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# BOOK REVIEWS

## Bovine Tuberculosis in Cattle and Badgers

BY J. KREBS

191 pp., illustr., no ISBN, £35, Admail 6000, London SW1 2XX: MAFF Publications, 1997

As a former member of the UK Government Consultative Badger Tuberculosis Panel, I have found the Krebs report to be, like the curate's egg, good in parts, a fascinating potpourri of science, philosophy and the history of science. The political overtones are in the very best Civil Service, 'Sir Humphry' tradition of maintaining accepted Establishment 'wisdom'. In fact the Report is almost more interesting for what is left out, than in what the media (bamboozled by 'heavy science') has not recognized as that political 'no! no!': a U-turn.

Being academic scientists, the Krebs team did not seek any data which had not been 'peer reviewed', and so were not given the full data on how bad cattle tuberculosis (TB) had become. The TB incidence in cattle has returned to the high 1962 levels despite two decades of badger culls. This data was not included even though it is published in the MAFF Annual Badger and the MAFF Chief Veterinary Officers Reports. The Krebs report hence notes the worsening TB situation without explaining it. Between 1986–96 the cases of Bovine TB rose from 83 to 703 herds, an 18-fold increase. The numbers doubled in 1997 to 1537 herds, and spread from tiny pockets in SW England to embrace the whole SW plus the Midlands and Wales. These were areas where TB had been absent from cattle and badgers for decades. With up to 70% of badgers diagnosed as carrying TB after these herd breakouts, they can only have caught it from the cattle. This 'knocks on the head' MAFF's oft repeated claim that badgers are not merely catching TB from the cattle because only rare, gross-lesions cattle cases are infectious (Neal 1996). Cattle are infectious at any stage of the disease (Irish 1996), and one cow can produce 38 million bacilli in 12 kg faeces/day. It would be surprising if badgers did not catch TB, hunting for worms as they do under cow-pats.

The current dramatic cattle TB crisis has implications for the proposed ban on unpasteurized or 'green-top' milk with the massive costs of a return to the more frequent herd-test intervals, to meet EU Directives. A map of the bovine TB epidemic from the Krebs evidence, given in the New Scientist (Anon. 1998) suggests that the province of Ulster should start culling badgers even though Dr L. Downey of ERAD told the 1991 Dublin Conference that 'Of course we've known for years that badger culling doesn't work'. In fact the Krebs 'scientific cull' in a mere 2000 square kilometres is a tacit admission that it may be a waste of time.

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## Reframing Deforestation. Global Analysis and Local Realities: Studies in West Africa

BY JAMES FAIRHEAD AND MELISSA LEACH

238 pp., 23.5 × 15.5 × 1.5 cm, ISBN 0 415 18591 2 paperback, £17.99, London and New York: Routledge Ltd, 1998

This volume is published as part of the Global Environment Change Programme of the UK Economic and Social Research Council, and seeks to challenge received wisdom on the extent and causes of tropical deforestation in West Africa. Aimed presumably at both policy-makers in forestry and conservation, and at students in the wider fields of environment and development, the book argues that the scale of deforestation in West Africa has been 'vastly exaggerated'. It uses case studies from six countries, Côte d'Ivoire, Liberia, Ghana, Benin, Togo, and Sierra Leone, to explain how and why this exaggeration has occurred, before arguing that a 'major rethinking' of approaches to forest conservation is needed, based on 'more respectful attention to local knowledge and practices'.

The material presented in this book is compelling, revealing and at times overwhelming in its message of how deforestation has become exaggerated by academics and policy-makers alike. First, it is argued that a combination of misunderstandings, and misrepresentation, have led to the general acceptance of alarming figures for the total amount of forest 'lost' in the region. Historical information is marshalled to demonstrate how estimates (or more usually assumptions) about how much forest 'originally' existed prior to human intervention are frequently wrong, and indeed how present day forests have been impacted by humans over centuries, and may in the past have supported less vegetation than at present. At the same time, the logic that current bioclimatic conditions provide the key to what vegetation is most likely to have existed in the past is also challenged. Second, the book questions more recent estimates of the rate of deforestation across West Africa, including those based on apparently 'objective' measures such as analysis of satellite images. Overall, Leach and Fairhead estimate that deforestation since 1900 in their six study countries lies at perhaps a third of the level of 'orthodox estimates', and as little as a fifth of the amount recently estimated by the World Conservation Monitoring Centre in Cambridge.

This is an iconoclastic book; yet at the same time, it is written at times with a patience and caution that reflects the seriousness of its conclusions, and their importance for public policy-makers. The book's conclusions are certainly important. Quite apart from questioning the direction of much conservation work currently being urged on governments and local communities in the tropical forest zone of West Africa, the book also throws doubt on estimates of deforestation rates that play a significant role in emerging global land cover models.

The critical parts of the book are the best. The Food and Agriculture Organization (FAO) comes in for particularly stinging criticism: for example, its figures of current rates of forest loss across the region as a whole are described not unfairly as 'massaged' (p. 8), with comparisons of forest area in 1980 and 1990 for 35 out of 40

African countries being based not on two, but just one measurement, which was then recalculated for the different years using a mathematical model based on population density. In Benin, meanwhile, Leach and Fairhead report the 'astonishing' example of how the FAO estimated deforestation for the whole country based on 'one, pre-selected, smaller forest island' that was chosen precisely because it was known to be contracting (p. 110).

Other highlights include a German forestry mission that overestimated the land area of Liberia by 15 per cent (!), and probably underestimated the area of forest as they were looking only for commercially-viable timber. Yet their calculated percentage forest cover became generally accepted as evidence for a steep decline in the area of forest, forming the basis for subsequent and widely quoted model-based extrapolations. Or there is Ghana, which 'lost the same area of forest twice over' (p. 67) as British colonial estimates revised forest area upwards in 1937 between two counting periods for which deforestation rates were calculated.

The book is also at its most convincing in citing evidence that contradicts much cherished beliefs about the historical extent of West Africa's forests. An excellent chapter on Côte d'Ivoire casts serious doubts on a series of estimates of forest cover, up to the 1960s. Although it then leaves unchallenged the most recent figure of 2.7 million ha of forest in 1990 despite some hints, and logic in their earlier argument, that this figure might also be inaccurate. More could certainly be written about the anthropological evidence now available on how people interact with, but do not necessarily clear forest in the region: also on the reasons why the discourse of deforestation has become so rooted in official policy, despite the shakiness of evidence for its extent and significance. Yet in fairness, these are both topics for books on their own. Indeed, the authors' earlier and detailed volume, *Misreading the African Landscape: Society and Ecology in a Forest-Savanna Mosaic* (1996), which deals with deforestation in the Kissidougou region of Guinea, provides a very good starting place for the interested reader.

In this sense, an important challenge raised by this book is not simply the questioning of current 'received wisdom', but the pointers it gives to further research that might be conducted to support or refute the book's arguments. This is the element of caution in the book: the argument is not presented as an open-and-shut case, and the authors are up front about the need for further, detailed research, especially to examine in more detail the historical sources available in the region. What the book achieves is that it demonstrates that the authors' earlier detailed work in Guinea cannot be dismissed as an isolated example, the exception that proves the rule of widespread deforestation. What is less clear, though, is who might fund the research needed to prove their point beyond reasonable doubt, for as the authors themselves remark, such reinterpretations 'might not prove acceptable to conservationists, carrying less rhetorical force crisis and decay' (p. 91).

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## The Biosphere

BY VLADIMIR I. VERNADSKY

192 pp., 24.5 × 18 × 2 cm, ISBN 0 387 98268 X hardback, US$49.00: New York: Copernicus, 1997

Vladimir Vernadsky's book was published in Russian in 1926, but was little known in the West until the 1980s, when growing eco-awareness coincided with a Vernadsky renaissance. Only now has an unabridged, annotated edition of this seminal book been published in English.

The word 'Biosphere' was not coined by Vernadsky, but his concept of it is the most widely accepted today. His basic thesis is that Earth is a self-contained sphere in which Life is the geological force, and in which living matter is expanding. He argues that we cannot understand the laws that determine the Earth's composition in terms of Earth's geological history; their roots lie in the structure of the chemical elements of the entire cosmos, which are all of a piece. This has been confirmed in the discovery of the similarity between the Earth's crust and the stars and the Sun. The Biosphere is largely the product of the radiation which converts rays of the Sun into varied forms of energy. We earthlings are more truly children of the Sun than even our Sun-worshipping forbears knew.

In this book Vernadsky sets out to describe a physics of living matter. Part One deals with the Biosphere in the Cosmos; Part Two deals with the Domain of Life. He takes as a principle that there is a permanent difference between living and inanimate matter; there is no case of direct creation of living matter from inert matter. The conditions of Earth have always favoured the existence of living matter, and have always been much as they are today. Without life the crustal mechanism of the Earth would not exist. Life remains unalterable in its essential traits throughout all geological times, and changes only in form.

The book explains in complex scientific equations the way life forms work. From these he draws empirical observations. Here is an example of a Vernadsky equation: to find the kinetic geochemical energy per hectare he creates formulas for

(i) the maximum number of organisms per hectare,
(ii) the co-efficient of density of life,
(iii) the stationary number for homogeneous living matter, and
(iv) the area of the Earth's surface and then makes a calculation.

Two appendices provide a chronology of the author's life and a list of his publications in English. The bibliography and the index are both useful and extensive.

How significant are his findings for today? I am no scientist and I am not competent to judge the flaws or the quality of Vernadsky's science. An eminent team which includes microbiologists and literary experts do offer an evaluation of his works in a well-written and weighty foreword.

In terms of science, the foreword writers claim that observation and measurement of substances such as carbon and nitrogen through the hydrosphere, lithosphere, atmosphere and iota are practices based on the style of thought invented by Vernadsky. In terms of metaphysics, his findings seem to support a holistic rather than a reductionist view of reality. In terms of ecology, there is no doubt in my mind that if Vernadsky's understanding of the Biosphere infiltrates the popular mind, it will inspire respect for such a precious, living, and fragile mystery as Earth, for Vernadsky concludes without question that living matter is not an accidental creation. He died before humans could look down on Earth from space, but his writing brings to mind these words of Archibald Macleish:

> To see the earth as it truly is, small and blue and beautiful,
> the earth in that eternal silence where it floats,
> is to see ourselves as riders on the earth together,
> brothers on that bright loveliness in the eternal cold –
> brothers who now know that they are truly brothers.

For Vernadsky's work helps us to appreciate the unique standing of the only living planet we know in the cosmos and the importance for the survival of this planet of realizing how dependent upon the Biosphere we are.

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## Cattle, Deforestation and Development in the Amazon: an Economic, Agronomic and Environmental Perspective

BY MERLE D. FAMINOW

x + 253 pp., 24 × 16 × 2 cm, ISBN 0 85199230 7 hardback, £45, US$85, Wallingford, UK: CAB International, 1998

This book reinterprets the role of cattle in Amazonian development, concluding that cattle are not as bad as they have been made out to be by many authors (including myself). The review marshals a considerable body of literature, much of it recent, and cannot be ignored by anyone dealing with deforestation issues in Brazil. However, the reader often must go beyond what is presented in the book to have all sides of the many controversial issues it touches.

The impacts of deforestation on climate and biodiversity are minimized in numerous ways, despite allusion to environmental costs in caveats to conclusions on the benefits of pasture (p. 230). Extinctions are presented as a normal event (p. 27). Faminow (an economist at the University of Manitoba in Winnipeg) believes firmly that the market will take care of everything: 'As deforestation increases, the value of remaining forest will increase, enhancing private and public incentives for preservation' (p. 30). Before placing faith in this mechanism, however, one might wonder about the ubiquitous 'market failures' that are evident around the world whenever 'prices aren't right' and human interests are not served by the course of laissez-faire development. Why not do what we can to steer away from dangers that we can use our intelligence to foresee, before the disastrous consequences of losing the Amazon forest force prices of forest to rise enough to affect rainforest 'supply'?

Faminow emphasizes that 'Much of what is written about the Amazon is based more on myth and anecdote than scientific fact' (p. 31), and that 'Data are fragmentary or imaginary' (p. 22). Characterization of scientific information as speculative or even imaginary is a leitmotif of the book. However, a substantial amount of sound scientific information exists, and much of it runs counter to the main thrust of the book, that cattle pasture is not really that bad.

One of the major impacts of converting rainforest to cattle pasture is the contribution of greenhouse gas emissions to global warming. Faminow examines in some detail the available information on methane emissions from the cattle themselves (pp. 28–9, 167–9), but makes only passing reference to emissions of gases from the deforestation done by ranchers to prepare land for planting pasture (p. 168). Unfortunately, these emissions are huge (Fearnside 1997*a*).

Faminow questions the reliability of global circulation models (GCMs), and consequently the predictions they make about climatic changes such as global warming (p. 30). While GCM results still contain substantial uncertainty, they have improved dramatically since the 1987–92 literature on which Faminow bases his criticism. The massive efforts under the Intergovernmental Panel for Climate Change (IPCC) to improve the models and their parameters are not even mentioned (e.g. Houghton *et al*. 1996). Above all, uncertainty of GCM results, even if unjustly assumed to be higher than it now stands, does not justify failing to act on the basis of the best available data, and those data point to a tremendous environmental cost of not containing the expansion of Amazonian deforestation for cattle pastures. While Faminow is careful not to advocate continued deforestation, his underplaying the impacts of forest loss could be expected to discourage decision-makers from mustering the political courage needed to take effective steps to change the present pattern of rapid conversion of Amazonian forest to pasture.

Faminow devotes a chapter to reviewing deforestation estimates; while much important information is covered, the review is uneven in that it concentrates on criticizing high estimates while failing to point out errors on the low side. Brazil's official estimate for Amazonian deforestation by 1988 as 5.12% (p. 98) is presented without mention of the invalid procedure used to calculate this percentage, with the denominator chosen being the area of the Legal Amazon, an administrative region over 20% of which was not originally forest, thereby substantially understating the relative amount (see Fearnside 1990). These numerical acrobatics were politically convenient given public statements by the President of Brazil immediately before the study was done; a series of similar political influences have also affected handling of subsequent official estimates (see Fearnside 1997*b*).

The question of who is doing the clearing is central to assessing the role of cattle pasture in the deforestation process. Faminow labels my estimate for 1990 (Fearnside 1993) that 70% of the clearing was done by medium and large ranches as being 'at one extreme' (p. 119). However, he justifies his 'extreme' classification by comparing my estimate with others that confine themselves to estimating the percentage of clearing that is done with the benefit of government subsidies in the form of fiscal incentives, which is not the same thing as clearing by medium and large ranches (most clearing is done without fiscal incentives). I stand by my estimate.

Faminow stresses the capacity of forest to recover: 'rain forest can be remarkably resilient and re-establish itself quickly' (p. 89). 'Land that has been cleared and later abandoned will often return to forest cover, even if used for pasture, although there is some uncertainty about the length of the process of forest recovery from pasture abandonment to mature forest' (p. 114). 'Some uncertainty' here might be taken as a euphemism for an inconvenient fact: recovery from pasture takes a very, very long time. Secondary forests grow more slowly on abandoned pastures than they do in shifting cultivation fallows, and since pastures dominate land-use in Brazilian Amazonia, it is this kind of secondary forest that affects the impacts of deforestation. The role of secondary forest in reducing the impact of deforestation on climate change (pp. 18 & 113) is less than Faminow implies (see Fearnside 1996; Fearnside & Guimares 1996).

Faminow presents the 'Yurimaguas technology' for continuous cultivation as the 'best' evaluation of the potential for agriculture in the Amazon (p. 48). He seems to have completely missed the debate concerning this high-input system (Fearnside 1987, 1988; Walker *et al.* 1987). Suffice it to say, strong indications exist that the 'Yurimaguas technology' will not prove viable on a wide scale in Amazonia.

Faminow attacks the idea that land speculation contributes to deforestation, claiming that 'the land speculation hypothesis is based upon questionable data and faulty logic' (p. 123). Weaknesses in some of the studies that have identified land speculation as critical are rightly pointed out. Faminow shows that land values have not sustained increases over long periods at the regional or at the state level. This is true, and Faminow does a valuable service by making this point strongly and numerically. However, this does not necessarily lead to Faminow's conclusion that speculation is insignificant as a motivation for deforestation. Land values can increase dramatically in areas smaller than entire states, for example along highway routes whenever a new road is built or an existing one is improved. While the experience of researchers who have spent a good deal of time talking with farmers and ranchers in Amazonia is frequently dismissed by Faminow as 'anecdotal', there are too many cases of individual properties being bought and sold with speculative motives to allow this to be written off as a freak occurrence. Just as in speculation in the stock market, many of the practitioners wind up selling during crashes and losing money, but this does not mean that speculation has not motivated their investments (and, in the case of ranches, their deforestation behaviour). In order to have confidence in attributing motives to deforestation behaviour one must have both a theoretical explanation in terms of the financial interests of the actors and a consistent set of on-the-ground observations of real people. Although the book is almost exclusively based on literature review (often with emphasis given to census data and other general statistics), Faminow did travel in some parts of the region to speak with farmers. One wonders, however, how much of a reality check this provided; i.e. is there really a trend to using oxen as draft animals (pp. 123 & 217)?

Faminow points out the seeming contradiction between land becoming degraded under cattle pasture and the expectation of land prices rising that provides the engine for speculation (p. 146). He fails to mention that speculation takes place on the basis of whole properties rather than just the portion of each one that has been converted to pasture. The forested portions of the properties, including the timber stocks they contain, represent a significant value; profits from timber have been a key factor in keeping the ranching industry going, especially in eastern Amazonia (e.g. Mattos & Uhl 1994). The pasture provides an effective guarantee of continued possession of the entire property, therefore providing an important motivation in addition to beef production. If a property were offered for sale without a portion of it being under pasture, even if degraded, the remaining forest would have a lower sale value because of the need for a prospective buyer to either make heavy expenditures in clearing part of the forest or risk losing possession of the property.

Perhaps the clearest sign that land speculation has been a significant force in deforestation is the pattern of deforestation since Brazil's July 1994 Plano Real economic package was instituted, greatly reducing the rate of inflation. The results of LANDSAT imagery interpretation were released in January 1998 (after Faminow's book was written) (Brazil, INPE 1998). They indicated first a tremendous initial jump in the deforestation rate in 1995 to $29 \times 103\ km^2\ yr^{-1}$, versus $15 \times 103\ km^2\ yr^{-1}$ in 1994; the jump is best explained as the result of a much larger volume of money becoming available for investment following institution of the Plano Real. The 1995 peak was followed by a substantial decline, to $14 \times 103\ km^2\ yr^{-1}$ in 1996 and $13 \times 103\ km^2\ yr^{-1}$ (according to a preliminary estimate) in 1997.

The decline in deforestation rates accompanies a drop in land prices by over 50% from 1995 to 1997, a price decrease that is best explained as the result of the greatly reduced rate of inflation having eliminated the role of land as an inflation hedge. The association of falling land prices with reduced deforestation rates suggests that a significant part of the deforestation that was taking place in prior years was motivated by speculation.

Faminow emphasizes demand for beef and milk in Amazonian cities as the key factor motivating pasture conversion (pp. 125 & 131). This demand exists, and it is good that Faminow has drawn attention to its force. Dairy production is emphasized (p. 123), but it should be remembered that this is recent and is limited to certain areas (such as Ouro Preto d'Oeste in Rondônia, visited by Faminow). It does not apply to the vast ranching areas in southern Par and northern Mato Grosso where most Amazonian pastures are located (areas apparently not visited by Faminow).

The explanatory power of local urban demand must be tempered by the situation in the state of Amazonas. In Amazonas, which is dominated by the state capital at Manaus (1998 population approximately 1.6 million), only 25% of beef consumed is produced in the state (p. 132). The SUFRAMA agriculture and ranching district, located on the outskirts of Manaus and protected from competition by vast distances to competing producer areas, is notorious for having become a sea of secondary forest when government subsidies dried up beginning in 1984. If beef production were so profitable, why have these ranches not remained active over the period since 1984, during which time the population of Manaus has approximately doubled, along with its attendant beef demand? The case of Manaus fits a picture that includes deforestation motives other than the beef market emphasized by Faminow: motivation for maintaining the SUFRAMA ranches would have depended almost solely on beef profits because the timber value of these forests is relatively low, because pasture is not needed to maintain possession of the land since the ranches are part of a government-organized scheme with proper surveying and documentation (unlike the legal free-for-all of southern Par), and because the threat of invasion by landless migrants has (until very recently) been quite remote.

Faminow stresses pasture as a source of income for the population in Amazonia. The social progression emphasized is that of individual families being released from the 'grueling physical work of slash-and-burn agriculture' and becoming progressively better off as the family cattle herd expands and the pasture management system employed modernizes (p. 217). Totally ignored is the dark side of pasture: the replacement of small farmer families with larger operators who either buy the small farmers out or expel them in various (often violent) ways (see Schmink & Wood 1992).

The role of pasture in exacerbating Brazil's notorious social inequalities is minimized with the observation that cattle production 'may be associated with but does not create inequality' (p. 228). True, just as chainsaws are associated with deforestation and handguns are associated with murders, but, while not capable of acting by themselves, these tools of the trade help enormously. The small labour and capital demands per hectare of pasture allow a tiny segment of the population to control a large fraction of the landscape: as of the last agricultural census (1986), 62% of all private land in the region was in the hands of ranchers with over 1000 ha each,

while in Mato Grosso the share held by ranchers in this class was 84%! If pasture had never been an option and landowners were obliged to plant, say, tree crops, then very few would be able to afford planting sufficient areas to stake out vast *latifundios* in Amazonia.

Faminow devotes only one page to sustainability, and admits that 'there seems to be little doubt that the sustainability of cattle production in the Amazon is open to question, from social, economic and physical perspectives' (p. 226). At the same time, however, he stresses the positive side of pasture monocultures: they allow landowners to capture the benefits of technological advances, as contrasted with traditional polyculture systems that 'prevent the capturing of gains from perturbations that create opportunities for upturns' (p. 226). This is certainly a novel view on the role of diversity in sustainability. One major unmentioned limit to the widespread expansion of the intensive pasture management Faminow advocates is phosphate deposits to supply the necessary fertilizers (see Fearnside 1997*c*).

The question of 'whether the best use of Amazonian rain forest is as pasture' is dismissed as 'now becoming passé' (p. 231). Really? Faminow seems blind to the fact that Brazil's Amazonian forests continue to fall at over two hectares per minute, and that virtually all of that area sooner or later becomes pasture. The low social value and high environmental cost of converting forest to pasture make the question of 'best use' anything but 'passé'!

Faminow has faith that increasing the productivity of pastures will 'limit future use of forest for new pasture' (p. 232). Presumably, the assumption is that, with higher productivity, either ranchers would be satisfied with their profits or the market for beef will be saturated such that further clearing is unprofitable. I have been one who has repeatedly called into question the 'full stomach' limitation on small farmer clearing, and I think the idea of ranchers limiting their expansion because they are satisfied with their level of material existence would be even more far-fetched. Markets, on the other hand, can eventually become saturated, but pasture is likely to be able to expand tremendously, and at great environmental cost, before market forces would restrain this process given the scale of beef demand in Amazonia, in the rest of Brazil, and beyond.

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### Vital Signs 1998. The Environmental Trends that are Shaping our Future

BY LESTER R. BROWN, MICHAEL RENNER AND CHRISTOPHER FLAVIN


207 pp., 23.4 × 18 × 1.3 cm, ISBN 0 393 31762 5 paper, US$12.00, New York, USA: W.W. Norton & Company, 1998


The quality of human life depends on the global factors that range from food supply to environment, and from emerging diseases to economy. If you want to know about the current status of global trends, *Vital Signs 1998* is the book to obtain a crash course to understand various issues ranging from grain stocks to world economy, and from global warming to human health.

The Worldwatch Institute, a think-tank based in Washington DC, monitors rapidly changing major global trends in grain production, population growth, diseases, carbon emissions, economy and politics that have the potential to shape the twenty-first century. It publishes documents such as the annual *State of the World Report*, *World Watch Magazine*, *Worldwatch Papers*, and *Vital Signs* which contains data extracted from thousands of documents obtained from government, industry, scientists and international organizations. We now live in a world electronically wired and covered in statistics; we do not pass a day without looking at the newspaper and television which cover financial figures and stock market graphs. The newspapers and television media however miss a lot of statistics we ought to know; for example the status of declining coral reefs around the world or the return of peregrine falcons in the United States. The statistics on coral reefs and peregrine falcons may not mean much for those who care only about the stock market. However, most people agree that we cannot live without a biosphere, and we have to know the ups and downs of technological development and the fate of our changing environment.

*Vital Signs 1998* is the seventh volume in the series from the Worldwatch Institute and it shows in graphic form the key global trends that we often miss. Part one has categorized eight trends that shape up our lives which are the food, agriculture, energy, atmosphere, economy, transportation, social and military. Part two has covered special features on forest loss, fossil fuel, pollution control, paper recycling, metals exploration, cigarette taxes, female education, and sanitation.

*Vital Signs 1998* warns us that the year 1997 was the warmest for our planet since record keeping began in 1866 and researchers found evidence that rising levels of greenhouse gases are probably responsible. The burning of oil, coal and gas boosted carbon emissions to 6.25 thousand million tonnes in 1996 which is the highest so far. The US is the largest polluting country in the world and is responsible for 23% of the emissions of the climate-changing gas. Amongst the developing countries, China accounts for 14% of carbon emissions. The world's first treaty to reduce greenhouse gases finally emerged after marathon talks in Kyoto during December 1997 and the treaty mandated an average cut of 5.2% in the emissions blamed for a warming of the planet that could eventually prove to be environmentally disastrous. Even from the emissions we have put in the atmosphere up to today, even if we cut off immediately today, the sea level would still keep rising for hundreds of years. So we are already committed to a fair level of sea level rise no matter what we do. The globe is destined to undergo climate change from what has already been pumped into the atmosphere since the industrial revolution of the late eighteenth century and experts agree that nothing can halt the process. But the faster world leaders act to reduce emissions of gases blamed for trapping the Earth's heat, the easier it will be to mitigate what lies ahead. It is interesting to know that 1997 is the year in which two of the world's largest oil companies, the British Petroleum and Royal Dutch Shell, announced that they are making major investment, US $1 thousand million and US $500 million respectively for the development of solar, wind and other renewable energy resources. These two oil giants indicated that they are taking the threat of global warming rather seriously.

At the end of 1997, we shared the planet with 80 million more people than at the beginning of the year and about 60% of these people were added in Asia, in countries that are already heavily populated. Educational levels are also increasing worldwide and especially there has been an increase in female education in developing countries. Of the social trends that affect human health directly, the spread of HIV is amongst the most deadly. In 1997, nearly six million people were newly infected with the AIDS causing virus, bringing the total infected globally to 42 million. Countries such as Uganda and Thailand have made good progress in checking the spread of HIV while the threats continue to increase in heavily populated China and India. Prostitutes in Bombay, India and intravenous drug users in parts of China have infection rates over 50%. With 2.3 million fatalities in 1997, this immune-stripping disease now claims more than twice as many lives as malaria. One threat to health that affects more people than AIDS is cigarette smoking. In 1997, the world produced about 5.8 trillion cigarettes, roughly 1000 for each of its 5.8 thousand million men, women and children on our planet. An encouraging sign is that cigarette production is not expanding as fast as human population. If recent smoking trends continue, tobacco-related deaths, now estimated at 3 million annually, could reach 10 million in the year 2020 with 70% of them being in developing countries.

The global military expenditures dropped to US $701 thousand million in 1996 compared to the peak in 1984 at US $1140 thousand million. The US still accounts for one third of the total. The number of armed conflicts is also declining. In 1992, the number exceeded 50 but by 1997 it had dropped to 24. Most of these conflicts were taking place within rather than between countries. Unfortunately, civilians are more often the victims of these conflicts than in earlier eras, rising from 67% of the victims in the Second World War to 90% in the 1990s. The heaviest fighting in 1996 took place in Afghanistan, Algeria, Sri Lanka, Sudan and Turkey involving ethnic, tribal or religious conflicts.

Despite economic crisis in Southeast Asia, the global economy expanded by 4.1% in 1997, marking the third consecutive year with growth of 4% or more. *Vital Signs 1998* predicts that if the global economy continues to expand as projected, output per person worldwide will top US $5000 for the first time in 1998. Despite the economic growth, *Vital Signs 1998* warns us about the continuing global environmental destruction. Between 1991 and 1995, the world lost an average of 11.3 million ha of net forest area annually, an area roughly the size of Cuba. A few countries such as Bolivia, Brazil, Indonesia, Malaysia, Mexico, Venezuela and Zaire together accounted for 50% of the tropical forest loss within the five years. Forest fires, logging and agricultural expansion account for about 40–50% of deforestation in Indonesia and Papua New Guinea. Primates that depend on the rainforest have been under severe pressure from deforestation and 50% of the total 233 known primate species are threatened with extinction. The IUCN estimates that 11% of all bird species are threatened with extinction now and for the fish species, this is about 34%. Furthermore, gold mining is also destructive for the environment and 2400 tonnes of gold produced in 1997 generated 725 million tonnes of waste, one tonne of waste for every eight people on our planet. This book clearly illustrates with figures and tables that the diversity of plants and animals is declining, carbon emission is above the earth's carbon-fixing capacity, and the human population pressure is exceeding the population of all species of non-human primates combined. Furthermore, the on-going destruction of mangrove forests, deterioration of coral reefs and the draining of wetlands globally threatens not only the survival of biodiversity, but also the human economic activity that largely depends on a healthier ecosystem. Thus *Vital Signs 1998* is a vital tool for all those who would like to know about the recent trends of our environment, economy, and life in a rapidly changing world.

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