Confuse: How Jared Diamond fails to convince

by

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In his latest book, *Collapse: How societies choose to fail or succeed*, Jared Diamond attempts to provide a scientific account of the causes of societal collapse:

> "This book employs the comparative method to understand societal collapse to which environmental problems contribute … I compare many past and present societies that differed with respect to environmental fragility, relations with neighbours, political institutions, and other "input" variables postulated to influence a society's stability. The "output" variables that I examine are collapse or survival, and form of the collapse if a collapse does occur. By relating output variables to input variables, I aim to tease out the influence of possible input variables on collapses." (18)

In so doing, he seeks to identify lessons for improving the chances that humanity will avoid or better cope with future calamities. Given this objective, five questions seem pertinent:

First, how accurate is Diamond's portrayal of the demise of the societies he describes (both those that collapsed and those that did not)?

Second, how plausible are the reasons Diamond gives for societal collapse and sustainability?

Third, how systematic is Diamond in his application of the rules that he derives?

Fourth, to the extent that Diamond identifies lessons for current societies, to what extent does he apply those lessons appropriately?

Fifth, what alternative theories might better explain past collapses and offer lessons for societal sustainability?

For this special edition of *Energy and Environment*, Kendra Okonski and I asked several experts to evaluate specific aspects of Collapse in order to provide some tentative answers to these questions. Here I attempt to summarise the conclusions that we have drawn from those analyses and offer some of my own observations.

1. MAN BITES DOG STORIES AND OTHER FISHY TALES

One of the persistent themes throughout *Collapse* is arborophilia – a love of trees. Thus, deforestation is assumed to be a significant driver of the collapse of many societies. Diamond asserts that "A rigorous, comprehensive, and quantitative application of this [comparative] method was possible for the problem of deforestation-induced collapses on Pacific islands. Prehistoric pacific peoples

deforested their islands to varying degrees, ranging from only slight to complete deforestation, and with societal outcomes ranging from long-term persistence to complete collapses that left everybody dead."(18)[1]

One of the prime examples of the latter outcome described by Diamond in some detail is the allegedly deforestation-induced collapse of Easter Island. As Diamond puts it himself:

> "Easter [Island's] isolation makes it the clearest example of a society that destroyed itself by overexploiting its own resources. Those are the reasons why people see the collapse of Easter Island society as a metaphor, a worst-case scenario, for what may lie ahead of us in our own future." (118)

According to Diamond, the Easter Islanders were so fixated with building statues to their gods that they chopped down every last tree in the effort to transport the giant stone carvings for which they are famous. As a result, they destroyed their livelihood, for the trees were essential not only as direct sources of nutrition but also for the wood they provided for the manufacture of canoes, which were used to catch fish, porpoises and other marine food, and also for the protection that they provided to the soil.

Diamond builds up the reader's confidence in his technical prowess and historiographical skills by making what appear to be shrewd assessments of evidence culled from various studies. Thus, he points out:

> "There is considerable uncertainty about the date [of Easter Island's first settlement] … The published literature on Easter Island often mentions possible evidence for settlement at A.D. 300–400, based especially on calculations of language divergence times by the technique known as glottochronology, and on three carbon dates … However, specialists on Easter Island history increasingly question these early dates. Glottochronological calculations are considered suspect …
>
> Instead, what appear to be the most reliable dates for early occupation of Easter are the radiocarbon dates of A.D. 900 that palaeontologist David Steadman and archaeologist Claudio Cristino and Patricia Vargas obtained on wood charcoal and on bones of porpoises eaten by people, from the oldest archaeological layers offering evidence of human presence at Easter's Anekena Beach." (89)

Diamond continues by explaining that Anekana is the best beach onto which a canoe could be landed on the island. Moreover, the charcoal came from the layers that contained "bones of native birds that were exterminated very quickly on Easter Island and many other Pacific islands" (89–90). From this erudite explanation, we are

1 P. 18 – Diamond asserts that he "graded the extent of deforestation on a numerical scale" for 81 pacific islands and also graded various other 'input' variables, enabling him and a colleague by statistical analysis "to calculate the relative strengths with which each input variable predisposed the outcome to deforestation." However, he gives no further details of this study.

encouraged to believe that he has sifted through all the available evidence, has dismissed earlier theories as being inadequate, and has adopted the conclusions of the technologically sophisticated modern researchers.

It seems quite plausible that Diamond is right, but why has he gone into all this detail, when it is tangential to the rest of his tale? The obvious reason is that he wishes to create the impression in the reader's mind that he is himself an authority on the matter. And if he is an authority on such a detail, then surely he must also be an authority on the many other details more pertinent to the story of Easter Island's collapse.

However, in this volume Benny Peiser argues that "Diamond's *historical* reconstruction is based largely on fallacious mythologies and legends." (this volume, p. 519). Diamond's portrait of an island falling victim to what he calls 'ecocide' is based on a selective reading of a few studies. By contrast, Peiser has conducted a more thorough survey of the available literature, going back to original sources as well as evaluating more recent re-analyses of oral traditions, combined with archaeological and palaeontological evidence.

Diamond's ecocide hypothesis rests on essentially three key conjectures:

1. The population of Easter Island grew during the first few centuries of the second millennium to a maximum of between 15,000 and 30,000 people before collapsing around the year 1680 – so that by the time the first Europeans arrived in 1720, the population had dwindled to 3000 or fewer.
2. Nutrition for this population was substantially dependent on trees, especially large palms, which provided food directly (in the form of palm hearts), acted as habitat to wild animals, provided fuel for heat and cooking, was a source of wood for (fishing) canoes, and bound the soil, thereby preventing erosion.
3. The islanders had such an obsession for constructing giant statues that they chopped down all the trees in order to transport pieces of rock from one part of the island to another.

Regarding each of these conjectures, Peiser concludes:

1. The maximum population of the island and the date that maximum was reached are unclear: "all estimates of the peak size of the prehistoric population are entirely speculative." (Peiser, this volume, citing Anderson 2002). Meanwhile, although oral traditions speak of violent struggles and even cannibalism, the veracity of these traditions is very dubious because of the strong likelihood that they were influenced by the missionaries who during the nineteenth century converted the rump of the population to Christianity.

Peiser argues convincingly that Diamond's reconstruction of civil war and societal collapse is based on "[Thor] Hyerdahl's creative dating and its speculative correlation" (this volume, p. 532). Yet, "the very foundation of Heyerdahl's civil war and societal breakdown in 1680 has been comprehensibly debunked." Indeed, "Contemporary ethnographical research … has confirmed that there is hardly any tangible evidence for the existence of cannibalism (other than individual) 'anywhere, in any period.'" (this volume, p. 536).

Most likely, the violent struggles of oral tradition actually refer to the incursions by European slave traders, who fought viciously with locals, killing many of the men, raping the women, and taking some of each captive to be sold in far away lands. Meanwhile, much of the population decline was probably the result of diseases, such as smallpox and syphilis, brought by the Europeans. Although Diamond accepts that these deadly incursions occurred, he follows a recent trend in revisionist history that lays most of the blame for the demise of the Easter Island civilisation on the Islanders themselves.

2. Trees no doubt contributed to the islanders' nutrition in various ways, but large palms were probably not nearly as important as Diamond asserts. First, there is strong evidence that, when the first Europeans arrived, Easter's inhabitants were still eating a nutritious diet consisting of both intensively farmed food and fresh fish from the sea – clearly not a society in terminal decline!

Second, while it is clear that deforestation took place on a substantial scale, it is unlikely to have caused the decline in Easter Island society. Indeed, Peiser shows that in order to justify a causal relationship, Diamond is forced to manipulate the timing of the decline not only in contradiction of the available evidence but also in contradiction of an earlier article that he wrote himself! (this volume, p. 522-23).

3. For many years, the giant stone statues on Easter Island baffled researchers, even leading some to suggest preposterous theories as to how they were built. However, it is now largely accepted that the islanders moved the stones from place to place and into position by rolling them on logs. But the notion that they were so obsessed with statue production that they cut down all the trees has no basis in fact.

Peiser refers to the Franco-Belgian expedition of 1934 led by Alfred Mètraux and Henry Lavachery, whose leaders provided what Peiser describes as "a reasonable – and some might say plausible – explanation of why the production of statues and the entire cult came to an end." According to this view, statue production continued until the European raids resulted in the near-extermination of the natives. Peiser cites Mètraux: "For a lack of orders, the sculptors did not finish the works they had begun, and as a result of the disaster that struck the island monumental sculpture disappeared." (this volume, p. 530) If this theory is correct – and it is certainly more intrinsically appealing than Diamond's – then the final plank in Diamond's argument falls away.

We can thus, with a reasonable degree of confidence, reject each of Diamond's conjectures and with them his theory of ecocide on Easter Island.

A second story of ecocide on a remote island – that of the Norse settlements on Greenland – is presented in a similarly persuasive style, with much allusion to evidence. Diamond again begins on reasonably firm ground, showing that in attempting to recreate their home environment in Greenland, the Norse caused substantial changes to the local environment (including soil erosion), and that these changes came back to haunt them as the climate cooled in the fourteenth and fifteenth centuries. The problems start when he tries to show that they didn't adapt, refusing to consume seafood and obstinately sticking to their traditional diet. In support of this

thesis, Diamond cites with enthusiasm the work of Jette Arneborg. Yet in a recent paper Arneborg *et al.* concluded:

> "In the beginning, the diet of the settlers is approximately 20% marine—more or less like that of contemporaneous Norwegians. Towards the end of the period, an adaptation to marine resources has taken place—if only up to 80% of the level that we observe for contemporaneous Eskimos. Whether or not this dramatic change in the ways of life of the Norse in the course of only a few hundred years is due to the strain of a changing climate, or simply because more seals were available for the Norse hunters must be left to future research to decide. But the present research at least can refute current speculations that the Norse finally succumbed because they were unable or unwilling to adapt to harsher climatic conditions by exploiting the rich resources of the sea." (Arneborg *et al.* 2002)

Although Diamond actually refers to a similar study by Arneborg *et al.* (1999), he assumes that the marine resources consumed were "mostly seals" (228) – presumably in order to justify his later claim that the Norse refused to eat fish. And he backs this statement up with an observation that "At one poor Western Settlement farm, an astonishing 70% of all animal bones in garbage middens were of seals." (228) Of course one farm does not a people make, but this is really astonishing only if one is attempting to portray the Greenland Norse as a people that refused to adapt to changing circumstances.

OK, so maybe the Norse adapted, but did they eat fish? Arneborg *et al.* point out that "It is not certain what proportion of bones from the various food sources actually ended up in the midden and if so, to what extent they have survived decomposition. For example, the absence of fishbone in the middens does not prove that the Norse did not eat fish. Not only will fishbone rapidly decay in a midden, more likely they never got there in the first place – fishbone is a food source highly appreciated by, e.g. birds, dogs, and pigs. In fact, the isotopes have revealed that dogs are often more marine than their masters." (*ibid.*)

Now it is not entirely impossible that the Greenland Norse were a stubborn lot who would prefer to eat their dogs and die than to copy the Innuit's fishing habits. But given the rather flimsy evidence presented by Diamond to support this thesis, it is tempting to dismiss it in favour of Arenborg et al's rather more plausible theory that they did change their diet.

Turning now to Diamond's description of modern societies: Okonski reviews the picture Diamond paints of Montana – a state of which she has intimate knowledge from both personal and professional experience – and again concludes that Diamond has failed to do his homework.

As elsewhere Diamond has made a number of bold claims that fail to withstand scrutiny of any kind. For example, he claims – without citing any evidence – that there are 20,000 abandoned mines in Montana. Yet Okonski finds that, depending on whom one believes, there are between 1000 and 6000 abandoned mine sites, of which only 300 pose concern and about 80 present a serious threat.

Okonski concludes that Diamond's analysis fails to take into consideration many of the factors that have influenced decision-making with regard to the use of natural

resources in Montana, especially the history of the state and the development of the systems of ownership of mineral rights, forest resources and water resources. By omitting these important factors, Diamond's description of the state lacks coherency and fails to provide the reader with an accurate portrait of its environment, its natural history, or its likely future.

Jennifer Marohasy, a PhD biologist, reviews Diamond's portrait of Australia. In Chapter 13 of *Collapse*, Diamond claims, *inter alia*, that Australia has unproductive agriculture, with low crop yields; that it's forests, fisheries and farmlands have been overexploited in a process akin to mining; that land degradation – caused by inappropriate land management practices – is causing deteriorating water quality and harming sensitive ecosystems such as the Great Barrier Reef, and that climate change is exacerbating all these effects. But how valid are these claims?

Marohasy points out that Diamond's chapter on Australia "contains no data, no tables or figures showing past or current trends with respect to particular indicators, and Diamond makes no reference to particular studies." (this volume, p. 461) She then goes on to consider the available evidence and concludes that Diamond's story doesn't add up, concluding, inter alia that (this volume, pp. ****):

- The Australian environment is not "accelerating exponentially out of control"
- Australian agriculture is generally profitable and high yielding, though profitability is not necessarily linked to productivity.
- Farmers have overcome the low fertility of many Australian soils through the use of fertilizers, manures and nitrogen-fixing pastures species.
- Many farmers have reduced the potential for soil loss and erosion through the adoption of minimum tillage techniques.
- The Great Barrier Reef is healthy and not affected by agriculture.
- Australia has significant water resources which continue to be well-managed.
- Water efficiency in agriculture is comparatively high on a global scale, and improving.
- Issues of salinisation including rising salt levels in the Murray River have been addressed. Salt levels in the Murray are now half of what they were when they peaked in the early 1980s, and dryland salinity is not spreading.
- Several marine fisheries appear to be over-fished, yet there is no formally agreed recovery plan for the same species, including the southern blue fin tuna fishery.
- Australian forests are generally well-managed.
- Changing community values, driven by environmental campaigning, has resulted in large areas of forest that were once managed for multiple-use becoming part of the national reserve system, with logging now banned.
- There has been a general increase in forest cover, particularly in northern Australia.
- Australia's climate has always changed. Contrary to popular perceptions much of Australia has gotten wetter, not drier, over the last 100 years.

At several points in the book, Diamond raises concerns about bad things being exported from rich countries to poor countries. He cites, for example, the terrible consequences of the rich world exporting used electronic goods to China. He even provides photographic evidence of this: a picture (plate 27) of "imported electronic garbage in China represents a direct transfer of pollution from the First World to the

Third World." The picture shows stacks of electronic items, including what appear to be air conditioning units and computers (some of which may indeed have been imported from rich countries) and in the foreground are workers busily sorting out the useful from the useless components. To the extent that people in China are importing discarded electronic goods from other countries, they are no doubt benefiting – otherwise, why would they be doing it? The waste from such items is presumably no more toxic than the waste produced by similar, locally manufactured items – so the problem if any would be how to dispose of electronic items in a way that does not cause unnecessary harm to the environment. The problem is not in the importation of the goods.

In sum, on the basis of the societies considered by authors in this volume, Diamond's description of the collapse of past societies as well as existing societies he considers particularly vulnerable is sorely lacking. He fails to consider much of the available evidence and instead develops his own line of reasoning based on dubious and often faulty data. The result is a series of rhetorically appealing but analytically dubious claims regarding the nature of collapse of past societies and the condition of present societies.

2. THE FEAR FACTOR

Diamond asserts that the collapse of societies can be explained by some combination of five sets of 'factors':

1. "damage that people inadvertently inflict upon the environment." (11)
2. "climate change" (12)
3. "hostile neighbours" (13)
4. "decreased support by friendly neighbours" (14)
5. "the society's responses to its own problems … [which] depend on its political, economic, and social institutions and on its cultural values." (14)

The use of the term factors lends Diamond's assessment a scientific air. 'Factor' is commonly used in science to describe a cause-effect relationship. In physics and other natural sciences, factors are typically derived by analysing the most important variables, hypothesising relationships between those variables and then testing the hypotheses in controlled experiments or by collecting data from nature.

In social sciences, factors are more often derived by collecting large amounts of data pertaining to many variables and then looking for relationships between those variables by evaluating the existence of statistical correlations. Alternatively, an axiomatic approach may be adopted. This approach, which is common in economics, relies on introspection, observation and scholarship to produce assumptions concerning the probable existence of specific relationships. From these axioms, general rules are then derived and tested.

To the extent that Diamond's five factors follow any of these traditions it is the axiomatic approach of economics. However, Diamond provides no evidence that he is drawing on a tradition of scholarship: His factors seem to have emerged almost entirely from his imagination. This makes them inherently weaker than the factors assumed to be at play in economic analysis.

In addition, his factors are rather vague in nature and inadequately specified, making it essentially impossible to derive testable hypotheses. For example, the fifth factor encompasses more-or-less all aspects of human interaction.

Moreover, because Diamond's descriptions cannot be relied upon, we are not able effectively to evaluate the plausibility or importance of those factors even in a general sense.

Diamond also ignores much more comprehensive studies of civilisation collapse – for instance, J.A. Tainter's *The Collapse of Comples Societies* (1990) which proffers eleven factors against Diamond's five.[2]

3. SYSTEMIC ERRORS

If Diamond wanted his five-factor theory of collapse to be taken seriously, he would have to apply the factor analysis systematically to each instance of collapse that he identifies. To do this, he would first have to specify the factors in a way that made them amenable to application in the wide variety of situations that he describes and would then have to collect data in an impartial way so that he could evaluate the relative importance of each factor in determining the collapse of a society. If Diamond were to be truly systematic, he would also posit other factors that might plausibly explain the data and then test these too – in order to rule them out. Diamond doesn't do any of these things.

Instead, Diamond selectively employs information derived from a small number of sources in order to support his 'ecocide' theory. In some cases, he even interprets data more or less in contradiction to the views of those on whose analysis he relies (*viz.* the work of Jette Arneborg cited above).

From the foregoing, it is clear that in his eagerness to foretell doom, "Diamond's methodological approach suffers from a manifest lack of scientific scrutiny." (this volume, p. 539) As Peiser points out, Diamond's approach suffers from 'confirmation bias': he seems to notice and include data that support an hypothesis, while ignoring those that would reject it. He is substantially unsystematic and it is therefore impossible to draw firm conclusions from his analysis regarding the relative importance of the factors he proffers.

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2 Tainter's factors include:

1. Depletion and cessation of vital resources (salinisation of soils, waters, etc)
2. Establishment of a maladaptive practices (war, civil war)
3. Occurrence of an insurmountable natural catastrophe (plague, mega drought, mega famine, etc.)
4. Insufficient response to circumstance
5. Competition from other complex societies
6. Intruders, foreign invaders
7. Class conflict, revolutions, elite mismanagement
8. Social dysfunction
9. Religious, ideological fanaticism
10. Chance accumulation of unfortunate events
11. Economic failure

4. IMPLAUSIBLE EXTRAPOLATIONS

To the extent that Diamond identifies lessons for modern society, to what extent does he apply them appropriately? Two subsidiary questions are implied here: First, to what extent does Diamond accurately portray the current problems facing society? Second, to what extent does he identify and apply lessons from his foregoing analysis usefully?

As with his descriptions of the collapse of past societies, Diamond's descriptions of the current problems facing society rely upon a narrow and selective reading of the literature. Diamond lists twelve 'most serious environmental problems', eight of which he claims were problems in the past and four have become problematic only recently. These are:

1. The destruction or conversion of natural habitats 'at an accelerating rate'. Diamond is particularly concerned about the loss of "forests, wetlands, coral reefs and the ocean bottom." (487). While it is true that forests have been and are being converted for human uses, the important question is: does it matter? Diamond certainly thinks so: he claims that "Deforestation was a or *the* major factor in all the collapses of past societies described in this book."

This is a remarkable statement that is certainly a wild exaggeration even on the basis of his own description (one wonders if he actually bothered to read his own book). In fact it is unclear that deforestation was a significant factor in *any* collapse that has taken place in history. Certainly, deforestation has been associated with the *rise* of many societies, including Europe and the US. Trees tend to get in the way of efficient agriculture, so their removal and replacement with crops enables more people to live on less land. It is perhaps unsurprising that people in Asia and Latin America are keen to follow in the footsteps of their wealthier cousins in other parts of the world.

Diamond's obsession with trees leads him to conclude that the most important difference between the Dominican Republic and Haiti – the two halves of the island of Hispaniola – is tree management. Never mind that Haiti has for the past 100 years been run by a succession of tyrants intent on plundering the people and thereby successfully scaring off practically all those who might have invested in economic improvements.

Having said that, there may be good reasons for keeping trees in certain places: for the production of furniture and paper, as shade for certain kinds of crops, to bind the soil on hillsides, to maintain watersheds, and for the maintenance of the microclimate in certain places, among other uses. To the extent that this is the case, it is important that forests are governed by institutions that enable humans effectively to manage them, as Wolfgang Kasper's and Fred Smith's essays in this volume emphasise.

Professor Douglas Southgate of Ohio State University has spent many years investigating alternative systems for managing forest resources and has concluded that the most important factor contributing to good forest management is the structure of property rights – not only for the forest but also for agriculture. If people are able to own the land they farm, then they tend to farm more intensively, reducing pressure on other land uses, such as conservation (Southgate 1998). Likewise, if people own forests, they tend to manage them better than if they are owned by the government.

Unfortunately, Diamond doesn't seem to understand very well the role of institutions such as property rights in management of resources (see e.g. the critiques by Kasper, Smith and Shaw in this volume), so instead of blaming the leviathan governments that undermine the incentives to manage forest resources appropriately, he blames corporations and encourages us to shift our consumption habits to the purchase of wood certified by the Forest Stewardship Council (FSC). Given that the dominant reason for loss of forest cover is habitat conversion, buying timber certified by the FSC – even if it were able reliably to certify the sustainability of timber management, which is doubtful – is unlikely to make much difference. (Perhaps it should be noted here that the FSC was established by the World Wildlife Fund, a fact that Diamond – a Board member of the WWF – conveniently fails to mention when giving it a plug on p. 473.)

Nor does it mean we need to be sentimental about trees. If people in poor countries want to convert their forests to grow crops, build towns or play golf, then who are we to tell them that they can't do such a thing?

The same arguments, more or less, apply to the other resources Diamond mentions. Bogs and swamps, also known as 'wetlands', are wonderful places for mosquitoes, and for that reason are often breeding grounds for malaria. Draining these wetlands – as we did in Europe in the 18th and 19th centuries – would be one way to reduce the scourge of this disease which currently kills over a million people a year.

2. The decline in wild food stocks – especially fish. Diamond here identifies a real problem and puts his finger on the main cause: inappropriate management of fish stocks (what he calls 'the tragedy of the commons').[3] Yet by making a blanket claim he ignores the very successful management of fisheries in Iceland, New Zealand, and a few other places, where systems of individual transferable quotas have led to an increase in stocks (Hannesson 2004; Gissurarson 2000).

Diamond also points out that declining wild stocks has led to increased demand for aquaculture. Yet, instead of acknowledging the role that aquaculture can play in supplying fish for human consumption, he paints a picture of a rapacious industry destroying the planet. To begin with, he claims that "Fish grown by aquaculture are mostly fed wild-caught fish and thereby usually consume more wild fish meat (up to 20 times more) than they yield in meat of their own" (488).

Both of these statements are true but misleading. First, all the fish that humans eat themselves consume wild fish. Second, aquaculture is a more controlled environment and enables fish to be grown more efficiently than in the wild – so the total amount of fish consumed by farmed fish is lower than for an equivalent wild fish. Third, the fish used as meal in aquaculture are either not suitable for human consumption or are the off-cuts of fish processed for humans. Since many of the

3 The phrase "tragedy of the commons" was made popular by Garrett Hardin in an article in *Science* in 1968, however subsequent research has shown that common pool resources need not necessarily descend into tragedy. The situation Hardin was describing mainly pertains when there is a situation of open access – that is to say, there is no effective constraint on who has access to a resource.

world's fisheries have declined substantially through over-fishing, these small fish are not currently being eaten by fish that would be suitable for human consumption, so aquaculture represents a way for humans to utilise these fish (Ministry of Agriculture, Food and Fisheries, no date).

Diamond goes on to list various other supposed characteristics of aquaculture reared fish that are harmful to humans or the environment. So "They contain higher toxin levels than do wild-caught fish." As with practically every bold claim in *Collapse*, this blanket statement comes without a reference. A recent study showed that levels of PCBs, toxaphene, and dieldrin in farmed salmon are higher than in wild salmon, but are within the very strict levels set by the US Food and Drug Administration (Hites *et al*. 2004). (As to why we probably shouldn't worry about these minute doses of potential toxins, see the section on chemicals below.)

Most preposterously, Diamond claims that "The lower costs of aquaculture than of fishing, by driving down fish prices, initially drive fishermen to exploit wild stocks even more heavily in order to maintain their incomes constant when they are receiving less money per pound of fish." This claim, stated as fact, is unsupported by any evidence. In reality, the opposite is far more likely to be the case: the lower cost of farmed fish drives ocean fishermen out of the market, ensuring that more fish are left in the oceans to breed.

3. "A significant fraction of wild species, populations, and genetic diversity has already been lost, and at present rates a large fraction of what remains will be lost within the next half-century." (488) Here, again, Diamond doesn't bother to back up his assertion with any facts.[4] Data on the loss of biodiversity is hard to come by and difficult to interpret. What we know is that there has been a substantial amount of habitat conversion (as per point 1 above). However, the impact on biodiversity remains unclear. Some studies suggest that this has impacted on the populations of certain species (King and Rapple, no date). However, it is unclear to what extent species are actually threatened.

Much of the concern about biodiversity loss can be traced to an assumption that was made by Norman Myers in a 1979 book – and much nonsense has proceeded from this (as it turns out unjustified) assumption. The following is what Ronald Bailey, a noted environmental journalist, had to say about the matter in testimony before the US Congress in February last year:

> In 1979, Oxford University biologist Norman Myers suggested in his book *The Sinking Ark* that 40,000 species per year were going extinct and that 1 million species would be gone by the year 2000. Myers suggested that the world could "lose one-quarter of all species by the year 2000." At a 1979 symposium at Brigham Young University, Thomas Lovejoy, who is now the president of

4 In the references at the back, Diamond cites four books: John Terborgh's *Where have all the Birds Gone* (1989) and *Requiem for Nature* (1999); David Quammen's *Song of the Dodo* (1997); and Marjorie Reaka-Kudla *et al.* eds. *Biodiversity 2: Understanding and Protecting Our Biological Resources* (1997).

The H. John Heinz III Center for Science, Economics, and the Environment announced that he had made "an estimate of extinctions that will take place between now and the end of the century. Attempting to be conservative wherever possible, I still came up with a reduction of global diversity between one-seventh and one-fifth." Lovejoy drew up the first projections of global extinction rates for the Global 2000 Report to the President in 1980. If Lovejoy had been right, between 15 and 20 percent of all species alive in 1980 would be extinct right now. No one believes that extinctions of this magnitude have occurred over the last three decades.

What did happen? Most species that were alive in 1970 are still around today. "Documented animal extinctions peaked in the 1930s, and the number of extinctions has been declining since then," according to Stephen Edwards, an ecologist with the World Conservation Union, a leading international conservation organization whose members are non-governmental organizations, international agencies, and national conservation agencies. Edwards notes that a 1994 World Conservation Union report found known extinctions since 1600 encompassed 258 animal species, 368 insect species, and 384 vascular plants. Most of these species were "island endemics" like the Dodo. They are particularly vulnerable to habitat disruption, hunting, and competition from invading species. Since the establishment of an endangered species list only seven species have been declared extinct in the United States. Four are freshwater fish: the Tecopa pupfish (1982), the Amistad gambusia (1987), the Cisco longjaw (1983), the blue pike (1983); a freshwater clam, the Sampson's pearlymussel (1984), and two small birds, the dusky seaside sparrow (1990) and the Santa Barbara song sparrow (1983).

Let me say clearly from a personal perspective that species extinction is undesirable and should be avoided when reasonably possible. Extinction really is forever. But to put it in perspective, Science magazine just published an article called "Prospects for Biodiversity" by Martin Jenkins, who works for the United Nations Environment Programme-World Conservation Monitoring Center that bears on this topic. Jenkins points out that even if the dire projections of extinction rates being made by conservation advocates are correct they "will not, in themselves, threaten the survival of humans as a species." The Science article notes, "In truth, ecologists and conservationists have struggled to demonstrate the increased material benefits to humans of 'intact' wild systems over largely anthropogenic ones [like farms]. ... Where increased benefits of natural systems have been shown, they are usually marginal and local." " (Bailey, 2004).

4. "Soils of farmlands used for growing crops are being carried away by water and wind erosion at rates between 10 and 40 times the rates of soil formation, and between 500 and 10,000 times soil erosion rates on forested land." Which should, I suppose, lead us to conclude that we should stop farming and convert all the land back to forest. (We'll ignore the fact that it wasn't all forest to begin with.) But is it true? The answer is, almost certainly, no.

To justify his claim that modern agriculture is to blame for soil erosion and other forms of soil damage Diamond refers to his mostly spurious descriptions of Australia and Montana, as well as offering a picturesque example of a church in Iowa that apparently stands 10 feet above the surrounding countryside because of soil erosion. The plural of anecdote is, apparently, data.

Soil erosion is a serious problem in many places – especially where agricultural practices favour leaving the land fallow and tilling the soil heavily (typical agricultural practices in many parts of Africa and among organic farmers in rich countries). But there are also many places where erosion rates are now essentially sustainable (see e.g. Marohasy's description of Australia, this volume). This is increasingly so in arable areas in wealthy countries, where the use of modern no-till farming (made possible by the use of chemical herbicides and, increasingly, biotechnology) as well as chemical fertilisers (which replace lost soil nutrients) means that farmers both experience less soil erosion and are less reliant on the formation of new soil for nutrition.[5]

But the good news isn't just limited to wealthy countries. Mary Tiffen, Michael Mortimore and Francis Gichuki found that in the Machakos district of Kenya, a five-fold increase in population between 1930 and 1990 led to the use of improved soil conservation techniques, reducing and even reversing erosion and increasing per capita output (Tiffen *et al.* 1993).

5. Diamond's fifth scare is that "The prevalent view is that known and likely reserves of readily accessible oil and natural gas will last for a few more decades." Yes, that probably is the prevalent view and it has been the prevalent view for at least fifty years. The rate of discounting investments in the discovery of new reserves and new technologies for extracting reserves of oil and gas mean that at any time we only know about the reserves that will be commercially viable to extract in the next thirty to forty years (fewer for gas than oil). The price of oil and gas fluctuates according to the amount that is currently in production and the amount that is demanded: if demand rises, it typically takes some time to increase output and in the meantime the price rises, which provides an incentive for more marginal producers to come online. The recent hike in oil prices, for example, has meant a substantial increase in supply of Canadian shale oil (a much more expensive source than, say, Saudi crude).

The only reason that we would stop extracting oil and gas is that we found alternatives that are cheaper, more efficient, or otherwise more desirable. Suggesting that we should reduce our consumption of these resources now so that we can have more of them in the future ignores the fact that our economic progress and hence our condition in the future is in part dependent on the cost of the energy sources that we use today. If we spend more on energy today, we will have fewer resources to spend on other investments, so growth will be slower and people in the future will be worse off. Thus, the question is: do we do something today (reduce oil and gas consumption) that will definitely impoverish us as well as future people in

5 This is true especially in dryland conditions. See Shaver *et al.* 2002.

order to ensure that future people have more of a resource that they might or might not need?[6]

6. We are using most of our available fresh water. This is a grotesque exaggeration. According to the most comprehensive assessment available, "about 24% of world river basin area has a withdrawal to availability ratio greater than 0.4." (Alcamo *et al.* 2003). One issue is that much of the available fresh water is very far from areas where humans have uses for it. In addition, water is better utilised in some places than in others – so that even where withdrawal rates are high this may not pose problems. But these are very different issues to those that Diamond highlights.

In extremis, as Diamond himself points out, freshwater can be produced through desalinization of sea water. Unfortunately, Diamond then falls into the trap of assuming that because desalinization is expensive today, it will always be too costly to supply "most of the world's water shortages". The main constraint on the desalinization of water, as with transport of fresh water, is energy cost. So, it is imperative that we continue to utilise and develop low-cost energy sources.

Diamond then makes a ridiculous leap of logic, stating that "The Anasazi and Maya were among the past societies to be undone by water problems, while today over a billion people lack access to reliable safe drinking water." Yet, the reason the poor lack access to safe drinking water has no relation to the problems of the Maya and the Anasazi. People in India, for example, do not suffer from a lack of clean water primarily for environmental reasons – they suffer water shortages and contaminated water because of the incompetence with which the water is managed (see e.g. McKenzie and Ray 2004). Moreover, the problem is being corrected: the proportion of people who have access to clean drinking water has been increasing over time (Goklany, 2002).[7]

The main reason people lack access to clean drinking water is – even in arid areas – primarily a failure to develop and manage appropriate infrastructure for the delivery of that water. That, in turn, is largely because of the control exerted over such infrastructure development and management by incompetent and often corrupt governments.

There is also a strong relationship between economic development and availability of clean water (Goklany *op. cit.*). In their comprehensive review of world water availability, Alcamo *et al*. point out that "In industrialised countries, water is intensively recycled by industry, and wastewater is usually treated before being sent on to downstream users. For these and other reasons, industrialised countries can often intensively utilise their freshwater resources without experiencing scarcity"

6 There are various ways in which we could reduce oil and gas consumption, inflicting harm of varying degrees. Taxes are probably the least harmful. Regulations limiting use are more damaging, as are subsidies to 'alternative' fuels. Currently, most governments do a mixture of these things, causing billions of dollars to be misdirected each year and thereby successfully undermining economic growth and harming the lives of people both today and in the future.

7 See e.g. Goklany (2002) especially figure 2, p. 26. – World Bank figures on access to safe water show a substantial upward trend in nearly all countries over the period 1970–1995.

(Alcamo *op.cit*). In other words, economic development, far from threatening water supplies, is in fact an important part of the process of improving access.

7. We are approaching the 'photosynthetic ceiling' for production of crops – which means we will use most sunlight to grow crops and none will be left over "to support the growth of natural plant communities, such as natural forests." These claims are both demonstrably false.

First, the claim that most incoming sunlight will be used to grow crops is contradicted by the evidence from around the world, which shows that crop production increases up to a point and then, as efficiency of land use, photosynthetic productivity and incomes rise, it decreases again. This applies not only in places such as the US, which have experienced a significant increase in the area of forests over the past 100 years (both 'natural' and plantation), but also even in India, which has recently seen an increase in forest land – linked to rises in crop productivity and income (Foster and Rosenzweig, 2002).

Second, as demand for food continues to rise, it is quite possible that the oceans could be used more comprehensively for food production – for example by seeding the ocean surface to produce phytoplankton and thereby enhancing the global use of sunlight. Alternatively, or in addition, other sources of ultraviolet radiation could be brought more comprehensively into use. In particular, it is quite feasible that food could be grown in hydroponic factories supplied with a combination of sunlight and UV radiation produced by lamps. Possibly neither solution will be necessary or cost effective, in which case we will simply continue to use more efficient land-based food production technologies, but given the possibilities it seems silly to make unfounded scary claims about the limits of photosynthetic productivity.

8. Diamond then tries to scare us into believing that we are poisoning ourselves and our environment with 'toxic chemicals'. It is true that today, many industrial processes rely on synthetic chemicals, and some of these chemicals are persistent in the environment. But Diamond and others seem to think that this persistence itself is dangerous.

Many synthetic chemicals confer significant benefits to human beings – for example by reducing the cost of food or increasing its shelf life. Some have even arguably had environmental benefits – for example, chemicals that increase yields mean that more food can be grown on less land, reducing pressure on wild land; meanwhile, chemicals that enable weeds to be killed with minimal tillage reduce the soil erosion that results when land is ploughed.

Since 1961, agricultural output has outstripped global population growth by 20% - and the majority of this increase has come from using improved agricultural technologies, including pesticides and fertiliser. When considered against the evidence, these 'toxic chemicals' have enabled humanity to benefit substantially from improved nutrition:

> Since 1950, the global population has increased by 90%, increasing the demand for food, but at the same time the real price of food commodities has declined 75%.

> Greater agricultural productivity and international trade have made this possible. As a result, average daily food supplies per person increased 24% globally from 1961–98. The increase for developing countries was even larger, at 38% … Between 1969–71 and 1995–7 such increases in food supplies reduced the number of chronically undernourished people in developing countries from 920 million to less than 800 million (or from 35% to 19% of their population), despite a 70% growth in population (Goklany, 2002).

Diamond implies that exposure to even minute doses of synthetic chemicals will certainly cause health problems including cancer in humans (in addition to whatever environmental effect they may have). Over the past few decades, it has become clear that a large proportion of all chemicals, synthetic and natural, cause cancers when fed to rodents in high doses. However, at the lower doses to which human beings are exposed to these chemicals mostly do no harm – for the simple reason that our bodies are able to deal with them through various processes (Ames and Gold, 2004). If we were not able to rid ourselves of even minute quantities of carcinogens, we would not live very long, precisely because of all the natural carcinogens!

One class of chemicals Diamond singles out for particular opprobrium is the polychlorinated biphenyls or PCBs. These chemicals were very widely used from the late 1920s as insulators and coolants in electrical equipment. A recent article reviewed the evidence for the carcinogenic properties of PCBs and concluded, "Applying a weight-of-evidence evaluation to the PCB epidemiological studies can only lead to the conclusion that there is no causal relationship between PCB exposure and any form of cancer" (Golden *et al.* 2003).

On the issue of endocrine disruption: Diamond says that certain chemicals interfere with our reproductive systems, mimicking or blocking effects of our own sex hormones, and thereby "probably make a major contribution to the steep decline in sperm count in many human populations over the last several decades, and to the apparently increasing frequency with which couples are unable to conceive, even when one takes into account the increasing average age of marriage in many societies." (492) Diamond never mentions the naturally-occurring substances that have endocrine disrupting effects. Nor does he mention that the birth control pill – which is *intended* to interfere with the hormone system, but doesn't seem to be doing much damage to the human species. Perhaps this is because it runs contrary to one of Diamond's other beliefs – that the human population is too large.

Diamond fails to discuss the extent to which health effects can actually be attributed to exposure to endocrine-disrupting chemicals. Stephen Safe, a professor of Veterinary Physiology & Pharmacology at Texas A&M University, and the director of the Center for Environmental and Rural Health analysed the scientific studies which have been conducted to analyse the 'endocrine disruption' hypothesis. Safe found that "Environmental concentrations of persistent organochlorine compounds have been decreasing over the past two decades, and this correlates with remarkable advances in the detection of exceedingly low levels of these compounds in human populations." (Safe, 2000).

In addition, Safe found that while testicular cancer is increasing in most countries, it is not correlated with other indicators of male reproductive capacity – and

it also runs contrary to the decline in organochlorine compounds in the environment. He says:

> "Results of recent studies suggest that there is not a global decrease in male reproductive capacity and that an etiologic role for xenoestrogens in female breast cancer is unlikely. It is possible that new scientific evidence may reinforce or weaken these conclusions; it is also important to carefully validate and replicate findings before media announcements that may contribute to unnecessary fear and worry by the public" (Safe, 1995).

After making various false claims about the risks of environmental chemicals, Diamond then claims without citing a single reference that "Deaths in the US from air pollution alone are conservatively estimated at over 130,000 per year." The idea here is to imply that outdoor air pollution, caused by industry (as well as those horrible, polluting contraptions called automobiles), presents a major environment and health problem. Yet available evidence suggests that air pollution – both indoor and outdoor – has declined dramatically during the past half-century in most industrialised countries.

Indur Goklany reviewed the US Environmental Protection Agency's own data and made the following conclusions about indoor and outdoor air pollution in the USA:

- Between 1940 and 1990, indoor air quality, according to EPA's own emissions estimates, improved by over 90 percent for particulate matter (PM, a measure of soot and smoke), carbon monoxide (CO), and sulphur dioxide (SO_2).
- Most major air pollutants had been declining prior to the Federal Clean Air Act of 1970. Particulate levels, which had been in decline at least since the 1940s, fell 15 percent between 1957 and 1970. Sulphur dioxide declined 40 percent between 1962 and 1969. Similarly, smog—a problem first and foremost in the Los Angeles area—had been improving there since the 1950s.
- Composite nationwide air quality data from the Environmental Protection Agency and its predecessor agencies show that ambient air quality for each of the traditional air pollutants has been improving for almost as long as such data are available (Goklany, 2001; see also Goklany, 1999).

Diamond here might have more reason to complain should he have examined air pollution in the developing world. In many poor countries, indoor air pollution – which results from the burning of wood, dung and crop residues – contributes to the very high incidence of acute lower respiratory infections, which according to the World Health Organisation results in nearly two million premature deaths each year (WHO 2000). One reason such deaths have declined so dramatically in industrialised countries is the switch to cleaner fuels, including natural gas and electricity (even when that electricity is produced in coal-fired power stations). But perhaps Diamond did not want to acknowledge the important role that modern energy (including fossil fuels) can have in eliminating what is still a major contributor to deaths in poor countries.

9. Alien species. Here Diamond is not referring to little green men, but rather plants, animals and microbes that travel beyond their native habitat. Some of these cause

damage – outcompeting native species because of a lack of natural predators – as rabbits did in Australia and kudzu does in the US. However, we typically learn to live with these species and sometimes come up with ways of reducing the harm that they do. That is not to say that it isn't worth investing in controls that limit such harmful invasions – it is just that we should avoid excessive concern.

Other alien species have of course produced substantial benefits: the diet of most people would be rather different without the tomato (from Peru) and wheat (from Mesopotamia). As for Australia, it is possible that the first colonists would never have survived but for the import of sheep and cattle from Britain.

10. "Human activities produce gases that escape into the atmosphere, where they either damage the protective ozone layer (as do formerly widespread refrigerator coolants) or else act as greenhouse gases that absorb sunlight and thereby lead to global warming." The statement is scientifically illiterate in the extreme. Notwithstanding the very poor construction of the sentence, which leads the reader to assume that *all* gases emitted by humans either cause ozone depletion or global warming, the description of the process by which global warming is supposed to take place is just plain wrong. The 'greenhouse gases' are important not because they absorb sunlight but because they prevent the re-emission of infra-red radiation.

Diamond's analysis of the problem of global warming doesn't improve much. He asserts that 'most knowledgeable scientists now agree that, despite year-to-year ups and downs of temperature … the atmosphere has been undergoing an unusually rapid rise in temperature recently, and that human activities are the major cause." Really? Most 'knowledgeable scientists'? Are they the same knowledgeable scientists from whom Diamond learned the mechanism of the greenhouse effect, perhaps? How many people has Diamond actually talked to, read papers of or otherwise gleaned information from – and what is the credibility of their opinion?

In the reference section, Diamond cites three books that offer "good accounts of global warming and climate change": Steven Schneider's *Laboratory Earth: the Planetary Gamble We Can't Afford to Lose* (1997); Michael Glantz *Currents of Change: Impacts of El Niño and La Niña on Climate and Society* (2001) and Spencer Weart's *The Discovery of Global Warming* (2003).

Michael Glantz is a political scientist and Spencer Weart is a historian. Of the three, only Schneider is a climate scientist – but he can hardly be relied upon to be impartial. In the 1970s, he was a strong advocate of taking action to address global cooling (see e.g. his praise on the dustcover of *The Cooling* by Lowell Ponte, 1976), and since the late 1980s he has been calling for action to avert catastrophic global warming. In 1989, Schneider said in an interview to *Discover* Magazine:

> "On one hand we are ethically bound to the scientific method, in effect promising to tell the truth, the whole truth and nothing but…which means that we must include all of the caveats, ifs, and buts. On the other hand, we are not just scientists, but human beings as well. And like most people, we'd like to see the world a better place, which in this context translates into our working to reduce potentially disastrous climate change. To do that we have to get some

> broad-based support, to capture the public's imagination. That, of course, entails getting loads of media coverage. So we have to offer up scary scenarios, and make little mention of any doubts we may have. Each of us has to decide what the right balance is between being effective and being honest. I hope that means being both" (Schneider, 1989).

Other papers in this edition – drawn from the evidence presented to a House of Lords inquiry into the economics of climate change – address in some detail various aspects of this debate. It is perhaps only worth noting in addition that Diamond seems to fall into the same trap as so many others in assuming that today's climate is somehow optimal. Yet, earlier in the book he has already discussed in some detail how the Greenland Norse suffered as a result of the little ice age. Other scientists have pointed out that our ancestors generally did better in warm than in cold climates (Lamb, 1995). Even today, in temperate climes, more people die from cold than from heat (data from tropical climes is not readily available). All of this does not necessarily imply that we should look forward with glee to a warmer world – for there might well be losers as well as winners – but it puts things in some perspective.

11. "The world's human population is growing. More people require more food, space, water, energy and other resources." (494) …
and
12. "What really counts is not the number of people alone, but their impact on the environment … Our numbers pose problems insofar as we consume resources and generate wastes." (494)

Diamond – in prose worthy of the dismal 18th Century preacher, Robert Malthus – claims that environmental problems "will be resolved, in one way or another, within the lifetimes of children and young adults alive today" … the only question is whether they will be resolved "in pleasant ways of our own choice, or in unpleasant ways not of our choice, such as warfare, genocide, starvation, disease epidemics and collapses of societies." (498)

To Diamond, the 1994 genocide in Rwanda is symptomatic of what is awaiting us unless we start a massive programme of population control. He devotes an entire chapter to the issue, basing much of his discussion on a paper written by two economists, Catherine Andre and Jean-Philippe Platteau, entitled "Land Relations Under Unendurable Stress: Rwanda Caught in the Malthusian Trap." (1998) The authors had conducted a survey of a province in North-West Rwanda during the late 1980s and early 1990s (before the genocide) and concluded that the rise in population in the region contributed to the tensions that led to the genocide. But they also point out that a fundamental problem was that as farm sizes and income fell, people were unable to compensate through non-farm incomes.

Underlying this lack of non-farm income was massive and persistent state intervention. As Peter Uvin, Henry J. Leir Professor of International Humanitarian Studies at Tufts University, observes in his award-winning account of the Rwandan genocide: "the lion's share of the salaried jobs is in the public service; in Rwanda even jobs in the private sector, or in development projects, were accessible only through the

state (Ministry of Labor permission required). Secondary and tertiary education – the main path for upward mobility for the few who made it – was largely state controlled, although often executed by religious orders (with development aid money). Little changed in that respect over the decades" (Uvin, 1998).

As to the broader causes of the genocide, Uvin continues:

> "Rwanda's genocide was the extreme outcome of the failure of a development model that was based on ethnic, regional, and social exclusion; that increased deprivation, humiliation and vulnerability of the poor; that allowed state-instigated racism and discrimination to continue unabated; that was top-down and authoritarian; that left the masses uninformed, uneducated, unable to resist orders and slogans. It was also the failure of a practice of development cooperation based on ethnic amnesia, technocracy, and political blindness." (Uvin, op.cit.)

Considering the practical aspects of the failed development model: "Rwanda's administration and extension system was authoritarian, vertical, and most peasant unfriendly, producing very limited impacts. More generally, the public sector was inefficient, not very well coordinated, and oriented towards the interests of a minority." (Uvin, *op.cit.*) Meanwhile, "the export dependence on coffee, inherited from the colonizer, continued and was subject to major government promotion; tea was added. The vagaries of the international market made this an extremely unstable and unsure path for development, for poor farmers as well as for the government. Rural diversification was neglected …" (Uvin, *op.cit.*).

Rwandan agriculture even today is extremely basic, as Diamond points out "farmers depend on handheld hoes, picks, and machetes." (319) Under the right conditions the private sector would probably have been able to supply all sorts of marvellous modern technologies, such as tractors, fertiliser and pesticides, which would have enabled the Rwandans to increase output. The problem is that the right conditions didn't prevail. Land tenure was largely informal, making it difficult for peasants to secure loans with which to buy the technologies that would enable them to improve agricultural efficiency. And in any case the banks and the suppliers of technology were largely controlled by the state, which restricted access to all but those it favoured.

The extreme level of government intervention also more-or-less precluded off-farm work, so even if some farmers were able to increase efficiency, the farmers who sold their land would have had – indeed, did have – a hard time making a living.

By exaggerating the role of Rwanda's population increase, Diamond underplays the importance of other factors in the genocide. Moreover, his policy prescription – (presumably compulsory) birth control – is quite inappropriate. Indeed, it seems plausible that if such a policy had been implemented in Rwanda it would have become another means of promoting the interests of the authoritarian government – and might even have exacerbated tensions.

More generally, Diamond has swallowed, hook line and sinker, the notion that increases in population and wealth are bad per se:

> "… a society's steep decline may begin only a decade or two after the society reaches its peak numbers, wealth and power. … The reason is simple: maximum

> population, wealth, resource consumption, and waste production mean maximum environmental impact, approaching the limit where impact outstrips environmental resources." (509)

Diamond's aim seems to be to scare us into thinking that there isn't much time to act if we want to save the Earth. Fortunately, his analysis is utter bunkum. In the past century, many societies have experienced simultaneously dramatic increases in both wealth and population, as well as increased consumption of resources, while experiencing reduced environmental impact. (Moore 2000)

In a particularly purple passage, Diamond compares economic migration – a consequence allegedly of population pressure – to the demise of the Eastern Settlement of the Greenland Norse and, bizarrely, the rioting that occurred in Los Angeles following the acquittal of the policemen who brutally beat up Rodney King:

> "I picture the scene at Gardar as like that in my home city of Los Angeles in 1992 at the time of the so-called Rodney King riots, when the acquittal of policemen on trial for brutally beating a poor person provoked thousands of outraged people from poor neighbourhoods to spread out to loot business and rich neighbourhoods. The greatly outnumbered police could do nothing more than put up pieces of yellow plastic warning tape across roads entering rich neighbourhoods, in a futile gesture aimed at keeping the looters out. We are increasingly seeing a similar phenomenon on a global scale today, as illegal immigrants from poor countries pour into the overcrowded lifeboats represented by rich countries, and as our border controls prove no more able to stop that influx than were Gardar's chiefs and Los Angeles's yellow tape." (273)

But what does this odd description have to do with the debate about migration? Economic studies suggest that migrants have a positive impact on the country to which they migrate.[8] Migrants may indeed leave their native country in desperation, but it is not because of "over-population": it is because the economic and/or political conditions in those countries are not conducive to the pursuit of economically rewarding activities.

Rich countries are currently experiencing a dramatic slow-down in the rate of reproduction as people choose to marry later and to have fewer children. In some countries this is beginning to result in a demographic structure biased towards older, retired people. This will have a negative impact on the economy of those countries because people in gainful employment typically create more wealth than people who are retired. In addition, the state will find it increasingly difficult to pay the pensions of those in retirement. In this context, immigrants fill a very important niche, increasing the pool of productive workers and thereby adding to the wealth of the country into which they migrate.

Even if there were no demographic crisis, migrants would most likely add value: each one represents an extra pair of hands and an extra set of eyes and ears, not to mention an extra brain – as Julian Simon argued so eloquently: humans are the "Ultimate Resource."

8 This can apply even to mass migrations, see Taylor (1997).

We now come to the second of our questions relating to the appropriateness of Diamond's analysis to the problems of today – does he identify and apply the lessons appropriately? The answer is "probably not".

Citing the example of the Greenland Norse, Diamond cautions against excessively conservative cultures and stresses that we have to adapt our culture to changing circumstances. He then asserts that in the current era we need to become more environmentally conscious and gives numerous examples of the importance of environmental interest groups influencing policy. But aren't the stasis-obsessed environmentalists he praises really arch conservatives? If stasis killed the Greenland Norse, as Diamond claims, won't it likely kill us too?

And what if 'environmental concern' leads us to ignore more important dangers, such as the threat of suicidal terrorists? Or, what if it leads us to reduce rates of economic growth and technological development, with the consequence that when a catastrophe does occur – of a human or non-human induced nature – such as a supervolcano, giant tsunami, asteroid or any number of unforeseen and unimagined threats – then society will be less able to cope with the consequences than had we allowed economic growth and technological change to proceed.

Ever since Kenneth Boulding's 1965 essay "The economics of the coming spaceship earth," environmental alarmists have claimed that the Earth is a fragile, island-like entity liable at any moment to be destroyed by our tinkering.

Diamond takes this analogy to its logical extreme. As Jane Shaw observes, he "believes that his fragmentary explanations of why small groups such as the Anasazi or the Easter Islanders disappeared can form the basis for predications about the future of the state of Montana or the continent of Australia" (this volume, p. 545).

Modern societies inhabiting large land masses and maintaining vast networks of interconnections and widespread trading links are hardly comparable to past societies that inhabited isolated islands with limited trading links. As Okonski notes in this volume(p. 500), Montana is not an island: "[It] is one state in a country with 49 other states with an interdependent history. In that country, people are free to move, and over the past century, many people have chosen to move to Montana. In that country, economic activity between individual states is extremely interdependent."

It is that interdependence, fostered by the rules and institutions that human societies have developed to enhance their ability to solve problems, which makes Montana, Australia and other modern societies fundamentally different to the societies that Diamond has written about. As Smith observes:

> One might have thought Diamond would have compared failures against successes: the Soviet Union versus the US, Chile versus Argentina, North versus South Korea, East versus West Germany. In all of these cases, the successes have fostered the evolution of institutions which enable enterprising people in those societies to be more resilient to change, and in many cases, to accommodate changing values. Instead, Collapse offers us isolated unique communities – Easter Island, the Mayans and Greenland and a few others — which most would view as falling outside the mainstream of western civilization. (this volume, p. 437)

Diamond would probably consider the contributors to this journal part of the problem and dismiss us all as members of the camp of fool-hearted optimists. Given the empirical evidence presented in this essay and in other contributions to this volume, and combined with Diamond's failure actually to prove his hypothesis in *Collapse*, let the optimists prevail.

5. SOLUTIONS

Perhaps the most fundamental problem with Collapse is one that is already apparent in the subtitle: "How societies choose to fail or succeed." The problem is this: societies don't make choices, individual people do.

Although Diamond has in general asked some good questions, his answers suffer from a lack of appropriate insight into the actual motives of humans as they are. For example, he asks us to examine the experience of the Norse in Greenland, who clearly suffered from a lack of resiliency to change. But, as Fred Smith observes, "Although [Diamond] alludes to resiliency as a key factor in determining a society's risk of collapse, he has little understanding of the way in which alternative institutional arrangements affect resiliency" (this volume, p. 427).

Adam Smith argued persuasively over 200 years ago that the history of civilisation is, to a large degree, a history of trade and specialisation. Individuals are able to specialise in the production of specific goods and services, rather than produce everything themselves, because they are able to trade with one another. Specialisation increases efficiency, enabling the production of more and better goods and services. As more surplus goods and services are produced, trade increases, resulting in a virtuous circle of enhanced levels of production and consumption. Competition in the supply of goods enhances this process further, providing incentives to producers to innovate better goods and ways of producing goods with fewer resources.

Yet as Kasper (this volume, p. 451) points out "Specialisation and trade – which have … been a driving force of prosperity and institutional innovation – are presented by Diamond only as dangerous risks of dependency." Indeed, Diamond seems to see trade as essentially a zero-sum game, claiming for example that "Socially stratified societies, including modern American and European society, consist of farmers who produce food, plus non-farmers such as bureaucrats and soldiers who do not produce food but merely consume the food grown by farmers and are in effect parasites on farmers." (164).

Kasper responds to this by asking: "Does Diamond really care to imply that 98% of the American population are parasites? Can anyone be totally unaware of the value of goods and services for which farmers exchange their produce – in the case of US farmers, quite voluntarily." Yet, it is not surprising that someone who thinks that non-farmers are parasites should have no real conception of the value of trade and specialisation.

The point is that in market economies, in which people are able to own and exchange property freely, non-farmers are more akin to symbiotes than parasites, each producing goods and services and then exchanging these in a voluntary process that is mutually beneficial.

Diamond's fear of trade and globalisation leads him to conclude that "Other peoples besides the Greenland Norse have similarly discovered their economies

(or even their survival) to be at risk when their major trading partners encountered problems; they include US oil-importing nations at the time of the 1973 Gulf oil embargo, Pitcairn and Henderson Islanders at the time of Mangareva's deforestation, and many others." (267) He than claims that "Globalization will surely multiply the examples." (*ibid.*)

Here he gets the problem quite upside down. The Greenland Norse, the islanders of Pitcairn and Henderson and even the victims of the Gulf oil embargo all suffered because of the *limited* extent of their trading relations. Had their trading been more extensive and varied, their exposure to a downturn in trade with one particular location would have not been nearly so severe. Since globalisation is the process by which trading relationships become multiplied and inter-woven, its onward march will surely reduce the number of examples of isolation-induced collapse.

Addressing a specific issue, what is the best solution to conservation of biodiversity? Dr Alexander James analysed data on park management collected by the World Conservation Monitoring Centre. He found that parks which were semi-autonomous from central government (that is they were primarily reliant on revenue from the park) were managed better than parks that were managed by the state (with budgets coming directly from central government and revenues going to central government coffers). The reason is quite simple: where park managers have more control and are able to affect revenues directly, rather than relying on lobbying of central government, they have stronger incentives to focus on improving the park for the purposes of attracting tourists.[9]

The conclusion seems clear: if one is concerned about the management of the world's forests and other ecosystems: allow parks the greatest freedom to be self managing. Logically, private parks would be even better than semi-autonomous state parks, though in many cases it is politically difficult entirely to privatise parks.

If Diamond had a better understanding of the role of institutions such as property rights, the rule of law and markets in mediating the incentives of individuals, he might have analysed the causes of successes and failures of past and present solutions in a more balanced and plausible way.

CONCLUSION

Based on the foregoing, it is possible to identify five factors that can explain the failure of Jared Diamond's book *Collapse* to provide an adequate explanation of "how societies choose to fail or survive":

First, 'truth slippage': Diamond fails adequately to describe the societies he chooses, often omitting important information and/or selecting his data to support his thesis rather than offering a balanced description.

Second, 'poor specification of cause-effect relationships': Diamond's explanation of societal collapse and sustainability is generally implausible: his factors are simply too poorly specified to be convincing.

9 Results for South Africa are reported in James (1996).

Third, 'lack of rigour in application of the scientific method': Diamond has failed to be systematic in evaluating societies, preferring to give long-winded accounts based on a combination of anecdote and speculative interpretation of data rather than collecting and analysing data in a way that would enable a truly systematic analysis.

Fourth, 'failure to apply his own analysis appropriately.'

Fifth, 'failure adequately to take account of alternative explanations' that might better explain the success or demise or certain societies.

These five factors, which derive from the five questions posed at the outset of this essay, combine in *Collapse* to produce a devastatingly misleading book. It is hoped that this collection of reviews will help readers understand how Diamond has erred and perhaps thereby prevent his mistaken notions from being too widely repeated. Perhaps it might also encourage someone to go away and write a good book about the collapse of past societies and the prognosis for future societies.

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