Letters

Population Growth

I am very sympathetic with the issues raised by Ehrlich and Holdren's recent article, "Impact of population growth" (26 Mar., p. 1212). It seems to me, however, that the essence of all the major points in this paper has been well known in the scientific community for about two centuries, even if in a slightly different technological and semantic context. To limit what should be a very long discussion, I quote just a few points, made in two older works (*1*, *2*).

1) About the lack of significance of average population densities and the "Netherlands fallacy": "And there is reason to believe that the poor and thinly inhabited tracts of the Scotch Highlands, are as much distressed by an overcharged population, as the rich and populous provinces of the Flanders" (*1*, p. 138). This because: "Improvement in manufacturing machinery . . . , added to the greater number of hands employed in manufactures, would cause the annual produce of the labour of the country to be upon the whole greatly increased" (*1*, p. 308). Therefore: "A small country with a large navy, and great inland accommodation for carriage, such as Holland, may, indeed, import and distribute an effectual quantity of provisions; but the price of provisions must be very high, to make such an importation and distribution answer in large countries, less advantageously circumstanced in this respect" (*1*, p. 311).

2) About urban and ghetto problems: "This mortality among the children of the poor has been constantly taken notice of in all towns" (*1*, p. 72). And again: "The unwholesomeness of towns . . . must be considered a species of misery" (*1*, p. 108).

3) About the epidemiological environment: "But it is not improbable, that among the secondary causes that produce even sickly seasons and epidemics, ought to be ranked, a crowded population and unwholesome and insufficient food" (*1*, p. 113). To conclude, on the basis of a wealth of different data: "I should expect, therefore, that those countries where subsistence was increasing sufficiently at times to encourage population . . . would be more subject to periodical epidemics than those where the population could more completely accommodate itself to the average produce" (*1*, pp. 119–120).

Most of this work by Malthus (*1*) deals with an argument similar to Ehrlich and Holdren's theorem 5, namely that "theoretical solutions to our problems are often not operational, and sometimes are not solutions." In the following quotations, Malthus refers to England, which had a welfare system (the poor laws) and a restrictive labor structure (the corporations) not unlike the present ones in the United States.

1) About the ill effects of welfare: "To remedy the frequent distress of the common people, the poor laws of England have been instituted; but it is to be feared, that though they may have alleviated a little the intensity of individual misfortune, they have spread the general evil over a much larger surface" (*1*, p. 74).

2) Against hoping for unlimited agricultural progress: "The capacity of improvement in plants and animals, to a certain degree, no person can possibly doubt. A clear and decided progress has already been made; and yet, I think it appears, that it would be highly absurd to say, that this progress has no limits" (*1*, p. 169).

3) About the dangers of theoretical solutions in general: "It has been frequently observed, that though we cannot hope to reach perfection in anything, yet that it must always be advantageous to us, to place before our eyes the most perfect models. This observation has a plausible appearance, but it is very far from being generally true" (*1*, p. 280).

Most points in this and other works by Malthus come from a detailed analysis of long-term effects in a variety of socioeconomic situations. The population models he used take carefully into account oscillatory phenomena, regular or not, and dumped or persistent.

Regarding theorem 1 in Ehrlich and Holdren, I would like to mention some major points from Volterra (*2*; see also *3*):

1) The adverse impact of population on environment can often have integral rather than proportional components. In some respects, the impact of population on environment would be, in Ehrlich and Holdren's notation

$$I(t) = \int_{-\infty}^{t} P(z)\, F(t - z)\, dz$$

where F would usually be a decreasing function of its argument, but it could even be approximately a constant.

2) There can be other "threshold" effects on ecosystems which are not directly related to pollution or agriculture, such as Volterra's "law of the perturbation of the means" (*2*) as applied to fishing both herbivores and carnivores in a community. Up to a certain intensity of exploitation the biomass of the community would actually increase; it would then decrease with increasing exploitation up to a critical level, at which the collapse of the whole community would rapidly occur.

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References

1. T. R. Malthus, *First Essay on Population* (J. Johnson, London, 1798).
2. V. Volterra, *Variazioni e fluttuazioni del numero d'individui dui in specie animali conviventi* (R. Comit. Tal. Ital., Venezia, 1927).
3. F. M. Scudo, *J. Theor. Pop. Biol.* **2**, 1 (1971).

Ehrlich and Holdren's helpful discussion of the significance of the population explosion did not explicity include one important aspect of population growth which follows directly from the process defined, namely growth. As Ehrlich has noted elsewhere, an expanding human population tends to contain a characteristically high percentage of members of low ages (age 14 and lower), and this tendency is usually aggravated still further by lower mortality rates.

Such a situation obtains here in Puerto Rico (*1*) and is a major factor in the maintenance of a high "dependency load," that is, that portion of the population which consumes products and services afforded by the rest of the population but does not itself contribute such products and services. Increasing the size of this group must generally increase the cost per capita of main-

taining a livable environment, and thus would increase the value of $F(P)$ in Ehrlich and Holdren's relation

$$I = P \cdot F(P)$$

$F(P)$ is thus a function of age structure as well as population size. The resulting extra cost subsumes not only fewer human resources to attack environmental problems but also the diversion of income, and ultimately energy, for the increased demands of health and public education that such age structure implies.

The further augmentation of the dependency load in Puerto Rico which has occurred as a result of the hasty industrialization of the island might serve as an illustration of the authors' theorems 2, 4, and 5 concerning the necessity for joint and thorough consideration of population and the total environment on a global basis. The fact that agriculture and conservation were long stepchildren to industrialization in Puerto Rico helped to induce many people to leave their homes in the deteriorating rural areas. These people, ill-educated for modern urban living, left the island (and thus its work force) in great numbers, settling largely in the urban ghettos of the United States (*2*).

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References and Note

1. *Anuario Demográfico* (United Nations, New York, 1964). Preliminary estimates of these statistics for the 1970 census, from the Bureau of Labor Force Statistics, Puerto Rico Department of Labor, indicate slight changes.
2. J. V. Calzada, *El Desbalance entre Recursos y Población en Puerto Rico* (Sección de Estudios Demográficos, Departamento de Medicina Preventiva y Salud Pública, Escuela de Medicina, Universidad de Puerto Rico, 1966).

Funding the National Research Council

Critics of the National Research Council suggest (News and Comment, 16 Apr., p. 242) that the reports of the council may be biased in favor of the viewpoint of the agencies that request that studies be made. It would seem that the present organization and method of financing practically guarantee such a bias. Well over two-thirds of the professionals involved in these studies are permanent NRC employees; less than one-third are brought in for specific assignments. NRC must therefore do a great deal of selling to obtain funds to support this permanent staff. Salesmen are not noted for their objectivity.

In order to remove this source of bias, the proportion of permanent professional staff should be greatly reduced, or the $25 million that NRC now receives annually from 20 or more separate agencies should come directly from the Executive Office of the President in one chunk, or both.

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Environment and Emotionalism

The editorial "Changing attitudes toward environmental problems" (7 May, p. 517) in general was quite realistic, particularly in emphasizing that all of us are going to have to pay for any improvements. But the statement that "benefits will be weighed against costs" constrains me to ask how "benefits" affecting the conditions in which we are to live, and even whether we are to continue to live, can be given a dollar value to arrive at any comparison with the "costs."

The "benefit-cost ratio" governing governmental spending in various areas of natural resource "development" has been the root of a good deal of evil. It has taken many years for the reality to be accepted that intangible values make benefit-cost comparisons impossible. Some things must be accepted as essential; they defy dollar evaluation.

I would like to comment also on the somewhat disparaging allusions to emotionalism about environmental matters. As a long-time professional observer of the legislative process, I have found that the screamers, who quote out of context and cite only selected facts, make a real contribution. It is their emotionalism which makes legislative bodies welcome the testimony of rational pleaders who follow. It makes the legislators listen, when otherwise they probably (judging by the record) would not. Rachel Carson was a screamer.

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I cannot challenge Abelson's remark that "[by 1970] most of the important components of pollution had leveled off" with any scientific instruments other than my memory and my eyes. As a lifelong resident of the Washing-