Measuring Progress and Decline

Chapter 9[1]

Genuine Progress Indicator (GPI) Accounting: Relating Ecological Integrity to Human Health and Well-being

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Introduction

Indicators are critical for monitoring the health of humans. They also are critical for monitoring the health of ecological systems, society, and the economy. Indicators provide vital signs to citizens and decision-makers about trends in the condition of human, social, and natural capital. Indicators of health can be used as an early warning system of risks to human health and hence of the sustainability of current trends in health. With the development of robust quantitative databases and information systems providing indicators of human, ecological, economic, and societal health, it is now possible to conduct more integrative analyses of the overall condition of societies, taking several determinants of human health into account.

Many researchers have provided evidence that ecological integrity (EI) is rapidly declining. Some functional measures of EI have been developed (e.g., the Index of Mean Functional Integrity (Loucks et al. 1999) and the Index of Biological Integrity (Karr and Chu 1999), but these have not yet been sufficiently widely implemented to be of use epidemiologically. McMichael's (1993) overview, given its health-based approach, is most useful for the epidemiologist. More recently, the Organization for Economic Cooperation and Development (OECD) (1998), the World Bank (1993), World Resources Institute (1998,1996), and the World Health Organization (WHO) (1992) have recognized the possible human health consequences of declining EI. Some authors

[1] This article is published as a chapter (p. 83-97) is in "Just Ecological Integrity: The Ethics of Maintaining Planetary Life" (2002) edited by Peter Miller and Laura Westra, Rowman & Littlefield Publishers Inc.

(Smith 1994; Mason 1992) have suggested that humanity has as little as two generations remaining before EI has diminished to the point where adaptive strategies will not be optional, but necessary for survival.

Despite these supposed threats to human health, the classic indicators of human health have been showing improvements for several decades. In addition, the traditional economic indicators, like rising gross domestic product (GDP) and stock market indices, suggest growing prosperity in the United States of America (USA) and elsewhere (Anielski 2000). Concern about present and future possible negative human health impacts from the degradation of environmental life-support systems justifies further work among epidemiologists because epidemiology is a public health science that informs policy.

If the role of epidemiology is to prevent epidemics, then a great challenge lies before this field to avert the potentially catastrophic consequences from environmental collapse. The human, social and environmental indicators and trends shown in this paper provide a starting point for assessing what long-term impacts to human health may result from declining social and ecological well-being. Inter-disciplinarity between epidemiology and ecological economics may provide the motivating information to justify the driving of policies toward sustainability.

The explosion of quality of life, economic, social and environmental indicators as a result of expanded data management capacity has enhanced our capacity to explore complex interrelationships among the variables that impact human health and EI. However, no comprehensive or unified analytical framework that integrates the complex interplay of human, ecological, and economic health has emerged. Indeed, the social cohesion factors of well-being have yet to emerge.

The 1998-99 edition of the biennial World Resources report by the World Resources Institute (WRI) (1999) focused on linking environmental change and human health data. However, no specific framework was specified as a theoretical basis for the choice of indicators. The WRI report (1999) provided new indicators that attempt to summarize some of the specific characteristics of the environment (such as air quality and access to clean water).

Other examples of environmental indicators that attempt to measure ecological and environmental conditions and sustainable development include: 1) the World Wildlife Fund's (2001) Living Planet Index (LPI), and 2) Ecological Footprint (EF) analysis by Wackernagel and Rees (1996). EF is a measure of how much ecological capital is required to sustain current consumption levels in relation to the average global carrying capacity of the earth.

Alternative measures of economic well-being that might replace the GDP have also emerged. These include the Genuine Progress Indicator (GPI) (Cobb et al. 1995) and its predecessor, the Index for Sustainable Economic Welfare (Daly and Cobb 1994). These represent efforts to correct for the shortcomings of GDP as an economic measure of well-being; it tends to either ignore or confound environmental and social costs associated with economic output and con-

sumption. For example, the more the environment is polluted and natural resource stocks are depleted, the more the GDP grows.

Measuring Ecological Integrity and Human Health

In a study by Sieswerda et al. (2001), the EI concept was used to unify environmental health indicators and transcend the usual piecemeal approach to environmental threats, thereby focusing on broader issues to clarify the paradoxical inverse relationship between declining EI and improving human health. Available aggregate data were used to explore possible relations between life expectancy and the large-scale deterioration of EI. In addition to indicators of EI as putative determinants, GDP per capita was used as a surrogate for socio-economic confounding.

Sieswerda et al. considered that "development" would be an important confounder of any EI-health relation. Because richer countries are healthier than poorer countries as measured by traditional health indicators—life expectancy, percent low birth weight babies, and infant mortality—they had wanted to isolate the positive influence of development on health from the negative influences of concurrent environmental degradation. Toward this end, they used GDP per capita (standardized by purchasing power parity (PPP) to 1985 International dollars) as a surrogate variable to control for potential socio-economic confounding. PPP is the number of units of a country's currency required to buy the same amount as $1 would buy in the "average country" (World Resources Institute et al. 1999). Thus, this variable takes cost of living into account. Once socio-economic status was controlled, as represented by GDP per capita, the relation between EI and life expectancy all but disappeared in their analysis.

The result of Sieswerda et al.'s attempt to relate traditional health indicators to declining EI produced the finding that health is improving while EI is declining. This apparent paradox is explained by Sieswerda et al. as being attributable to international trade that permits wealthy nations to import the resources needed to maintain both their high levels of consumption and their corresponding high levels of health, while disposing of their wastes elsewhere. Wealthy nations thus impose ecological deficits on the developing regions of the world. Meanwhile, the drawdown of the world's ecological capital continues, forcing accelerating declines in and collapses of the world's ecological life-support systems. Technology and trade thus insulate rich populations from the ill effects of local ecological disintegrity, thus blinding them to their *de facto* continued dependence on EI somewhere else.

The relation between declining EI and human health is undoubtedly highly complex, and mediated by many inter-related social, political, and economic factors that Sieswerda et al. were unable to consider. Second, it is likely that their measures of EI were insufficiently representative of the true ecological situation. The concept of EI is relatively new, and measures of EI are still being formulated and are very much in the "trial and error" phase.

For GDP per capita to be a confounder, it has to be causally related to the outcome in question and be unaffected by the other covariates in the model. If the other covariates in the model are causally related to GDP per capita, however, then it may be inappropriate to control for GDP per capita, because if GDP per capita is in the causal pathway, controlling it will adjust away part of the effect under study and may create confounding (Sieswerda et al. 2001). It is most likely, however, that there are multiple causal pathways from covariates to outcomes. Some pathways probably go through GDP per capita and others not.

Fundamental Flaws in Measuring Economic Progress

Paradoxically, the word 'economy' comes from the Greek oikonomia, meaning the careful management or stewardship of the household. 'Ecology' is comprised of the words 'oikos' (household) and 'logia' (knowledge or logic). Anielski (2000) argues that modern economics has lost its soul by focusing almost exclusively on monetary (chrematistic) measures of well-being to the exclusion of measuring the physical condition and welfare of individuals, households, communities and the environment.

For example, the United Nation's System of National Accounts (UNSNA) and the GDP, derived from the national accounts, simply account for the monetary value of the goods and services produced in an economy while ignoring the physical realities of the "living capital" (human, social, natural) which contributed to this production (Anielski 2000).

Indeed, Simon Küznets (1965), the original architect of the USA's GDP and System of National Accounts and 1971 winner of the Nobel Prize in economics, warned the US Congress that: "The welfare of a nation can scarcely be inferred from a measurement of national income as defined (by the GDP). Goals for more growth should specify of what and for what." Robert Kennedy once remarked that the "Gross National Product [GNP or GDP] measures everything, in short, except that which makes life worthwhile" (Kennedy 1968).

The GDP ignores, for example, the value of many important activities, such as unpaid work (housework, parenting, eldercare, volunteerism) and the value of ecosystem services in providing society with clean air, water and waste assimilation. Neither does the GDP distinguish between expenditures in the economy that contribute to genuine improvements in human, social and environmental 'health' or well-being, and those that were made to mitigate or repair damage to or erosion of human health (e.g., disease), social cohesion (e.g., crime) or EI. Indeed, the greater the level of production and the more money changing hands, the greater the GDP grows

The GDP also does not distinguish between health care expenditures that contribute to improved human health and those made to mitigate against disease, injury or other human health outcomes that are impacted by various determinants of health (socio-economic, environmental, genetic, and others). When decision-makers use the GDP and other economic variables to guide decision-

making, they are diagnosing the health of the patient 'economy' through a very narrow lens.

Genuine Progress Indicator Well-being Accounting

In order to measure the total health and well-being of the economy, society and the environment, a more comprehensive system of accounting for the physical conditions of total well-being or total wealth is needed. The Genuine Progress Indicator (GPI) System of Sustainable Well-being Accounts has been developed by Anielski et al. (2001) to address this challenge, providing a more holistic diagnostic tool for measuring the overall health and well-being of nations. The new GPI accounting system has been applied for the first time to the province of Alberta, Canada (Anielski et al. 2001).

GPI accounting takes an inter-disciplinary, integrated approach to assessing the condition of overall well-being and thus is ideally suited to measuring the overall conditions of and risks to human health, social cohesion and EI. However, GPI accounts do not provide a definitive answer to discerning where epidemiological and EI thresholds may exist. Rather, they provide evidence of long-term trends in the condition of all 'living capital.'

GPI accounts allow decision-makers to diagnose the total health and well-being at the individual, household, societal (community) and the environmental scale. GPI accounts provide meaningful indicators of the condition and sustainability of 'living capital' (human, social, and natural-environmental) and produced capital (manufactured and financial).

One of the strengths of the GPI accounting system is that it takes a traditional accounting approach. Using both physical and qualitative inventories or assessments of all capital, and monetary values of production, the data can be presented in the form of a GPI balance sheet and net sustainable income statement. The GPI balance sheet, for example, shows the current and historical physical conditions of all assets and liabilities related to human, social, natural and produced capital. The GPI balance sheet provides an early warning system of emerging risks to sustainable well-being. The GPI income statement accounts for the full costs and benefits associated with economic production (GDP) in an economy. These include accounting for the total costs and benefits associated with consuming human, social and natural-environmental capital in the production of goods and services. The structure of the GPI income statement is drawn from the original USA GPI model by Cobb, Halstead and Rowe (1995) at Redefining Progress and updated by Anielski and Rowe (1999) for measuring sustainable economic welfare.

From the data contained in the GPI accounts, indicators of well-being (genuine progress indicators) can show longitudinal trends. For example, the Alberta GPI accounts developed by Anielski et al. (2001) include some 51 indicators of well-being (Table 9.1). The breadth of the database and the GPI's open architecture lends itself to analyzing the inter-relationships of variables that de-

termine human health and ecological well-being outcomes. For example, changes in human health conditions can be compared with trends in the condition of ecosystems, natural resource stocks or socio-economic conditions. The accounts can also be used to show liabilities or risks to well-being that may be emerging in areas of social cohesion (e.g., poverty, income inequality), ecosystem fragmentation, toxic waste production and other risk factors.

Table 9.1. The Alberta Genuine Progress Indicators of Sustainable Well-being

GPI Economic Well-Being Indicators	GPI Social-Human Well-Being Indicators	GPI Environmental Well-Being Indicators
• Economic growth • Economic diversity • Trade • Disposable income • Weekly wage rate • Personal expenditures • Transportation expen ditures • Taxes • Savings rate • Household debt • Public infrastructure • Household infrastructure	• Poverty • Income distribution • Unemployment • Underemployment • Paid work time • Household work • Parenting and eldercare • Free time • Volunteerism • Commuting time • Life expectancy • Premature mortality • Infant mortality • Obesity • Suicide • Drug use • Auto crashes • Divorce • Crime • Problem gambling • Voter participation • Educational attainment	• Oil and gas reserve life • Oilsands reserve life • Energy use intensity • Agriculture sustainability • Timber sustainability • Forest fragmentation (ecological integrity) • Fish and wildlife • Parks and wilderness • Wetland • Peatland • Water quality • Air quality related emissions • Greenhouse gas emissions • Carbon budget deficit • Hazardous waste • Landfill waste • Ecological footprint

GPI Accounts yield a longitudinal time series of: 1) the physical-qualitative inventory of stocks and flows of living and produced capital, and; 2) monetary accounts or full cost-benefit accounts related to the consumption of living and produced capital. From this inventory, any number or combination of indicators and composite indicators of genuine well-being, sustainability, or quality of life can be derived. These could include indicators of EI.

There are limitations to the GPI accounts, including lack of data and incompatible data time-series. Nor do the indicators themselves reveal causality between a driver or multiple drivers and health or ecological outcomes. The indi-

cators provide only a rough portrait of overall well-being. GPI accounts do, however, allow decision-makers to assess the tradeoffs, relationships and common trends between variables. For example, the GDP can be compared with trends in human health (e.g., disease, premature mortality, suicide), environmental degradation, natural resource depletion and social costs (e.g., crime).

Living Capital Declines While the Economy Booms

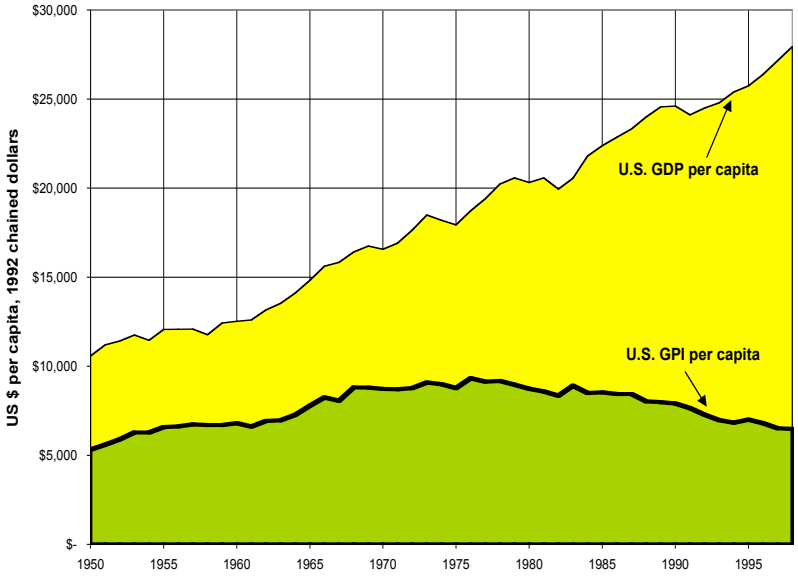
The Alberta GPI accounts by Anielski et al. (2001) show that economic growth (GDP) from 1961 to 1999 has been mirrored by a dramatic loss of EI (fragmentation) of Alberta's forests. The Alberta GPI accounts also reveal declines in the stock and quality of other natural capital including forests, agricultural soils, and ground water and wildlife habitat.

Prior to this study, Anielski (2000) illustrated the potential utility of GPI accounting for assessing overall changes in the conditions of human, societal and environmental well-being vis-à-vis economic prosperity. Anielski (2000) compared the USA GPI cost-benefit analysis (Anielski and Rowe 1999) results with traditional measures of economic prosperity, like the GDP and stock market indicators. In addition, Anielski compared measures like the USA GPI against other measures of human development, ecosystem integrity and sustainability, including the UNDP Human Development Index (2000), the World Wildlife Fund's (2001) Living Planet Index, the Ecological Footprint analysis (Wackernagel and Rees 1996), and Miringoff and Miringoff's (1999) Index for Social Health.

The USA GPI (Cobb et al. 1995) and its predecessor, the Index for Sustainable Economic Welfare (ISEW) by Daly and Cobb (1994) were updated in 1999 by Anielski and Rowe (1999). The USA GPI is an account of sustainable economic welfare, measured in monetary terms. It is constructed by taking GDP (personal consumption expenditures) and adjusting for unaccounted benefits (e.g., unpaid work) and netting out estimated costs of environmental and social degradation associated with economic production. For example, the monetary value of unpaid work is added while the regrettable expenditure (costs) to correct against the decline in the condition of environmental, human and social capital are deducted.

The USA GPI results for 1999 show that USA GDP per capita rose steadily from 1950 to 1999, yet the GPI, a wider account of economic well-being, rose with GDP up until the mid-1970s, then has declined since its peak (Figure 9.1). The key determinants of this decline in sustainable economic well-being (GPI) are rising income inequality, declining stocks of non-renewable energy resources (oil and gas), loss of wetlands and old-growth forest ecosystems, and the growing environmental costs associated with greenhouse gas emissions and the accumulated costs of ozone-depleting substances (e.g., CFCs). In addition, there have been rising levels of the cost of crime, family breakdown and a net loss of quality leisure time.

Figure 9.1. USA GDP growth (per capita) versus GPI (per capita), 1950 to 1999



Source: Data derived from spreasheets from the U.S. Genuine Progress Indicator (GPI) for 1999. Redefining Progress, Oakland, CA

Evidence of Declining Living Capital

Using the detailed cost and benefit analysis contained in the 1999 USA GPI accounting system of data spreadsheets (Anielski and Rowe 1999) and analysis by Anielski (2000), a comprehensive 'report' card of the changes (trends) in key indicators of well-being in the US was developed (see Appendix, Table 9.2). This total "well-being diagnostic report card" shows where the USA is better or worse off in 1999, relative to 1950, or after almost 50 years of economic progress. Of the 28 indicators examined, seven showed improvements, 18 showed declines, and 3 showed no discernable change. While many of the proxies for the condition of human, social, and environmental capital are based on monetary estimates of costs or benefits, they nevertheless provide a common denominator for comparison with monetary metrics of economic prosperity. Ideally, we would like to compare real physical or qualitative conditions in these 'living capital' assets and identify emerging 'liabilities' to sustainable well-being.

The results are sobering. Virtually every indicator of human, social and environmental well-being has declined in the USA since 1950. Yet, virtually every

measure of financial and economic prosperity (GDP and stock markets) has shown dramatic increases. For example, the market value of all stocks traded on USA stock exchanges has increased 6,060 percent (in current dollars per capita) from 1950 to 1999. The USA GDP per capita increased 1,529 percent (in current dollars). And, levels of financial debt (personal, business and government debt) have risen 3,262 percent (current dollars per capita) since 1950, to in excess of US$ 26 trillion, eclipsing all other market values, including the GDP and stock markets.

Some of the more important declines in living capital include the growing disparity between the incomes of the rich and poor in the USA that may lead to the erosion of social cohesion. Such signs of poverty are likely to have long-term human health impacts. The social fabric of households and communities also appears to be fraying as evidenced by increases in divorce and family breakdown as well as by high levels of crime and the world's second highest level of incarceration rates after Russia.

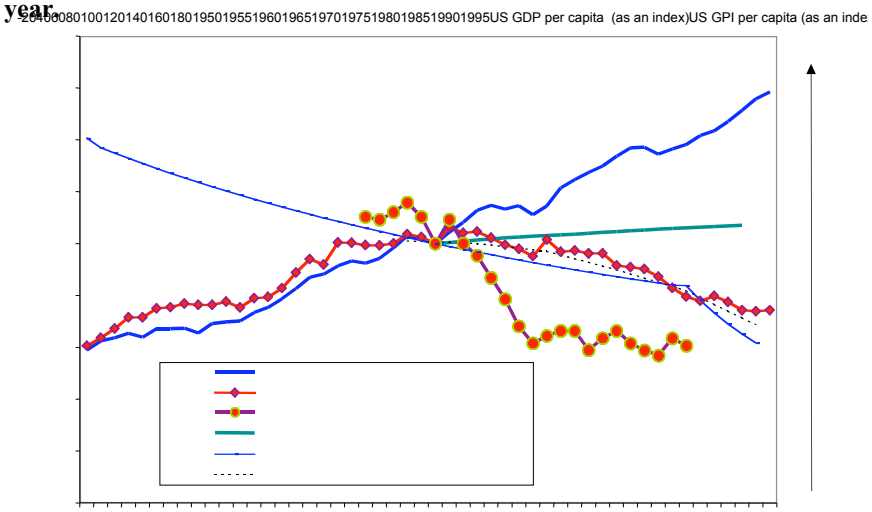
The USA's GPI results also suggest rising ecological liabilities or deficits, with the loss of wetlands and old growth forest ecosystems, as well as the increasing ecological liability associated with the extraction and burning of fossil fuels. Agricultural sustainability may also be a question with soil erosion impacts. Ozone depletion caused by accumulated Chlorofluorohydrocarbons (CFCs) in the atmosphere also poses a long-term human health risk. The only exceptions to declining ecological health have been improvements in air quality that began following the introduction of stringent environmental standards in the 1970s.

While the results suggest declining stocks and flows of living capital, they do not necessarily provide definitive evidence that these losses in EI are having any measurable impact on long-term human health. In fact, the continual increase in USA life expectancy suggests that the *meta* measure of human health is improving. Neither does the evidence provide any sense of where potential unsustainable thresholds might exist for ecological or human health given the continuation of the trends we observe. The problem is that the indicators of both human health and ecosystem health conditions may simply not be sensitive enough to emerging risks to sustainable well-being and thus need to be refined and expanded. This is where epidemiological studies and detailed EI studies could assist in shedding light on why declining living capital is relevant to long-term well-being. For example, more detailed analysis of the incidence of disease by age-sex cohorts, associated with various ecosystem regions across the USA, could provide useful information about these complex relationships.

Another perspective on living capital conditions is to compare other international indicators of human development, social health and ecological health relative to the GPI, the GDP and other measures of economic well-being (see Appendix, Table 9.2 and Figure 9.2). Figure 9.2 compares the key monetary expression of economic well-being (the GDP per capita) with several indices of social, human, and ecological well-being indicators. By converting raw data to

an index we can compare trends in the GDP per capita against the UN Human Development Index (for the USA), the GPI per capita (converted to an index), the Index for Social Health (Miringoff and Miringoff 1999), the Living Planet Index (World Wildlife Fund (2001) and a measure of the USA EF deficit.

Figure 9.2. Living Capital Indicators versus Economic Growth (GDP): The USA GPI, GDP, Index for Social Health, WWF Living Planet Index, and UN Human Development Index (U.S.) 1950 to 1999, 1975 as benchmark year.



The results show that while the USA's GDP has continued to increase over the past 50 years, virtually every measure of human, societal and environmental well-being has declined. The only exception is the UNDP Human Development Index (HDI) that has risen slightly. However, this is not surprising given that the HDI is composed of only five key indicators which includes GDP per capita and life expectancy, both of which have increased. Again, while the GDP, stock markets and debt have risen substantially in 50 years, three composite indices of living capital all show declines.

Anielski (2000) shows that since 1970, USA financial wealth indicators grew dramatically. For example, a composite index of USA stock market values and total credit market debt reached heights of 1,688 basis points by 1999 from the 1970 benchmark year of 100 basis points; an increase of some 16.9 times the 1970 value. At the same time, the Index of Social Health (ISH) had fallen by almost half (55%) by 1993, compared to 1970. The global Living Planet Index, a broad measure of global ecological health, fell 68 percent by 1995 since 1970.

So, as financial assets have shown torrid growth, real or living capital has been eroding.

The World Wildlife Fund's (2001) LPI—a composite index of the health of the world's forests, fresh waters and oceans—shows that between 1970 and 1999, the world's ecosystems have declined by 33 percent. This ranged from declines of 12 percent for forests, 50 percent for fresh waters, and 35 percent for oceans (World Wildlife Fund 2001). Their study also found that human pressure on nature has increased about 50 percent over the study period and concluded that "the natural wealth of the world's forests, freshwater ecosystems, oceans and coasts has declined rapidly, particularly in freshwater and marine ecosystems." The authors concluded that sometime in the 1970s, humanity passed the point at which it lived within the global regenerative capacity of the earth. These findings are supported by the independent work of Loucks et al. (1999) and Karr and Chu (1999) who found that between 1982 and 1997, in the ecosystems that they have monitored, there has been an approximately 50 percent decline in their ecological and biological integrity, respectively.

The conclusion that the earth's carrying capacity has been breached is based on the EF analysis of humanity by each nation. The EF analysis is used as the basis for calculating the overshoot of global ecosystem carrying capacity. The EF is a measure of the land area, resources and ecosystem services (e.g., to assimilate waste) required to meet current levels of human consumption of food, materials and energy. While some historical EF data points are available for the USA, the LPI for the USA is not. We have assumed that the global LPI can serve as a proxy for EI for the USA, given the significant EF that Americans impose on both North American and also on global ecosystems from their lifestyles. Future analysis should consider an LPI or similar index for the USA that could be compared with other USA indicators of economic, social, and human development and environmental well-being.

The UN Human Development Index (HDI) for the USA (using only the five data points: 1975, 1980, 1985, 1990, and 1997 and interpolating between years) suggests rising quality of life in the USA since 1975. However, this may be misleading because the HDI includes only GDP per capita (as a proxy for income and economic prosperity), life expectancy, literacy and educational attainment. Since both GDP and life expectancy have risen for the USA and most nations along with rising levels of educational attainment, it is not surprising that this narrow measure of human well-being is improving.

The Miringoff and Miringoff (1999) Index of Social Health (ISH), which includes a composite index of 17 social and human health indicators, has shown a steady decline since the benchmark year of 1971, including indicators such as suicide rates, teen pregnancy, income inequality, life expectancy and other intuitive social and human health indicators. Many of these are also used in the GPI Accounting framework.

Discussion

The GPI Accounting provides a framework for well-being measurement that until now has not existed. Important progress is being made in measuring economic welfare, human development and ecological integrity, including the UN Human Development Index, the Living Planet Index, the total wealth accounting (monetary) by the World Bank, Index for Sustainable Economic Welfare/Genuine Progress Indicator, and the Index for Social Health. However, no holistic, integrated and unified framework for assessing the well-being of human, social, produced (built) and natural capital (or total wealth) has emerged.

The GPI Accounting framework provides an important starting point towards a more holistic and unified analytic framework for assessing the physical, qualitative, and monetary conditions or expressions of living capital. With an abundance of publicly available statistical data, the construction of longitudinal GPI accounts is achievable for most jurisdictions.

The GPI system of well-being accounts provides a powerful tool for policy analysis allowing decision makers to examine the inter-relationships between economic, social, human health, and environmental variables as contributors to well-being. The relationships among these variables and their impact on human health and EI can be examined through a holistic, integrated analytical framework. GPI Accounts also provide important longitudinal information necessary to assess trends in the condition of the real wealth (living capital) of a nation, region or community, and to use this information for examining "what if" scenarios for the future. Further work is needed to address the question of equal weighting of individual indicators in the construction of the GPI well-being composite indices, indicator selection bias, and researching other methods of selecting and combining meaningful measures of sustainable well-being.

The examples of GPI accounting presented in this paper provide a glimpse of what is possible for future well-being accounting. Even more detailed and comprehensive GPI accounts of well-being are desirable; accounts capable of demonstrating the full impact on human health and well-being of ecological degradation. Only then will epidemiology be able to fulfill its role as the science for rational policy formulation in this critical area.

References

Anielski, Mark, Mary Griffiths, David Pollock, Amy Taylor, Jeff Wilson, and Sara Wilson. 2001. *Alberta Sustainability Trends 2000: The Genuine Progress Indicators Report 1961 to 1999*. The Pembina Institute for Appropriate Development. <www.pembina.org> (22 May 2001).

Anielski, Mark. 2000. "Fertile Obfuscation: Making Money Whilst Eroding Living Capital." Paper presented to the 34th Annual Conference of the Canadian Economics

Association, University of British Columbia, Vancouver, BC <www.pembina.org> (22 May 2001).

Anielski, Mark and Jonathan Rowe. 1999. *The Genuine Progress Indicator – 1998 Update.* San Francisco, CA; Redefining Progress. <www.rprogress.org> (22 May 2001).

Cobb, Clifford, Ted Halstead, and Jonathan Rowe. 1995. *The Genuine Progress Indicator: Summary of Data and Methodology*. San Francisco, CA: Redefining Progress.

Daly, Herman and John B. Cobb. 1994. *For the Common Good: redirecting the economy toward community, the environment, and a sustainable future*, 2nd *edition*. Boston, MA: Beacon Press.

Karr, J.R. and E.W, Chu. 1999. *Restoring life in running waters: better biological monitoring*. Washington, DC: Island Press.

Kennedy, Robert. 1993. "Recapturing America's moral vision," March 18, 1968 in *RFK: Collected Speeches.* Viking Press.

Küznets, Simon. 1965. "Economic Growth and Structure" in *Towards a Theory of Economic Growth*. New York: W.W. Norton and Co..

Loucks, O., O.H. Ereksen, J.W. Bol R.F. Gorman, P.C. Johnson, and T.C. Krehbiel. 1999. *Sustainability perspectives for resources and business.* Lewis Publishers.

Mason, J. 1992. "The greenhouse effect and global warming." Pp. 55-92 in Cartledge B, ed. *Monitoring the environment.* Oxford: Oxford University Press.

McMichael, A.J. 1993. *Planetary Overload: Global Environmental Change and the Health of the Human Species*. Cambridge: Cambridge University Press.

Miringoff, Marc and Marque-Luisa Miringoff. 1999. *The Social Health of the Nation*. New York: Oxford University Press.

Organization for Economic Cooperation and Development (OECD). 1998. *Towards sustainable development: environmental indicators*. Paris, France: OECD Publications.

Sieswerda, L.E., C.L. Soskolne, S.C. Newman, D. Schopflocher, K.E. Smoyer. 2001. "Toward measuring the impact of ecological disintegrity on human health." *Epidemiology 2001*. 12:28-32.

Smith, D. 1994. "How will it all end?" In Cartledge B, ed. *Health and the environment*. Oxford: Oxford University Press.

The United Nations Development Program. 2000. *Human Development Index 1999*. New York.

Wackernagel, M. and W.E. Rees. 1996. *Our ecological footprint: reducing human impact on the earth*. Gabriola Island, BC: New Society Publishers.

World Bank. 1993. *World Development Report 1993: Investing in Health*. New York: Oxford University Press.

World Health Organization (WHO). 1992.. *Our planet, our health: report of the WHO Commission on Health and the Environment.* Geneva: WHO.

World Resources Institute, United Nations Environment Programme, United Nations Development Programme, World Bank, (joint publication). 1999. *World Resources 1998-99*. New York: Oxford University Press.

World Resources Institute, United Nations Environment Programme, United Nations Development Programme, World Bank, (joint publication). 1997. *World Resources 1996-97*. New York: Oxford University Press.

World Wildlife Fund. 2001. *The Living Planet Report 2000*. <www.wwf.org> (22 May 2001).

Appendix

Table 9.2. Is the United States (US) better off or worse off in 1999 compared to 1950?

	Better off or Worse off than in 1950?	% Change in cost/value per capita since 1950 (or benchmark year)	Absolute Quantitative Change
What we want more of…			
Longer life (life expectancy)	_Better	Up 8.5% since 1970	Average life expectancy has increased 6.0 years between 1970 and 1997
More sustainable and genuine progress (GPI)	_ Worse	Down 29% since 1978 peak	
Higher Quality of Life (UN Human Development Index and Index for Social Health, Miringoff)	__ Better and Worse	US HDI improved 7.2% between 1975 and 1999; the ISH declined 45% between 1970 and 1993.	
More economic growth (GDP)	_Better	Up 164% (1992 $) Up 1,529% (current $)	
More US stock market growth (total stock market capitalization value)	_Better	Up 6,060% (current $)	
More personal consumption (expenditures)	_Better	Up 181%	
Higher quality and more household durables	_Worse	Down 245%	
More leisure and family time	_Worse	Down 1,428%	19% less leisure time per worker; 58% increase in hours of TV viewing per household
More productive farm land	_Worse	Down 248%	
More volunteerism	_Better	Up 128%	169% increase in average hours volunteered per cap.
More renewable energy use	_Better		3% of total energy consumption from less than $2/10^{th}$ of 1% in 1950
What we want less of…			
Less debt (total market credit)	_Worse	Up 3,262% (current dollars per capita)	20,410% increase in margin debt
Less foreign borrowing	_Worse	Up 400% (since 1983 peak of net foreign lending).	
Less inequality (income and wealth)	_Worse	Up 18% (since 1968 low)	In 1995 the richest 0.5% of families claimed 28% of net worth, almost as much as the bottom 90% of the population (32%)

Continued on next page

Table 9.2—Continued

	Better off or Worse off than in 1950	% Change in cost/ value per capita since 1950 (or benchmark year)	% Absolute Quantitative Change
What we want less of (continued)…			
Less poverty	_Better	Down 17.5%	In 1969 13.7% of US citizens lived poverty; in 2000 11.3% lived in poverty.
Less family breakdown	_Worse	Up 121%	195% increase in number of divorces; 238% increase in num-ber of kids impacted by divorce
Less hours of work	_Worse		7% more hours worked per annum per worker.
Less commuting time	_Worse	Up 89%	30% increase in times com-muting to work.
Less underemployment	_Worse	Up 375%	125% increase in the number of constrained hours per worker
Less automobile accidents	_Worse	Up 200%	
Smaller Ecological Foot-print	_Worse	Up 152%	The U.S. has the third-highest EF in the world; each American consumes over 5 times the global car-rying capacity
Less depletion of nonre-newable resources	_Worse	Up 389%	14% increase in nonrenew-able energy produced per capita from US sources
Less long-term environ-mental damage	_Worse	Up 142%	73% increase in barrels of oil equivalent of nonrenew-able energy consumed per capita
No net loss of wetlands	_Worse	Up 358%	6% decrease in the area of total wetlands
No net loss of old growth forests	_Worse	Up 6%	69% less old growth forest
Less ozone depletion	_Worse	Up 5,109%	9,247% increase in global CFC production
Less air pollution	_Better	Down 67%	42% improvement in ambi-ent air quality; but emissions of CO are down 13%, NO_2 up 132%, VOCs down 9%, SO_2 down 15% and particu-late matter up 83%
Less water pollution	_Worse	Up 33%	
Less noise pollution	_Worse	Up 43%	

Source: The analysis is based on Anielski 2000