perceptive, and informed discussion of the kinds of actions that will be required to ensure the adequacy of resources for America's future. A certain degree of self-confidence is required before man can finally slay the Malthusian dragon, and the efforts of those men who created this triad of books will do much to boost our morale.