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Human health and forested ecosystems: Exploring historical transitions of diseases and perceptions

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ABSTRACT: This paper examines the relationships between human health and the health of ecosystems from a historical perspective, by summarizing first the changing nature of human diseases over the last century, and then the changing perceptions of illness. A section detailing the relationships between emergent diseases and environmental change is followed by examples of forest change and human health in Australia, highlighting particular features of forest management that are related to human health issues. The paper makes a prognosis for future perceptions of the significance of this relationship.

1 INTRODUCTION

Humans, trees and disease can be linked in a variety of ways. As a starting point it is clear that a forested ecosystem can be judged as 'healthy' in the same way that a human can be regarded so. Humans might transmit a tree disease, a forest might harbour a disease of humans, and humans might influence forest structures or components resulting in a pathological response in either or both the forest ecosystem and the human population.

These types of understandings demonstrate the reciprocal relationship between the well-being of ecosystems and the well-being of humans, where the presence or absence of disease or illness is not the sole measure of human health, nor the health of an ecosystem. This broader notion of health incorporates a state of being from the perspective of a system to which everything belongs. Health is very much a perceptual notion, and these perceptions are themselves subject to historical change (Kaplan 2004; see also Hassed 2004; Barsky 1998).

This paper examines the relationships between human health and the health of ecosystems from a historical perspective, by summarizing first the changing nature of human diseases over the last few centuries, and then the changing perceptions of illness. A section detailing the relationships between emergent diseases and environmental change is followed by a final section that looks at examples of forest change and human health in Australia, making a prognosis for the future perceptions of the significance of this relationship.

2 HISTORICAL TRANSITIONS OF DISEASE

In most of the world where living conditions, nutrition and access to medical services and technology have 'improved', the majority of causes for death and disability are linked to over-indulgence

and longevity not infections (WHO 2002; Mathers et al. 2001). Although there is debate about how long we can extend our life, most demographers accept that living to 85 is increasingly possible in the Western world (Olshansky et al. 2001, Haylick 2004). This provides sufficient years to silt-up arteries, develop cancers, wear out joints and get very tired of life (see Radio National 2004; Hassed 2002).

This is a very different picture from the challenges before 1930 where death was more a result of infectious diseases such as pneumonia, cholera, diphtheria and tuberculosis (Brown et al. 2005; Olshansky 1997). These are diseases essentially of overcrowding and poverty, and despite disproportionate western affluence, they are still valid for a significant proportion of the world's population. Before 1930 diseases like cancer and cardiovascular disease were only responsible for a small proportion of deaths (Brown et al. 2005).

Since 1970 the medical challenge in the western world has changed to one that seeks to mitigate the impact of plenty and to develop strategies to counter the effects of a constructed world created by socio-economic relations, wastes, and patterns of resource use (See ABC Radio National 2004, WHO 2002). The world of the 21st Century is urbanised, car-orientated, time-pressured, and markedly less physically active and must respond to the global stresses of increased UV radiation, climate change and environmental degradation (McMicheal 1997; Brown et al. 2005). The main causes of mortality in Australia are melanoma, cardiovascular disease, diabetes, and inflammatory diseases such as asthma are on the increase (ABS 2000; Mathers et al. 2001). Exotic emergent infections like SARS, Avian –flu, and VEE have become prominent as have forecasts of the emergence of superbugs resistant to antibiotics (Olshansky et al. 1997; CDC 2004; Bell 2003). Today's medicine provides surgery to help control appetite, bypass clogged arteries, suppress chronic conditions, and remodel worn out joints. Health promotion encourages citizens exercise and to apply sun cream, to shield harmful ultraviolet rays that can now penetrate the atmosphere due to a depleted ozone level. Expensive lifestyle centres have been built and personal trainers hired to construct voluntary activity that can be parcelled into a neat 30 minute appointment slot. For some mental peace is sought through medication, for others alternative religions and therapies, or wilderness experiences.

This narrative highlights the historical transitions experienced in western societies by medicine in particular, and the health sector in general: a shift from a system dominated by a need to address mortality caused by communicable diseases, to mortality dominated by non-communicable diseases, the so-called epidemiological transition. Indeed, Santow (1999) argues that further gains in cultural, social and behavioural arenas, the domain of health promotion have addressed the latter. Now the stage is set for a further transition to ill health caused by a myriad of environmental changes (see McMichael, 2001), the feedback loop of people's desires to 'improve' their standard of living and their level of security and comfort under the dominance of an economically rational political system.

3 CHANGING PERCEPTIONS OF ILLNESS

With the above developments has also come an ability to detect abnormalities earlier: we are discovering pathology in the knees of apparently 'healthy adolescents', and we have methods to screen for cancers that ultimately may, if left alone, have little influence on our health (Kaplan 2004, Barsky 1997). Once an individual has entered the medical system and been found to be 'diseased' the wheels are set in motion and under western medicine this almost inevitably results in an intervention that is financially and often socially and psychologically costly (Getz et al. 2003; Flanagan 2002). Studies by Kaplan et al (2004) have shown that despite twice the number of cardiac bypass surgery being performed in America the outcomes are exactly the same as those found in Canada where cardiac catherizations to detect vessel blockage is provided by the public system and more limited. Once an abnormality is found there are not clear indicators to select who should or should not receive surgery. Knowing about something does not always result in knowing what to do and far from providing peace of mind, can cause significant mental trauma.

Yet the medical mantra today is visit your general practitioner at least annually, be proactive, promote prevention, screen: 'if you don't look you don't find' (Flanagan 2002, Sanson-Fisher et al. 2004. A visit by someone feeling slightly overweight, keen to get reassurance and an all clear, instead is delivered a diagnosis of being obese, diabetic, hypertensive, and having elevated blood cholesterol. The patient emerges anxious, with a swathe of medications and significant sense of guilt and inadequacy tempered only slightly by the fact that the doctor wasn't that thin and certainly looked like her blood pressure might be up today!

These types of scenarios have led to debates amongst medical practitioners on what disease really is, when it is appropriate to investigate or screen and how can the individual concerned be involved in the decision making process (Getz et al. 2003 Stott 2003; Clarke 2003; Hassad 2004). It has been shown that when someone is given all the evidence his or her response to screening is more conservative (Kaplan et al. 2004).

Decisions to intervene are based on economically driven and/or normative notions of health, and perceived probabilities of prognosis. Both are subject to change according to the influence of clinico-medical trials. For instance the threshold for cholesterol levels in the Unites States of America requiring action used to be values greater than 240md/ dl, and this represented about 20% of US citizens. Lately this threshold has dropped to 200mg/dl, which has resulted in 50% fitting the criteria for treatment (Kaplan et al. 2004).

Similarly for diabetes, the diagnostic threshold used to be 140mg/dl, while today it is 126mg/dl increasing the number of US citizens with diabetes by 1.7 million. Interestingly although there is excellent evidence that good glucose control for people with levels above 140mg/dl makes a difference to outcomes, the benefit of medical care to people with blood glucose levels between 126 and 140 is uncertain (Kaplan et al. 2004).

More and more asymptomatic people are being asked to take medication or have medical intervention; great for the pharmaceutical companies but is it good for us? Obviously taking a lifestyle approach that focuses on eating plenty of fruit and vegetables and keeping active regularly manages depression, cancer, diabetes, obesity and benefits anyone without a doctor or tablet in sight.

So is prevention always better than cure? Is it sometimes better to wait until you feel bad rather than look for something when you feel well? Is acting early always the best strategy? The Hippocratic oath states "first, do no harm". Some doctors today are beginning to wonder whether an enthusiasm to detect "disease" and intervene is beginning to back fire and it is time to reassess the benefits of promoting asymptomatic screening and to focus on prevention through valid population measures that promote good health outside of the medical model (Hassed 2004).

This raises questions about the direct and indirect implications for the way we understand the relationship between human health and health of forested ecosystems:

- Are decisions to intervene in the management of forests driven by particular societal agendas themselves subject to change over time?
- Are new diseases emerging from a forest-human interaction?
- Do our perceptions of a healthy forested ecosystem change with time?

4 EMERGENT DISEASES AND ENVIRONMENTAL CHANGE

Several examples exist of the emergence of diseases in response to forest clearing for extensive agricultural mono-cropping, usually when humans are exposed to host switches by vectors and the parasite at the edges of forests (McMichael 2001). Yellow fever in Eastern Africa demonstrates this well. Ordinarily, in the absence of a forest edge effect, the virus circulates among monkeys high in the canopy, transmitted by the mosquito *Aedes africanus*; having co-evolved the monkeys are unaffected by this viral infection. The situation changes with human activity that results in forest clearing. Monkeys come down from the trees to steal food and provide an opportunity for another mosquito (*Aedes simpsoni*), this one low-flying and biting both monkeys and humans, to pass on the infection to humans (McMichael 2001).

The impact of development on nature has resulted in the emergence of new diseases throughout time. Recently in Mexico the clearing of the forest resulted in the development of a deadly new virus, Venezuelan equine encephalitis or VEE that affects both horses and humans (Witte 2002). It is believed that the clearing of the forests put extreme evolutionary pressure on the strain of VEE virus normally found there. The VEE virus previously found was spread by the mosquito *Culex taenipus*. This mosquito feeds and infects mainly rodents and small mammals. It was not thought that this mosquito was effective at transmitting the virus to horses or people. In 1995 and 1996 in the deforested regions of the Mexican states of Chiapas and Oaxaca two outbreaks of VEE killing both horses and humans occurred. This caused scientists from the University of Texas to explore why suddenly the mosquito appeared to have altered its feeding habits (Brault et al. 2004).

The researchers suggest that the deforestation resulted in wiping out the *Culex* subspecies, a single mutation in the virus (Brault et al. 2004) allowed the virus to move to a new ecological niche. The mutation increased its ability to infect an entirely different species of mosquitoes (*Ochlerotatus taeniorhynchus*) which prefers the taste of horses and other large mammals like humans. It was found that this mutation also made the virus more infectious and made it easier for the mosquito to transmit it to horses and people (Kinney et al. 1992; Brault et al. 2004). So significant is this environmental and ecological shift that today no samples exist of the original VEE strain that used to circulate between the *Culex* mosquito and small mammals in the Chiapas and Oaxaca coastal plains.

Patz et al. (2000) summarize the types of environmental changes and conditions that contribute to the proliferation of emerging zoonotic parasitic diseases, arguing that most have three distinct life cycles: sylvanic (forests), zoonotic, and anthroponotic. They outline a number of characteristic ways in which parasite-vector-host relationships can be distorted by changes to land and water conditions. Deforestation, replacement of forests with crop farming, ranching, small animals, bodies of water in disrupted areas, and human movement all contribute to changing vector breeding conditions, non-human and human host populations, and so result in shifts between parasites, vectors and their hosts. VEE is a good example. Animal conservation programmes, nature reserves or wildlife refuges can contribute to the process by harbouring vectors and parasites during shifts from zoonotic to anthroponotic life cycles. These types of shifts are exacerbated by water 'development' projects, road construction and changed access to forested areas, the El Nino phenomenon, climate change caused by the accumulation of greenhouse gases in the atmosphere, changing temperature and rainfall patterns. The point being made by Patz et al (2000), obtusely, appears to be that these types of environmental changes will produce shuffles and shifts between species relationships, increasing the likelihood that humans nearby or in such systems will be affected, either directly as part of a life cycle of an existing or emerging parasite, or indirectly as a complicit bystander in a landscape rendered managed and/or productive for humankind.

Historically the trend in depletion or disruption of major biophysical components like forests results in multiple effects, a drop in the living planet index (comprising forest, marine and freshwater ecosystems), changes in biodiversity, removing hosts and reservoirs from pathogenic organisms and often resulting in the emergence of new disease such as SARS, HIV and VEE. Similar examples exist by linking forest management in the 19th and 20th century to climate change, the subsequent shifting of mosquito vector distributions and their parasite loads, and the emergence of illnesses in geographically naïve areas. Host switches, vector distribution changes and epidemics such as these remind us that environmental change has direct consequences for human health. New human diseases are indeed emerging from human-induced changes to forested ecosystems.

5 FORESTS AND HUMAN HEALTH IN AUSTRALIA

Australian forested or wooded ecosystems appear to offer a good example of ecosystem change and the emergence of new or previously more localised arboviruses. Barmah Forest Virus and Ross River virus, and Murray Valley encephalitis, can be associated to some degree with changes to forested landscapes. BFv and RRv are both transmitted by mosquito vectors, some species of which

are expanding their range in Australia due to the increasing salinisation of once wooded and forested landscapes (see Horwitz et al. 2001), and another species which is wedded to fresher water in exposed floodplain areas. Both appear to require immunologically naïve hosts, in this case common in cleared areas, and benefit from intense unpredictable summer rainfall events, likely to increase in populated parts of Australia (like the southwestern corner) due to climate change.

A second, more widely articulated connection between forests and human health, stems from the more direct influences of particular forest practices on humans. Such influences include exposure to pesticides applied to forest plantations, chemicals which subsequently drift into human settlements, or where aquacultural products become chemically contaminated through catchment flows (Scammell et al. 2004), a situation currently contested in eastern Tasmania. Indeed, water quality in catchment areas used for the supply of water for domestic consumption, is arguably the closest link between human health and the health of forested ecosystems. Water yields are greater (Leaman 2003), and water quality arguably more superior, when catchments remain in an aged, or undisturbed condition, even in an 'old growth' state. Old growth (and so the effects of forest condition on drinking water quality and human health), and the health effects of exposure to pesticides, are both historically contextual concepts. We can therefore demonstrate that the changing perceptions of forests, the services they provide and the way we manage them, modifies, and is modified by, our perceptions of our own health.

Forests represent a spiritual retreat for a small but significant group of people in western societies, capable of delivering renewal or revitalization, and Australian forests are no exception. To some people nature-based recreation, even if it means transporting oneself from a distant urban environment to an isolated forested ecosystem, wilderness area or nature park (see Townsend et al. 2003) is said to be capable of revitalising the soul (Winter 2004). To other people their attachment to forests as symbolic of their place, and the psychological consequences of seeing that place impaired, degraded or otherwise changed, suggests a tangible link between forests and the mental well-being of people.

> A world without forests is a world in which both the earth and ourselves are wounded beyond repair. … No work is more important now than that of creating new visions of human identity and human purpose that deliver the forest from the status of cellulose reservoir. And in this work, perhaps we may deliver ourselves, finding new roles as forest peacemakers, forest healers, forest storytellers – perhaps even forest lovers. (Plumwood 1999).

Have these types of emotional attachment to restorative capacities of forests changed with time? It might be argued that they have, particularly as relatively undisturbed forested ecosystems are sought, as they become rarer in the landscape, and as populations increase. It is not unreasonable to argue that the wilderness movement, conservationist or preservationist perspectives of deep personal attachment to forests, might well lead to a sense of despair, loss and grief over forest change. If so, would these mental health effects have been observed when forests were perceived to be wild, unkempt, unruly, disorderly and uncontrolled, and requiring 'management' by clearing under storey, thinning out stems, regularly burning and so on? Clearly not - no equivalent human ill-health could be argued by historians or public health practitioners when attitudes to forests, and forest condition, were different.

Knowing about these types of consequences for human health (exposure to emerging diseases caused by land use changes, mental health issues, and exposure to chemicals used in forestry or the contributions to human health of ecosystem services provided) in forested parts of Australia has had, and is continuing to have, minimal impact on forest management. Our prognosis is clearer – noting the historically changing perceptions of health and health determinants, a plausible future is for forest management and the health sector to pay closer attention to these consequences.

Our question might then become: what biophysical condition of the forests (to some the 'health' of forested ecosystems) or socio-economic well-being of communities in forested landscapes, would be acceptable to mitigate undesirable consequences for human health?

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