

National Collaborating Centre
for **Healthy Public Policy**

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PEAK OIL**
AN INTERVIEW WITH DR. DONALD SPADY

PRELIMINARY VERSION | OCTOBER 2010



Centre de collaboration nationale
sur les politiques publiques et la santé

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for Healthy Public Policy

*Institut national
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ABOUT THE NATIONAL COLLABORATING CENTRE FOR HEALTHY PUBLIC POLICY (NCCHPP)

The National Collaborating Centre for Healthy Public Policy (NCCHPP) seeks to increase the expertise of public health actors across Canada in healthy public policy through the development, sharing and use of knowledge. The NCCHPP is one of six Centres financed by the Public Health Agency of Canada. The six Centres form a network across Canada, each hosted by a different institution and each focusing on a specific topic linked to public health. In addition to the Centres' individual contributions, the collaborating network of Collaborating Centres provides focal points for the exchange and common production of knowledge relating to these topics.

FOREWORD

Human life is impossible without energy. It can indeed be understood as a process of energy exchange between human beings and their environment. Oil today is the single most important energy resource for the lives and the way of life of Canadians. However, oil is a finite resource, and there is an ongoing debate surrounding what has been termed “peak oil”. Current discussions are not so much focused on whether peak oil will happen, but rather, on when it will happen, and what will be the scope and range of its effects.

Some U.S. researchers have begun to examine how this phenomenon affects health outcomes and to consider possible responses by the public health sector. Many of these researchers attended a conference entitled “Peak Oil and Health” organized by the Johns Hopkins Bloomberg School of Public Health in March, 2009. Canadian public health circles have thus far been less engaged with these issues. To begin to clarify what is at stake specifically for Canadian public health with regards to peak oil, François Gagnon from the National Collaborating Centre for Healthy Public Policy (NCCHPP) interviewed Dr. Donald W. Spady, a paediatrician/epidemiologist in the Departments of Pediatrics and Public Health Sciences of the Faculty of Medicine of the University of Alberta in Edmonton, who is keenly interested in this issue and has been following these debates and engaging in conferences and webinars about them for the past few years.

Dr. Spady can be reached at: dspady@ualberta.net.

François Gagnon (NCCHPP) – Why should public health professionals be concerned with peak oil?

Dr. Donald Spady (DS) – Since there are no clear and easy sources of energy to replace oil, and adequate amounts of affordable energy are essential to Canadian life, peak oil could affect the health of Canadians in significant ways. It will affect many parts of the infrastructure of Canadian society that largely determine the health of the Canadian population. For public health professionals, peak oil is significant because it will affect what are commonly called the social, environmental and economic determinants of health. For example, it will significantly affect, and require some reorganization of, our economic, transportation, and food systems. It is also important to public health professionals because it will very likely affect how health services are organized (the use of products and services dependent on petroleum permeates our health care system), but I understand the mandate of the NCCHPP does not cover this area and thus I will not expand on this now.

NCCHPP – There is a lot of confusion around the concept of peak oil. Some think that those who use the term are saying that there will be no more oil after peak oil has occurred.

DS – Well, oil is a non-renewable resource and thus supply is limited, but I don't think we will ever totally 'run out' of oil; it will just become too difficult to get before then. What we are soon to face, however, is 'peak oil'. 'Peak oil' refers to the period when global oil production reaches a maximum and then begins an irreversible decline. The rate of the decline may vary, and there may be periods where production plateaus, perhaps due to economic or political events, but the general direction will be downward. The phenomenon was first described by the American geologist M. King Hubbert, who predicted that oil production in the lower 48 states of the United States would peak in about 1970 and then subsequently decline. His prediction was ridiculed, but time proved him right. Today most oil producing countries are post-peak in their oil production.

Oil will not disappear from the earth. It will be around for a long time after the peak has passed, but less and less will be produced each year, and what is produced will probably be of lesser quality and more expensive to extract in terms of money, energy, and technological ingenuity. The end result is that today's most important energy resource will no longer be functionally available, even if it has not totally disappeared.

NCCHPP – There are a lot of different positions as to when this moment will occur: could you indicate what seem to be the dominant views among those who are discussing peak oil?

DS – The timing of peak oil is difficult to determine with certainty and we will know that peak oil has occurred only after the fact. For political and economic reasons, data on reserves are often obscure, i.e. those who own or produce oil don't necessarily want to say how much they have. As well, other factors can influence how much oil is produced at any one time, such as political considerations, financial feasibility, and the technical ability to find and extract oil. One big factor we are seeing today is economic demand.

With the recession, oil demand has dropped; as the economy improves, oil demand should rise. Considering these caveats, and responding to your question, most experts think peak oil either has already occurred or will do so soon, very likely within 10 years. The fact that crude oil production has been on a plateau for almost five years now, and that production did not rise significantly even when oil prices were above \$140, is taken by some as an indication that we may already have reached peak oil. Others predict that peak oil will not occur until 2030 or later, but most analysts regard these predictions as unrealistic.

NCCHPP – Could you sum up the situation of oil reserves and production, both globally and in Canada?

DS – Worldwide, about 1.2 trillion barrels have been extracted over the past 150 years and around another trillion barrels of proven global reserves remain. These include oil sands, like those found in Alberta and Venezuela, and oil under the oceans. Other oil resources undoubtedly exist, such as oil shale in the United States and perhaps in the high Arctic, but we lack the technology, skills, money, and resources to exploit these at present. Global total oil production has hovered around 84 million barrels per day (mbd) over the past few years and a little less this past year, probably due to the recession and diminished economic demand. Every year we find some more oil, but we use up much more than we are finding. If you take that daily production and divide it into the available reserves, you will see that, at current levels of use, the world has about 32 years of oil left. Even doubling our reserves leaves us with only about a 65-year supply.

As far as Canada is concerned, in January 2007, Canada reported 179.2 billion barrels of proven oil reserves; second in amount only to those of Saudi Arabia. Some of these reserves are in the form of conventional crude oil, found mainly on the prairies but also in Eastern Canada and the Atlantic provinces. But most of these reserves are in the form of oil sands. Canada's conventional oil sources have peaked and its current growth in production depends on the development of oil sands found in Alberta and Saskatchewan – the exploitation of which is controversial. The sands require huge amounts of water and natural gas to extract the oil from bitumen and the amounts required strain Alberta's ability to provide. As well, it is extremely expensive to establish new mining facilities and the current economic downturn has halted or delayed many projects, thus reducing long term output predictions. Finally, oil sands extraction is environmentally destructive, producing large amounts of CO₂ and huge tailing ponds of toxic waste. Their ultimate exploitation cannot be discounted, but their promise may take a long time to fulfill.

NCCHPP – As you just mentioned, Canada appears to have large reserves of oil. Doesn't that alleviate any worry for Canadians about peak oil, at least in the mid-term?

DS – Many different factors determine how a country will ultimately experience the consequences of peak oil. Each country's experience will be different and will depend on factors such as: "Does the country produce oil?"; "Can it obtain – and afford – to import oil?"; and "What is the degree of its infrastructural reliance on oil?"

While Canada produces a lot of oil today, like all other producers, it will eventually face peak oil and its consequences. In view of its own resources, it should be possible for Canada to be self-sufficient for some time, but even today it has to import oil, especially for eastern Canada. The main reason for this is that, for various reasons, Canada sells more than its surplus supply of oil to the United States. In fact, Canada is the main supplier of oil to the U.S., and is obligated under its NAFTA agreement to provide a certain amount of oil to the U.S. In 2006 it produced 3.3 mbd and exported 2.3 mbd to the US. But Canada also consumed 2.2 mbd and thus had to import the difference -- about 1.2 mbd - from a varying mix of about 10 international suppliers. This imported oil mainly went to eastern Canada, as western Canada is self-sufficient.

There is a problem with this in that the oil production of many of these international oil suppliers has plateaued or started to decline, and the remainder face a seller's market. Therefore, in the not too distant future Canada will have to either: (a) improve its internal supply to Eastern Canada; (b) rely on increasingly expensive and hard to obtain imports; (c) develop alternative energy sources; or (d) institute stringent energy conservation measures. Of these, 'c' and 'd' are things we can start to do now. Exporting countries, who have their own declining oil production but at the same time have growing energy demands from their own citizens, may reduce their oil exports, thus reducing the petroleum available for importing countries to purchase. Importing countries will have to compete for these steadily declining exports. This phenomenon is already happening and a significant contraction of energy supply within a few years is quite possible. Finally, Canada, unlike other countries such as the U.S., does not maintain a Strategic Petroleum Reserve to tap in an emergency. Even if it did, such a reserve is not intended for long term use, but rather the short term crunch. Unfortunately, Eastern Canada could become an unwilling participant in this competition.

NCCHPP – You mentioned earlier that there are currently no clear and easy ways to replace oil, which runs counter to many ideas that circulate frequently in the public realm. Why do you say this?

DS – The reality is that alternative energies are insufficient to allow Canadians to keep using energy at the same level of intensity, and for the same uses as today, and most experts predict that energy demands will only rise.

Petroleum can be replaced by natural gas, or coal, but these are also fossil fuels, and thus non-renewable, and will eventually reach their own peak production and then their use as a key energy source will also fade away. Coal and natural gas lack the convenient combination of high energy density and portability that petroleum provides. More practically, transportation, which is the biggest user of petroleum, is based on oil, and switching to natural gas, or coal, or coal-derived gas, would be expensive, time consuming and ultimately futile, as sources dwindled. Finally, and this has not been mentioned as yet, but is critically important, climate change is due in large part to increasing amounts of carbon dioxide in the atmosphere from the combustion of fossil fuels. Therefore, to turn to coal and gas to meet our energy needs, even on an interim basis, is an ethically questionable approach. Carbon capture might be an option, but it has not yet been demonstrated to be a viable solution.

Alternatives exist, but none have the virtues of energy density, price, and transportability that petroleum offers. David MacKay, in a very readable book: ***Sustainable Energy: Without the Hot Air***, provides a rigorous exploration of the physical basis of various alternatives.¹ Also, Richard Heinberg at the Post-Carbon Institute has released ***Searching for a Miracle***, which is a good review of the issues involved.² Both books are free to download. The alternatives are: biofuels, nuclear power, hydro, wind, solar photovoltaic, concentrating solar thermal, passive solar, biomass, geothermal, wave and tidal energy. These all generate electricity, but, apart from biofuels, do little to meet the need for a practical form of power for transportation. Except for nuclear energy, all of these are renewable sources of energy.

In some localities, alternative sources may provide sufficient levels of available energy, but for Canada as a whole, alternative energies are unlikely to provide the level of energy we currently use. As well, the lead time needed to design, resource, obtain political and social acceptance, and finance new energy infrastructure means that there will be a sizeable gap by the time fossil fuels become insufficient to meet demand. In other words, our society faces a descent—over an indeterminate time period, but starting very soon—from a life of easy, cheap, and ready energy to one of expensive and restricted energy availability.

I want to finish answering your question by emphasizing that energy conservation is the biggest, cheapest, most important, most sustainable, alternative energy source. It may also be incredibly difficult to achieve.

NCCHPP – You mentioned earlier three systems – i.e. economic, food and transportation systems – that will be affected by peak oil. Just to help our imagination with regard to the effects of peak oil on these determinants of health, it would be interesting to go through them briefly. Can you first tell us how you think our economic system could be affected by peak oil and how this could in turn affect health determinants and outcomes?

DS – Before I answer this question, I just want to make three points. First, the systems in question are integrated to a high degree, and thus the distinctions made here are artificial. Second, peak oil has both positive and negative consequences on health determinants and outcomes. For example it could make us rely more on our own activity, such as by walking and biking, to get around and to work; thus, it could improve our weight control and aerobic capacity and have significant cardiovascular benefits. Third, the positive effects will be much less common than the negative ones.

That said, our world economy functions today because of access to abundant, cheap, energy and we can expect that as cheap fossil energy fades away and no abundant replacement arrives, the economic capacity of production, circulation and consumption of products and services will shrink.

¹ <http://www.withouthotair.com/download.html>. Accessed April 13, 2010.

² http://www.ifg.org/pdf/Searching%20for%20a%20Miracle_web10nov09.pdf. Accessed April 13, 2010.

The 1980s oil crisis was associated with increased unemployment, reduced health expenditures, increased cost-sharing and imposition of budget ceilings, and thus reduced health services along with other government services, generally increased poverty and led to more nutritional problems. Since many of these effects were seen mainly in low income countries, their applicability to the current situation is hard to assess. However, given our own current economic problems, and especially those of the United States, these observations seem relevant, in part because some observers have argued that peak oil was at least partially responsible for the current economic recession. Other possible economic effects include: rising oil prices, higher travel and transport costs and less personal and business travel, higher food costs and less food security, fewer and less varied consumer goods, less discretionary spending, more loan defaults, failing businesses and financial institutions, more unemployment, failing infrastructure, and increased fuel poverty, a situation associated with increased mortality, especially among the elderly. We have seen examples of some of these consequences already. For example, transport and food costs rose in the summer of 2008 when oil prices were at an historic high.

These consequences will likely affect virtually everyone but may be especially important for children, who need good food and safe, stimulating environments within which to play and learn, but who often cannot advocate for themselves regarding the problems they face. The lack of voice is particularly true for children living in poverty, who are at risk of poor educational attainment, poor nutritional status, and who may develop a sense of helplessness regarding their life circumstances. This in turn affects their immediate and long-term health and well-being.

Business practices will most probably change. Some rural communities depend on diesel generators to maintain their businesses and to provide services such as water and sewers and in a post-peak situation these may fail. Peak oil will likely change the amount and cost of materials brought to stores and businesses for sale or for use as raw material for new products. This in turn would affect what and how much is purchased, and thus could affect the economy. It might also change the reliability of supply for all forms of business and services, and the 'just in time' paradigm may fail. This would in turn affect how materials are ordered and stored.

Considering the seriousness of these economic consequences, it is reasonable to contemplate the possibility that significant physical and mental health problems will be attributable to peak oil. Job losses and employment status, to use one example from what could be a long list, are often linked to mental and physical health problems. Economic insecurity – worrying about whether or not you will keep your job – not just unemployment, is also associated with health problems. Economically insecure people are more anxious, less likely to spend money on their health needs and have higher rates of morbidity and mortality. Economic growth has been associated with improved health while economic recession is associated with increased mortality.

NCCHPP – Can you share your thoughts on the links between peak oil, the food system and health outcomes?

DS – Petroleum is used in virtually all aspects of food production and transportation, therefore peak oil presents a significant threat to Canadian food security. While this could pose a problem as petroleum supplies diminish, the immediate problem in Canada is not food production, it is food security; i.e. finding and buying adequate amounts of affordable and nutritious food. Peak oil will likely affect every component of food security: accessibility, availability, adequacy, acceptability, and agency. It will do so mainly and initially through economic factors, but ultimately also through the consequences of the lack of fuel and fertilizers which will be secondary to an absolute lack of petroleum. Food security is a common problem in an economic downturn where unemployment is high, but it is always and specifically the case in more remote areas of the country and on native reserves, where food is expensive and choice is limited. As well, some segments of the population, such as the elderly or single parent families, are always more exposed to food insecurity because they may lack the ability to find and purchase adequate amounts of nutritious food.

The 2004 Canadian Community Health Survey found that 9.2% of Canadian households were food insecure at some point in the previous year and 8.8% of the population lived in food insecure households in 2004. It was the poorer person, often on social assistance, worker's compensation or unemployment insurance, who was at greatest risk. Another group, at risk for many problems besides food insecurity, was the Aboriginal household living off the reserve. Lone-parent families, larger families, and families with young children were at particular risk. Housing costs can play a role in determining food security status in low-income households and living in rental housing posed a particular risk. Quite possibly rent trumps food; these days a mortgage or a high energy bill may do the same.

In Canada in 2008, food prices rose 7.3% over the year, as compared to a rise in the Consumer Price Index of only 1.2%. Reasons for these rises include: high oil costs, climate change and associated crop losses and decreased yield, more land and food crops being used for biofuel production, and market speculation. It is reasonable to expect that these factors will persist over the next decades.

Depending on where you live, food prices in Canada can vary by as much as six-fold for the same product, and it has been reported that between 14% and 40% of Canadians face a problem of no or limited access to desirable nutritious foods, even when money is adequate. Food costs and value are particular problems in remote areas of Canada, especially Northern Canada, the high Arctic and on First Nations Reserves, where the types of food are less varied and the food is often of lower quality. For all Canadians, a lack of food access and variety may become a significant issue as long distance transport becomes increasingly expensive or even absent.

Two other issues that may affect the Canadian food supply are long-distance foods and corn-based biofuels. Much of our food travels thousands of kilometres to reach our table. These 'long-distance' foods may be more energy efficient and environmentally friendly

than similar local foods, especially if foods are transported in large volumes, and thus long-distance foods should not be dismissed arbitrarily. Biofuels grown in North America are more problematic, with concerns about their energy benefits, their high fertilizer, fuel and water requirements, and their potential competition with food production contributing to concerns of food security. Other forms of biofuel, such as sugar cane and palm oil, are less 'food' based and have better energy characteristics; but, they also can have significant environmental impacts.

NCCHPP – How do you view the links between peak oil and the transportation system?

DS – About 80% of petroleum is used for transport, as gasoline or diesel fuel for motor vehicles, kerosene for airplanes, bunker oil for ships or asphalt for road construction. Thus, restrictions in oil supply, or a rise in oil price, could have major and immediate effects on transport. This is also the area where renewable energies are the most problematic. Most renewable energy ultimately enters the system in the form of electricity and there are no electric vehicles capable of air travel or commercial long-distance heavy-load trucking, which will probably be the two areas most affected by peak oil. The shipping industry may be more affected by a peak oil-driven recession than by restricted supply and high cost of petroleum directly. In fact, shipping may benefit, because it is the least expensive method of long-distance transport. All of these industries have shown their vulnerability to either high oil prices or reduced consumer demand.

The airline industry is in particular trouble, with over 25 airlines going out of business in 2008. Other airlines reduced flights, some smaller communities lost air service altogether and some airports delayed or cancelled planned expansions. Air travel will be significantly constrained and more expensive within 20 years. This will have profound business and cultural consequences.

The trucking industry is also very vulnerable to high oil prices. It is the diesel-fueled semi-trailer truck that delivers most goods to malls, factories, schools, hospitals, grocery stores, offices and other destinations. Ontario and Quebec recently imposed a 105 km/h speed limit on all trucks, an act partly justified by energy efficiency objectives, but to mixed reviews. In the U.K., some commercial carriers have 'slowed' down their speed to save fuel, and there has been consideration of reinstating a 55 mph speed limit in the U.S. Since practical fuel alternatives do not exist for the trucking industry, they could have to raise prices, reduce speed and limit services as petroleum rises in cost and declines in availability. The long term consequence is that many of the items we use on a daily basis will become harder to supply and, therefore, less available and more costly. There might also be a shift to stock-piling as opposed to the current 'just-in-time' delivery paradigm.

Peak oil will also affect private automobile travel. Electric or hybrid vehicles may eventually replace the fossil-fueled automobile, but replacing the 20 million automobiles currently registered in Canada will be expensive and time-consuming. Electric vehicles could strain the electric power grid, and perhaps also water supplies. Because of the

relatively high water requirements for electricity generation, mile for mile, about 3 times more water is consumed and 17 times more water is withdrawn when an electric vehicle is used rather than a gasoline-powered one.

Rail transport may become important again. In Eastern Canada, with its higher population density, inter-city transport by rail is viable and already fairly popular. For the rest of Canada, however, with its vast distances, rail transport is used mainly to transport goods rather than people. For much of the 20th century, rail travel was basically the only way to go and this may again be the situation in the future. A problem is that long distance rail also depends on diesel fuel in Canada, as we lack the extensive infrastructure necessary for electric trains.

Public transport in general could both benefit and also face problems of high costs and ultimate service restrictions. Increased public transit and the development of the appropriate infrastructure is a likely response to peak oil. While this is generally considered to be a desirable development, it is only good to the degree that financial resources are available to build, run and maintain the service. Several reports have emerged indicating that cities were swamped with demand for public transport at a time of severe financial constraint. As well, large school-bus systems reported financial problems during the high oil prices of 2008 leading to a 4-day school week in some cities. These examples may be evidence of what could be an ongoing problem when governments at all levels face financial constraints secondary to a peak oil-driven recession while facing higher service demands and reduced tax revenue.

Finally, I would just like to point out that regardless of the mode of transport, efficient transportation requires a well-maintained infrastructure of roads, bridges, railways, airports and ports and a depressed economy may impair normal infrastructure maintenance. Infrastructure will also be directly affected by absolute petroleum shortages, due either to high costs or just increased petroleum scarcity. For instance, an increased cost for asphalt could lower our ability to build new roads and maintain older ones. This was seen in some states in the U.S. in 2008, when road maintenance was put off because of the very high cost of asphalt. In 2009, some counties ripped up some asphalt roads and replaced them with gravel. On the other hand, diminished heavy transport will reduce highway breakdown, thus requiring less maintenance. Even this poses a problem because it is the use of the highway and the tolls collected and the gasoline taxes collected, that help to pay for maintenance. With decreased use, there might be fewer funds to maintain highway infrastructure.

NCCHPP – How can all of this be linked to other health determinants and to health outcomes?

DS – For the less well off, or those living in more remote areas, or with long commutes, the effects of peak oil on transportation systems might result in accessibility problems for even basic things such as obtaining food, going to the doctor, visiting family and getting to work. Increased fuel costs will reduce discretionary income and could push some into bankruptcy, or force them to decide between food, fuel, heat, rent or the mortgage. Ultimately we will all feel these effects because fuel might not be as available, or will be

available mainly for essential services such as fire fighting and ambulances. Services dependent on volunteers for mobility, e.g. meals on wheels, have had to stop or cut back because of high fuel costs although this may have been resolved somewhat now (late 2009) with lower gasoline prices, but this relief is likely transitory. Fuel rationing is a distinct possibility in the years ahead.

The effects of higher prices are already apparent in statistics showing a decline in personal automobile transport. Increased use of public transit and a shift to cycling or walking may replace vehicles for much of the day to day travel of individuals. This will provide the benefit of improved health and weight management for those who walk or ride bicycles.

Another health benefit could be the reduction in atmospheric pollution associated with the internal combustion engine. The reduced use of cars and trucks post-peak may lead to a reduction in asthma and other lung diseases. In a similar manner, the increased use of biking and walking could promote general health and well-being. Less car and truck traffic could also lead to fewer deaths and injuries from motor vehicle accidents. As well, city planning may change to reflect the reality of reduced vehicular traffic and the increased use of public transit, cycling and walking. This may lead to cities with more green space and reduced pollution and which generally improve the physical and mental health of citizens.

NCCHPP – It is apparent from your responses that the specific ways in which and the chronology according to which peak oil will affect other health determinants and health outcomes in Canada are probably highly variable from one region to the next and difficult to apprehend. The general challenges that public health will face if it is to live up to its mandate seem nonetheless quite clear – if somewhat overwhelming. How can public health plan a response to peak oil?

DS – The specifics and chronology of the effects I described are all but impossible to predict, let alone outline with any detail. Several authors, such as John Michael Greer,³ Richard Heinberg⁴ and James Howard Kunstler⁵ have tried to visualize possible scenarios. It is not likely that we will 'fall off the cliff' in some rapid decline scenario, although we may lie awake nights thinking about that. This did happen to some degree in Russia after the price of oil collapsed in the 1980s, as described by Dmitry Orlov⁶, and Orlov argues that Russia was better able to respond to such an event than will we be in North America. A more hopeful (and more likely?) scenario is one characterized by times of significant decline in energy availability and in the complexity of our lives, as the

³ Greer, J.M. (2008). *The Long Descent: A User's Guide to the End of the Industrial Age*, Gabriola Island, BC (Canada), New Society Publishers. Greer, J.M (2009). *The Ecotechnic Future: Envisioning a Post-peak World*, Gabriola Island, BC (Canada), New Society Publishers.

⁴ Heinberg, R. (2004). *Powerdown: Options and Actions for a Post-carbon World*, Gabriola Island, BC (Canada), New Society Publishers.

⁵ Howard Kunstler, J. (2005). *The Long Emergency: Surviving the Converging Catastrophes of the Twenty-first Century*, New York, Atlantic Monthly Press.

⁶ Orlov, D. (2008). *Re-Inventing Collapse: The Soviet example and American Prospects*. Gabriola Island, BC (Canada), New Society Publishers.

amenities and comforts of life become less available. Interspersed with these periods of decline will be periods of stability and consolidation until we reach a new level of energy and ecological stability.

Although this discussion has limited itself to peak oil, it is critical to understand that peak oil cannot be considered in a vacuum. We are also facing very serious problems posed by climate change, loss of biodiversity, overpopulation, the rising expectations of growing economies and the rapid depletion or destruction of essential resources such as water, soil and the oceans.

As far as planning for peak oil goes, I think public health is probably facing its biggest challenge and that the events of this century will demonstrate how important public health really is to society. The public health community faces a heavy burden. It will have to meet the 'business as usual' problems of public health plus the added responsibilities of helping society deal with the emerging health concerns of adapting to a low energy, less complex way of life. All of this will likely have to be done as budgets wane in response to economic reality.

Peak oil strips away much of the façade of our economic and technological society and illustrates our dependence on nature that we have neglected for so long. It also will force us to reconsider our societal and personal interrelationships because life will be more local and more community based. We have much to learn. Research projects grounded in complex systems theory are needed now if we want to get some sense of these interdependencies and to gain insight into possible adaptive responses. At a time when the average public health practitioner's life is overfull with the obligations of professional life, the addition of even thinking about planning for the eventualities of peak oil may seem overwhelming. Some health professionals might read the information presented here and become depressed, but others will see a great challenge, a personal, intellectual, philosophical, political, social, and scientific challenge – a new adventure.

Perhaps the first step is to accept that we have a problem; that peak oil is inevitable, that climate change is real, and that the other problems above are real. One early step is to educate ourselves, through inquiry, dialogue, argument, and skepticism. After that, or maybe even at the same time, we begin a dialogue between all who play a role in the maintenance of public health at any level, the purpose of the dialogue being to assess what resources exist and what vulnerabilities are present, and to try to anticipate the likely course of events. We can do this by creating scenarios to gain insight into what might happen. I think this is important to do at the local level particularly, because as peak oil becomes more evident and 'real,' especially with diminished transport, life will become more local. One local level action is to create metrics to detect those individuals, services, and institutions that could be affected by peak oil and to plan and monitor responses relevant to the community. Public health systems at all levels have plans for "the next big pandemic." In similar ways for peak oil, many scenarios could be explored, from the best to the worst outcomes: the technological fix, the slow decline, the interactions with climate change, the rapid drop, the financial collapse and the social collapse. These scenarios could show us our strengths and our weaknesses and orient

current and future population health interventions. These scenarios will show that we must act soon.

