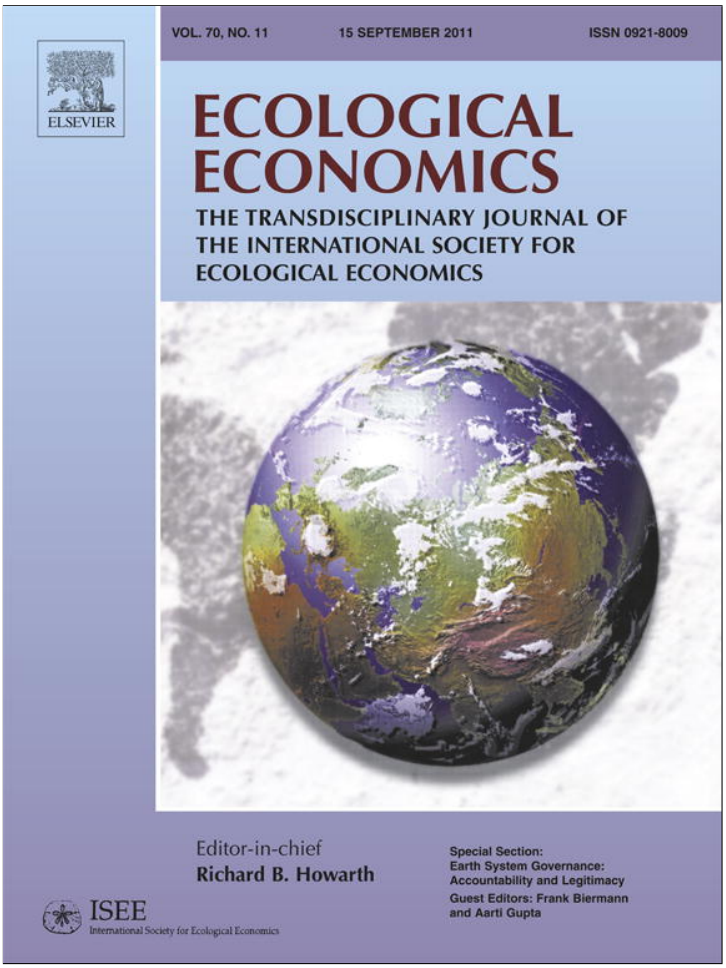

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Analysis

A summary of ISEW and GPI studies at multiple scales and new estimates for Baltimore City, Baltimore County, and the State of Maryland ☆

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ABSTRACT

This paper (1) summarizes a number of previous Index of Sustainable Economic Welfare (ISEW) and Genuine Progress Indicator (GPI) studies at various scales; (2) estimates the GPI for Baltimore, Baltimore County, and the State of Maryland; and (3) compares these results with previous and parallel studies. GPI incorporates environmental, social, and economic information into a single metric to represent economic well-being. At all three scales, GPI was found to grow at a slower rate than the conventional economic measure of gross domestic product (GDP), while at the US national scale GPI has been relatively flat since 1975. State-level results match an independently calculated Maryland GPI, confirming that GPI methods are robust and reproducible. In addition, the State of Maryland has recently made GPI one of their official State statistics, reported annually. State-level GPI results were also compared with studies for the states of Ohio and Vermont to explore regional differences. We recommend that the GPI research community develop consensus on a standardized measurement approach and seek common ground for advancing the use of improved indicators and accounting systems in official policy settings.

1. Introduction

Interest in revising governmental indicators and systems of accounts has grown in recent years. The French government created the Commission on the Measurement of Economic Performance and Social Progress to address concerns about the relevance of current measures of economic performance, and published the findings of the commission in Fall 2009 (Stiglitz et al., 2009). The European Commission led a "Beyond GDP" international initiative and published a report on measuring progress in a changing world in the Summer of 2009 (European Commission, 2009). And the Organization of Economic Cooperation and Development has held three global forums in the last 6 years on the topic of measuring progress in societies (OECD, 2010). As the measurement of environmental, social, and economic aspects of well-being becomes more widely recognized as relevant, indicators that address these elements are being developed and tested in a variety of settings.

The misuse of Gross Domestic Product (GDP) as an overall metric for well-being has played a significant role in motivating research around improved indicators. A goal is to develop tools that are more effective for evaluating policies and measuring societal progress toward sustainability. As a chief economic gauge used to guide macro-scale development, GDP measures marketed economic activity while largely disregarding the broader extra-market impacts of that activity. GDP counts some environmental and social costs as benefits (i.e. money spent on increased commuting, divorce rates, and pollution), ignores other environmental and social costs (i.e. the depletion of nonrenewable resources), and ignores many valuable parts of the economy that exist outside of the market (i.e. volunteer and household work). Many others have described GDP's shortcomings as a well-being indicator in detail, including Harris (1997), England (1998), Talberth (2008) Costanza et al. (2009), and Van den Bergh (2009).

Others have also described the long history of attempts to develop improved macroeconomic indicators (including Lawn, 2006; Lawn and Clarke, 2008). Sametz (1968) called for a review of the costs and benefits of economic growth in measuring welfare, Nordhaus and Tobin (1971) constructed a Measure of Economic Welfare that adjusts GDP to account for omitted economic and social factors, and Zolotas (1981) expanded GDP improvement efforts to include environmental and natural resource elements using the Economic Aspects of Welfare index. Max-Neef (1995) later proposed a 'threshold hypothesis' to describe the situation where GDP growth leads to increased quality of life only up to a point, beyond which further growth creates environmental and social costs that begin to outweigh economic benefits.

Daly and Cobb (1989) built upon previous work measuring economic welfare with the Index of Sustainable Economic Welfare (ISEW), which featured a series of adjustments to GDP to account for social factors that affect welfare as well as environmental issues and long-term sustainable use of natural resources. In the mid-1990s, an

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organization called Redefining Progress revised the ISEW methodology and published a renamed Genuine Progress Indicator (GPI). The ISEW and the GPI are both still in use. Only minor differences exist between the two indicators and in the remainder of this paper we will treat them as equivalent unless otherwise noted.

The GPI uses monetary valuation to assess the impacts of economic growth on sustainable welfare. GPI is an indicator that goes beyond measuring the quantity of economic activity to include details about quality, by incorporating changes in environmental conditions, resource stocks, social capital, income distribution, and other non-marketed economic activity. It is one of the first alternatives to GDP that has been debated within the scientific community and used by governments and non-governmental organizations to more closely measure sustainable economic welfare (Talberth et al., 2007).

Computation of the GPI begins with a core component of GDP, personal consumption expenditures. It then goes on to weight this term for income distribution (in order to reflect the welfare implications of social equity — that the same marginal increase in wealth has more benefit to a poor person than to a rich person). Next, monetized valuations (adjustment items) are added or subtracted to account for the aspects of economic activity that enhance or diminish welfare. Costanza et al. (2004) describe the approach as a weighting for income distribution followed by adjustment items related to household expenditures and work, mobility, social capital, pollution, land loss, natural capital, and net investment. The formula for calculating GPI looks like

$$GPI = C_{adj} + G_{nd} + W - D - E - N$$

where C_{adj} is personal consumption expenditures adjusted for income inequality, G_{nd} is non-defensive government expenditures, W is non-market contributions to welfare, D is defensive private expenditures, E is the costs of environmental degradation, and N represents depreciation of the natural capital base. Appendix A shows the specific indicators calculated and uses the bold italics font to indicate costs that are subtracted.

GPI has drawn criticism based on the inconsistent and somewhat arbitrary list of adjustment items, as well the monetary valuation methods used to measure aspects of well-being outside the market (Neumayer, 1999, 2000). Responses to these criticisms have defended GPI methods and provided a more solid theoretical foundation for the GPI and related indicators (Lawn, 2003, 2005). An additional point is that many of the choices involved in GDP accounting are equally "arbitrary" but, as with GPI, are justified according to the goals of the measure being constructed. It is also important to point out that it is the height of inconsistency and arbitrariness to use GDP (a measure of activity or income) as a measure of welfare — something for which it was never intended. As has been said, it is better to be approximately right than precisely wrong.

Though GPI is now well established as an indicator of human well-being, it is not yet widely accepted within mainstream economics. To persuade more mainstream consideration of accounting reform, this paper presents a comprehensive list of past and current published GPI applications, reports on multi-scale applications within the US (including new results calculated for Maryland), and contributes to the debate on GPI's usefulness as an indicator of sustainable economic well-being. The summary of GPI studies provides researchers with up-to-date sources of GPI applications. The results of GPI estimates for Baltimore City, Baltimore County, and Maryland are discussed in the context of a growing number of local GPI studies in the US and demonstrate the value and flaws in sub-national GPI measurements.

1.1. Summary of GPI Studies

The ISEW and GPI have been applied at the national level to over 20 different countries. These studies are listed in Table 1, which extends and updates the summary provided by Dietz and Neumayer (2006). The availability of data and authors' preferences for certain valuation methods have led to slight differences in the methods of each study. If GPI studies are to gain more traction in mainstream debate and policy settings, there needs to be a coherent and mutually-agreed upon way to calculate each element of the indicator.

Table 1
Studies of the Genuine Progress Indicator at the national scale listed by country.

Country	Reference	Study period	Method
Australia	Hamilton (1999)	1950–1996	GPI
	Hamilton and Denniss (2000)	1950–2000	GPI
	Lawn (2008a)	1967–2006	GPI
Austria	Stockhammer et al. (1997)	1955–1992	ISEW
Belgium	Bleys (2006, 2008)	1970–2000	ISEW
Chile	Castaneda (1999)	1965–1995	ISEW
China	Wen, et al. (2008)	1970–2005	GPI
Czech Republic	Scasny (2002)		ISEW
France	Nourry (2008)	1990–2002	ISEW
Germany	Diefenbacher (1994)	1950–1990	ISEW
India	Lawn (2008b)	1987–2003	GPI
Italy	Guenno and Tiezzi (1998)	1960–1991	ISEW
Japan	Makino (2008)	1970–2003	GPI
Netherlands	Oegema and Rosenberg (1995)	1950–1992	ISEW
	Bleys (2007)	1971–2004	ISEW
New Zealand	Forgie, et al. (2008)	1970–2005	GPI
Poland	Gil and Sleszynski (2003)	1980–1997	ISEW
Scotland	Hanley (1999)	1980–1993	ISEW
Sweden	Jackson and Stymne (1996)	1950–1992	ISEW
Thailand	Clarke and Islam (2005)	1975–1999	ISEW
	Clarke and Shaw (2008)	1975–2004	GPI
UK	Jackson, et al. (1997)	1950–1996	ISEW
US	Talberth, et al. (2007)	1950–2004	GPI
Vietnam	Hong, et al. (2008)	1992–2004	GPI
Wales	Matthews (2003)	1990–2000	ISEW

Still, use of the same general framework allows for some comparison among national studies. The general findings are similar: GDP rises over the course of decades while there is either a leveling off, falling, or more slowly rising GPI. In many cases, GPI is positively correlated with GDP up to a certain point in time, beyond which the two indicators diverge. The bulk of the studies thus confirm Max-Neef's threshold hypothesis and find that GPI begins to diverge from GDP around 1970 or 1980 in many European countries. Recent work (Lawn and Clarke, 2008) shows a similar pattern in China, but with divergence beginning about 1995. The body of work at the national level, despite variation between studies, calls into question the welfare impacts of policies designed to grow GDP. Since GPI reflects changes in environmental and social conditions that impact well-being, GPI is a more useful tool for gauging welfare.

Studies at the sub-national scale have also found GPI to be useful in understanding the full range of welfare impacts resulting from various kinds of economic activity. These studies, summarized in Table 2, are especially valuable in informing debate and stimulating questions about the nature of the economic development process at the local to regional scale (Jackson et al., 2008). Sub-national studies have been performed in six different countries and they in general do not reveal as sharp a divergence between GPI and regional scale GDP-equivalent as the gap seen in national GPI studies. This could be due to relatively more externalities missed by GPI at smaller scales; the uneven distribution of economic costs and benefits at different scales; or environmental, social, and economic costs that accumulate more with increasing scale.

Bagstad and Ceroni (2007) point out how local and regional differences can lead to an uneven distribution of the costs and benefits of economic growth across a country. Local GPI estimates would be expected to reflect differences in income distribution, environmental impact, or social capital between areas. For instance, two studies for Vermont found GPI to be higher than the national average (and thus masking the divergence between GPI and GDP-equivalent), primarily due to environmental quality, lower gaps in income, and relatively low levels of pollution compared with national average amounts

Table 2
Studies of the Genuine Progress Indicator at the sub-national scale.

Regional focus of GPI estimate	Country	Reference
State of Victoria	Australia	Lawn and Clarke (2006)
Province of Alberta	Canada	Anielski (2001)
Province of British Columbia	Canada	Gustavson and Lonergan (1994)
Province of Nova Scotia	Canada	Pannozzo, et al. (2008)
City of Edmonton	Canada	Anielski and Johannessen (2009)
Cities of Suzhou, Yangzhou, Ningbo, and Guangzhou	China	Wen, et al. (2008)
All English regions	England	Jackson, et al. (2008)
Regions of Päijät Häme and Kainuu	Finland	Hoffren (2011)
Province of Siena	Italy	Pulselli, et al. (2006)
Provinces of Modena and Rimini	Italy	Pulselli, et al. (2008)
Province of Tuscany	Italy	Pulselli, et al. (2009)
7 northeast Vermont counties, State of Vermont	US	Bagstad and Ceroni (2007)
Cities of Akron and Cleveland, 17 northeast Ohio counties, State of Ohio	US	Bagstad and Shammin (2009)
City of San Francisco, 8 California counties	US	Bay Area Genuine Progress Indicator (2006)
City of Burlington, Chittenden County, State of Vermont	US	Costanza, et al. (2004)
City of Baltimore, Baltimore County, State of Maryland	US	Posner (2010)
State of Maryland	US	Maryland Genuine Progress Indicator (2010)
State of Minnesota	US	Minnesota Planning Agency (2000)
State of Utah	US	Berik and Gaddis (2011)

(Bagstad and Ceroni, 2007; Costanza et al., 2004). As more GPI studies become available at the sub-national scale, this issue can be explored in more detail. Despite the lack of as sharply-defined a threshold in sub-national GPI studies, local and regional estimates of GDP-equivalent are found to consistently overstate the welfare of regions when compared with GPI, and there is often evidence that a portion of GDP growth is not related to increases in well-being.

2. Methods

The GPI study for Baltimore City, Baltimore County, and Maryland contributes to the growing body of sub-national GPI research. An effort was made to maintain consistency with previous sub-national GPI methods in the United States when possible, so that results are directly comparable. While the use of methods from previous GPI studies can be seen as restricting the use of unique, place-specific GPI adjustment items, it does provide for meaningful comparisons among GPI studies in different regions. The list of twenty-six adjustment items and non-market valuation methods are derived from previous GPI studies, namely Costanza et al. (2004), Bagstad and Ceroni (2007), and Talberth et al. (2007), with a few exceptions. Detailed methods including data sources are available upon request to the corresponding author, or online through the Gund Institute for Ecological Economics website (http://www.uvm.edu/giee/genuine/Baltimore_GPI_Methods.pdf).

2.1. Divergence from Earlier GPI Methods

Three main divergences from earlier studies first proposed by Bagstad and Ceroni (2007) and Bagstad and Shammin (2009) are adopted here. First, the value of education is omitted, as it is believed that other categories such as personal consumption, value of volunteer work, and the cost of crime already account for many elements of the social value of education. Including a separate category for the value of education would constitute double counting. Second, the year 1940's baseline figures were used instead of pre-settlement baselines for the negative adjustments of lost wetland, forest, and farmland. Pre-settlement land cover baselines are believed to be inappropriate starting points for these calculations, as a return to such land cover conditions in the modern age is highly unlikely and not necessarily desirable (and thus trends toward or away from these conditions should not be used to gauge social progress).

Third, in estimating the negative adjustment from the depletion of nonrenewable resources, a replacement cost approach is used that distinguishes between consumption of nonrenewable energy resources for electricity generation and for transportation and related sectors. Previous GPI studies have used replacement costs based on biofuels alone, although biofuels are not suitable for replacing coal-derived electricity. The approach in this study recognizes the distinction by using a 50/50 mix of solar and wind power for replacement costs of electricity fuels and biofuels for non-electricity nonrenewable energy consumption. Following the point of Neumayer (2000), this study does not accumulate the cost of climate change because it uses the marginal social damage cost for greenhouse gas emissions, which aims to already capture the discounted future cost of emissions.

2.2. GPI Methods at the Local Scale

This GPI study further investigates the challenges and opportunities in applying GPI at a local scale explored by Bagstad and Ceroni (2007) and Costanza et al. (2004). At the state level, almost all of the data used in calculating the GPI are publicly available, and missing data points are estimated based on trends in known data. At the city and county scale, however, larger data gaps required further reliance on proxies and standard methods such as scaling, interpolation, extrapolation, and calibration based on known figures at state or federal levels. For example, the sub-national values of services of highways and streets is determined by scaling down national value figures using data on the relative mileage of highways and roads in Maryland, Baltimore County, and Baltimore City. In another example, the average percentage difference between Maryland and national Gini coefficients from 1970 to 2000 was used to estimate Maryland figures for 1950 and 1960 based on known national data. These examples illustrate how sub-national GPI data is a combination of observed and estimated figures, with an increasing number of estimated data at smaller spatial scales.

Sub-national GPI uses the best estimates available, but the lack of observed data highlights the need to more closely monitor information related to sustainability and well-being at the local level. For GDP, local analogs are more specifically classified as Gross State Product (GSP) for Maryland or Gross State Product Localized (GSP_L) for Baltimore City and County, as transboundary accounting (or the absence thereof) makes more local measures of economic activity slightly different than national measures of GDP.

3. Results and Discussion

3.1. GPI for Baltimore City, Baltimore County, and Maryland

Appendix A contains detailed GPI results in an accounting spreadsheet. To simplify the presentation and discussion of results here, comparisons are made with GDP, though as described in the methods section the actual measures are GSP or GSP_L. At all three scales, the growth trend of per capita GPI mirrors per capita GDP growth up until the year 1990 (Fig. 1). For the period 1990–2005, average annual growth rates for GDP are at least four times higher than for GPI at all scales. The significant divergence between the two indicators since 1990 supports Max-Neef's threshold hypothesis and suggests that environmental and social costs are accumulating in such a way that the study areas have entered a period of uneconomic growth. In comparison, the United States GPI levels off earlier, around the 1970s–1980s. The earlier divergence observed for sub-national GPI trends could result from the rate at which environmental and social costs measured by GPI accumulate at more local scales.

Looking more closely at the year 2000, the single largest adjustment item at all scales is the added value of household work, adding approximately 30% to GDP. The next three largest adjustment items are all negative, including the depletion of nonrenewable resources, the cost

of income inequality, and the cost of consumer durables. The cost of long-term environmental damage is a less significant item in Maryland than in most other sub-national GPI studies because the cost of climate change is not accumulated.

To simplify GPI calculations, Bleys (2007) suggests omitting the adjustments that have low quantitative significance when compared with the other adjustments. Since the GPI involves large amounts of varied data, a simplified form could allow GPI estimates for different areas to be calculated more quickly and easily. However, a simplified GPI indicator would omit the fine details present in the trends of underlying adjustment items.

This is a more general problem of aggregating large amounts of varied information into a single value — the details of important aspects of well-being can be lost in assembling the data. Disaggregating the GPI adjustments and presenting the trends of underlying items on their own aids policy discussions about what needs to change. For example, GPI data for Baltimore City since 1980 is normalized to the initial year and presented in Table 3 using a facial icon to assess the trends toward or away from desirable conditions.

3.2. Comparison with Independent GPI Study for the State of Maryland

At the same time as this study was being conducted, an inter-agency workgroup was assembled by the Governor of Maryland in order to develop a state-level GPI. This represents the first state government-led GPI effort in the United States and demonstrates the growing interest in GPI as a measure of social well-being. The State of Maryland GPI project also offers a chance to compare two independently computed GPI estimates for the same location.

Fig. 2 presents a comparison of GPI per capita results with the State of Maryland study conducted by the inter-agency workgroup in partnership with the University of Maryland Center for Integrative Environmental Research. The indicator trends match closely until they diverge for 1990–2005. Methodological differences account for this discrepancy. The most significant differences include a positive adjustment term for the value of higher education in the State of Maryland GPI (reasons for omitting this term from our study are described in the methods section). The value of higher education is a significant contribution in the state of Maryland, especially since 1980 when the value grew at approximately twice the rate for previous years. Also, a slightly different measure of income inequality was used between the two studies: Gini coefficient for income inequality among households was used in the State of Maryland GPI; a Gini coefficient for income inequality among families was used in the authors' study. The two studies also differ in their calculation of nonrenewable energy resource depletion, stemming from the treatment of net interstate electricity flows (which increased significantly since the 1990s) and the quantities of different energy resources consumed. The nonrenewable resource depletion cost figures presented in this paper are about 50% higher in 2000 and 2005. Finally, the State of Maryland study calculated the services of consumer durables using a household capital depreciation rate plus the interest rate that could have been achieved if the money had instead been invested, while the study in this paper used only a capital depreciation rate. This combination of higher services (values of education and services from consumer durables) and lower costs (costs of income inequality and nonrenewable resource depletion) in the State of Maryland study leads to a 2005 GPI about 20% greater than the figure calculated in this paper.

These differences highlight the need for standardization in the methods governments use to account more accurately for social well-being. A process for building consensus on how to measure key elements of welfare could advance the theoretical basis and use of improved indicators. When methodological differences between the studies are

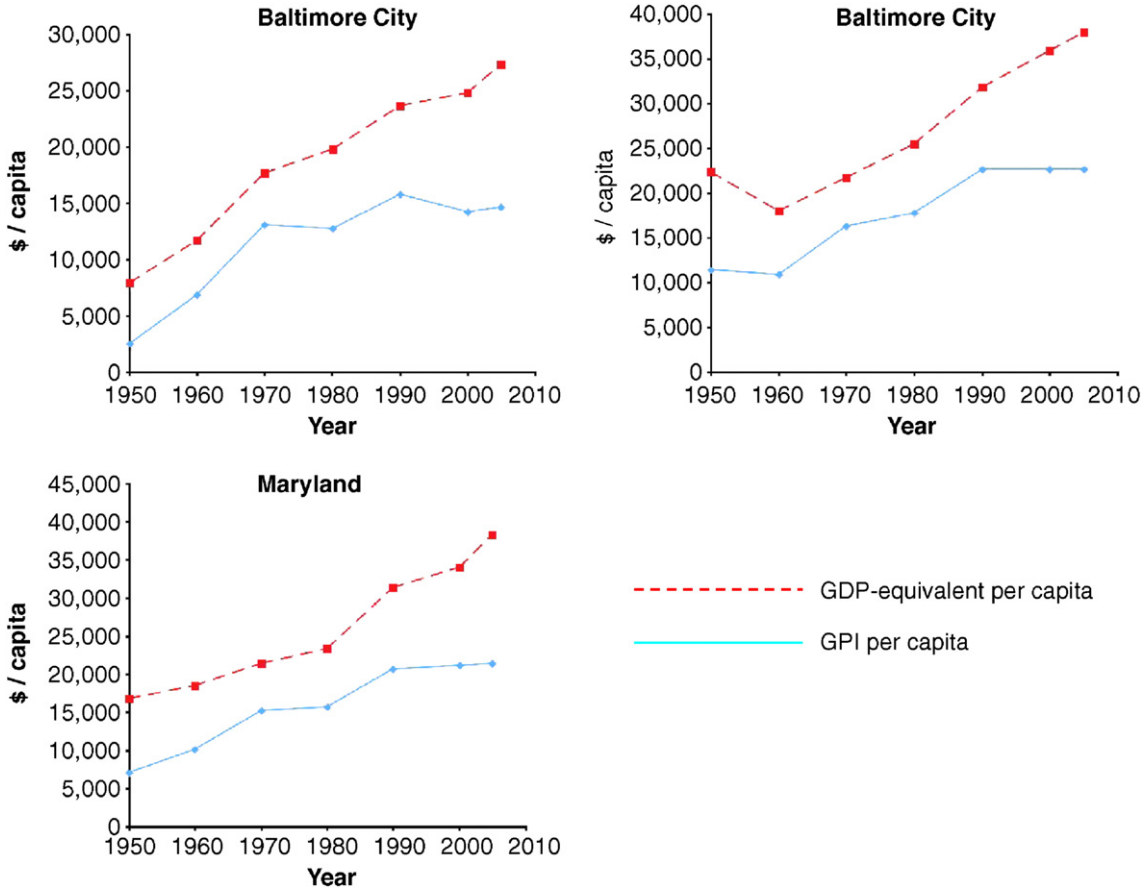

Fig. 1. Multi-scale comparison of per capita GPI with regional equivalent of GDP.

Table 3
Assessment of Baltimore City GPI contributions 1980–2005.

Positive trend Negative trend Somewhat positive trend

Indicator (per capita)	1980	1990	2000	2005	Trend
Economic Variables					
Personal consumption expenditures	100	115.7	108.7	125.1	
Income distribution index (larger is worse)	100	107.2	113.1	121.5	
Value of household labor	100	116.6	88.3	84.9	
Value of volunteer work	100	106.1	107.0	114.9	
Services of household capital	100	117.2	114.2	120.5	
Services of highways and streets	100	96.8	121.0	150.5	
Net capital investment	100	85.4	318.2	255.4	
Net foreign lending and borrowing	100	NA	NA	NA	
Social Variables					
Cost of crime	100	138.7	118.0	103.6	
zCost of family breakdown	100	88.9	81.1	74.3	
Loss of leisure time	100	189.8	385.3	484.7	
Cost of underemployment	100	148.9	212.4	249.8	
Cost of consumer durables	100	117.2	114.2	120.5	
Cost of commuting	100	112.4	116.8	106.2	
Cost of household pollution abatement	100	92.9	82.88	83.1	
Cost of automobile accidents	100	93.5	82.4	78.6	
Environmental Variables					
Cost of water pollution	100	93.5	67.6	60.3	
Cost of air pollution	100	87.3	72.9	78.9	
Cost of noise pollution	100	91.9	75.6	74.6	
Loss of wetlands	100	111.4	122.4	129.7	
Loss of farmland	100	146.7	160.6	160.3	
Cost of nonrenewable resource depletion	100	88.1	82.1	84.0	
Cost of long-term environmental damage	100	160.2	183.4	213.9	
Cost of ozone depletion	100	92.8	11.2	4.7	
Loss of forest cover	100	113.2	125.8	95.8	
Final Results					
Genuine Progress Indicator	100	124.1	112.1	115.0	

accounted for, the agreement between GPI estimates for Maryland provides evidence for the reproducibility and integrity of the GPI framework.

3.3. Comparison among State-level GPI Estimates in the United States

Fig. 3 presents the estimate of the Maryland GPI per capita compared with results from Vermont (Costanza et al., 2004) and Ohio (Bagstad and Shammin, 2009). All three states follow the same trend of an overall increasing GPI per capita, with Maryland's GPI per capita increasing the most at an average rate of 1.9% per year between 1950 and 2005. In comparison, Vermont's GPI per capita average annual growth rate is 1.7% per year between 1950 and 2000, and Ohio's GPI per capita average annual growth rate is 1.0% per year between 1950 and 2005.

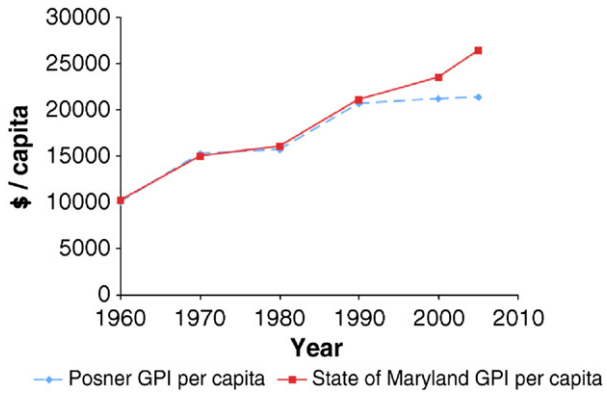

Fig. 2. Two estimates of the Maryland GPI derived independently.

Vermont has lower levels of income inequality and greenhouse gas emissions than the national average. This can be seen in the way the Vermont GPI outpaces the measure for Ohio, where environmental costs are notably larger. Interestingly, though, the Vermont GPI grows less over the entire study period than the Maryland GPI. The increase in personal consumption expenditures in Maryland, especially during the decade of the 1980s, leads to the significant rise in GPI. This is an example of how growth in consumption can outweigh environmental and social costs in GPI calculations.

3.4. Indicator Bias and Challenges for GPI

Within any indicator framework, value judgments must be made about the desirability of particular trends. The GPI is no exception, and as an indicator framework it makes assumptions about how changes in the underlying data affect sustainable economic welfare. When indicators are used as policy instruments, such assumptions can implicitly favor particular policy and development outcomes. The aim is to favor outcomes that improve overall well-being, but 'indicator bias' could foster undesirable outcomes if it reinforces conditions or behaviors that are not universally beneficial for sustainable welfare.

In exploring a few of the inherent tendencies built in to the GPI framework, it can be seen that there is room for improvement. For example, the GPI strongly favors sewer over septic systems when calculating the cost of household pollution abatement. This is due to the way wastewater treatment costs (which comprise over half of household pollution abatement) are calculated, namely, that septic systems involve a cost per use and a significant installation cost while sewer systems are assumed only to have a cost per use. The installation and maintenance costs of sewers are ignored because of lack of available, locally specific data. If GPI information were used to guide local development policy and behaviors, then it could result in positive feedback for more sewer and less septic systems, placing an unaccounted for burden on public sewer infrastructure.

Overall, the GPI also ignores the distribution of costs and benefits among various regions. GPI focuses on the location where consumption of goods or services occurs, but the costs associated with economic growth can be born far from the place of consumption. For example, one region may enjoy the benefits of natural resource consumption (and have an inflated GPI) while another region may bear the costs of depleted natural capital stocks (and have a lowered GPI) (as described in Lawn and Clarke, 2008). This can lead to one region's economic welfare being artificially supported by externalizing costs to another region. The failure to properly account for resource and waste imports and exports creates indicator bias in GPI toward exporting the costs of economic growth to other locations — not a sustainable outcome. Smaller regions such as cities and counties are more open systems (both economically and ecologically), and so this issue becomes worse as one moves from national down to city level GPI measurement. This leads us to believe that national level GPI is the most useful and reliable spatial scale of

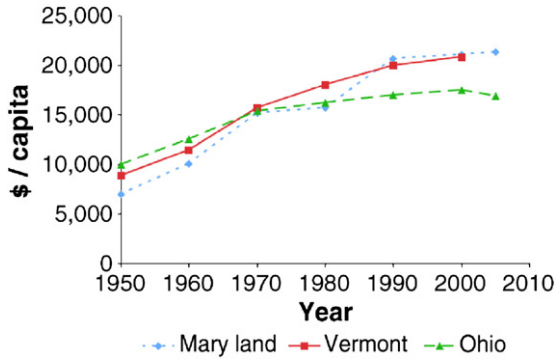

Fig. 3. GPI studies for three states in the US.

measurement, though there are still certain advantages to state level GPI described in the section on policy implications. The lack of accurate local data and the increasingly problematic boundary problems present at the county and city scale make these levels of GPI analysis less useful.

Further, GPI studies often do not identify an optimum level of inequality, but use a baseline chosen by the researcher or of the lowest level in the study period. The debate continues as to whether inequality should be measured with a Gini coefficient, looking at the distribution of income by quintile, or with an Atkinson index, including some estimate of society's aversion to income inequality, or in some other way. This raises the question of what amount of inequality in incomes is best for societal well-being. The ambiguous selection of an inequality baseline could lead to policy based on this indicator to foster unfavorable levels of inequality.

GPI assumes that more is better, but acknowledges the decreasing marginal returns to consumption and the fact that net benefits are what we want more of, not gross benefits. For example, adjusting personal consumption expenditures to account for income distribution adjusts for a diminishing marginal utility of consumption. GPI can also help establish the "optimal scale" of aggregate personal consumption. This would occur when the costs of additional consumption begin to outweigh the benefits — essentially when GDP and GPI begin to diverge.

3.5. Policy Implications

The economic, environmental, and social indicators that compose GPI can inform policy in several important ways. In a broad sense, GPI can help policymakers better understand the wide-ranging impacts of policies designed to maximize GDP growth. Such policies may have differential impacts across populations, regions, and industries that can be exposed with local level GPI analysis. For example, changes in income inequality could help show state tax policies benefiting the wealthy while doing little to influence standards of living for the majority of a population. With a more accurate understanding of the sources of economic growth or decline, as well as the impacts of economic production, policymakers could more effectively plan for genuine improvements in the well-being of their citizens.

GPI information could add value to the design of social and welfare policies. Accounting for the value of household work could inform child care programs by showing that social and human capital investments made at home are significant in preparing children for school later. Policies focused only on marketed economic production could disregard the contributions of household work that occur outside the market, and resources could be spent encouraging workforce participation at the expense of family well-being. In terms of measuring nonmarket value, GPI also accounts for the value of certain government outputs that may not traditionally factor into local development policy decisions, such as the services of roads and highways.

The ways that GPI accounts for environmental assets may have the most significant policy implications. The benefits humans receive from nature are often neglected and undervalued in decision-making. Public goods and services such as those provided by wetlands or forests are especially prone to suboptimal policies, as these assets often lack market prices. GPI includes indicators of the costs associated with declining environmental quality and can help policymakers understand the environmental pressures that can occur as a result of economic activities. Local land use policies and planning processes informed by GPI could more effectively guide development that doesn't compromise the quality of land, air, or water. GPI could also be used to estimate returns to human well-being from state investments in environmental protection and restoration.

GPI was originally designed as a national level tool and many of the factors that affect sub-national GPI are most effectively dealt with through national policies (Clarke and Lawn, 2008). However, variations in regional GPI estimates could highlight areas that experience genuine progress, and whether these areas are improving to the advantage of, or at the expense of, the well-being of neighboring areas. Studies that substitute or complement traditional economic measures with GPI would be able to explore the effects of policy changes on a more complete economic picture. Economic analysis that uses GPI could illuminate nonmarket considerations and promote programs that generate positive social net benefits. The performance of regional policy could be monitored based on whether it creates environmental or social costs that lead to uneconomic growth.

Governmental accounting methods must stay relevant to our changing understanding of economies and ecosystems. At a sub-national scale, GPI studies can encourage debate about what makes for sustainable economic welfare and how communities can achieve it (Clarke and Lawn, 2008). Maryland's GPI initiative has sparked such conversations in media and within government agencies about the elements of a healthy, functioning state economy. In Maryland, state agency budgets have been formulated by assessing potential impacts to GPI indicators. Using a GPI lens to view scenarios in this way can support decisions based on improving quality of life without negatively impacting overall environmental or social conditions.

4. Conclusions

The GPI has its flaws, (as do all indicators) but it is still of great value as a way to raise awareness of unsustainable economic, social, and environmental trends and to inspire debate on what makes for societal progress and how to measure it. Maryland may be the first example in the US where GPI has become an official state statistic used to evaluate budgetary and policy decisions. With a commitment among the GPI research community to adopt a standardized methodology, this effort could be replicated widely. Consistency among subsequent studies would be an important step toward developing common ground from which to improve systems of account at multiple levels of government, to better measure the full range of impacts from our policy decisions.

A key part of realizing sustainability is to create a network of people who develop performance indicators and engage in a dialog and a process for moving toward sustainability goals. Rethinking resource use, progress, and development patterns requires an evolved set of policy tools. GPI could be up to the task, but only if it can become more widely vetted, politically attractive, easily available, and broadly applicable. It needs to have the same level of recognition and reliability that GDP currently holds with top-level managers as well as everyday citizens. Wide-spread recognition of an indicator by large, trusted organizations is required if it is to be accepted as a new welfare index (Lawn, 2005).

The methodological bias and inconsistencies within and between GPI studies hinder such acceptance and should be addressed. GPI is an imperfect measure of full progress, but a significant improvement over GDP as a measure of sustainable human welfare. Incorporating human needs, livelihoods, and capabilities and engaging in a consensus-building process to address inconsistencies would make GPI a stronger candidate for guiding human economies toward genuine progress.

Appendix A. Results of GPI Calculations

Figures in bold italics indicate costs that are subtracted. Although income distribution index is a weighting element, it is shown in bold italics to indicate that its effect in all scales and years is to adjust personal consumption downward. Two anomalies worth noting: the cost of long-term environmental damage is zero for 1950 and 1960 at all three scales due to the assumption that Earth's CO_2 sequestration capacity became exceeded in the mid-1960s (Talberth et al., 2007), and the loss of leisure time is zero for 1970 at all three scales due to how the value of lost leisure time is estimated in relation to 1969, the year in the study period with the greatest leisure.

	Year	Personal consumption	Gini coefficient	Income distribution index	Adjusted personal consumption	Value of household work	Value of volunteer work	Services of household capital	Services of highways and streets	Cost of crime
		A		B	C	D	E	F	G	H
Baltimore City	1950	$4,622,851,521	0.458	***106.64***	$4,335,011,618	$5,151,925,258	$70,321,577	$646,104,833	$10,533,812	***$80,839,820***
	1960	$6,860,517,148	0.439	***102.11***	$6,718,572,349	$6,683,077,559	$78,263,613	$783,623,284	$16,151,912	***$162,854,350***
	1970	$12,322,504,945	0.430	***100.00***	$12,322,504,945	$7,601,928,837	$84,981,700	$1,413,240,255	$35,758,687	***$456,918,513***
	1980	$11,821,119,227	0.439	***102.18***	$11,569,453,253	$6,423,199,252	$87,808,549	$1,260,926,112	$43,532,624	***$555,303,384***
	1990	$13,678,043,562	0.471	***109.62***	$12,477,334,948	$7,488,117,945	$93,188,255	$1,477,997,402	$42,137,070	***$770,306,837***
	2000	$12,845,418,331	0.496	***115.53***	$11,118,219,345	$5,669,451,539	$93,981,028	$1,439,782,242	$52,660,874	***$655,138,228***
	2005	$14,793,913,345	0.534	***124.18***	$11,912,957,446	$5,450,286,737	$100,828,807	$1,519,872,488	$65,534,093	***$575,545,585***
Baltimore County	1950	$3,899,621,093	0.388	***106.64***	$3,656,812,829	$1,493,232,737	$20,012,44	$545,023,786	$15,187,863	***$20,203,090***
	1960	$5,787,211,064	0.371	***102.11***	$5,667,473,077	$3,569,340,101	$43,787,286	$661,027,914	$22,679,978	***$40,582,038***
	1970	$10,394,688,184	0.364	***100.00***	$10,394,688,184	$5,311,975,430	$66,326,784	$1,192,143,306	$47,101,419	***$122,615,509***
	1980	$12,705,202,323	0.364	***100.11***	$12,690,828,690	$5,462,128,377	$90,480,106	$1,355,228,812	$60,114,678	***$166,559,364***
	1990	$17,295,873,167	0.400	***109.88***	$15,741,114,874	$7,187,926,570	$112,625,057	$1,868,926,319	$62,085,915	***$214,242,081***
	2000	$21,639,384,116	0.428	***117.63***	$18,395,662,193	$6,745,589,912	$141,108,383	$2,425,456,312	$80,980,769	***$208,013,007***
	2005	$25,153,234,039	0.452	***124.18***	$20,254,911,582	$6,804,884,664	$154,911,091	$2,584,151,165	$103,188,638	***$216,213,249***
Maryland	1950	$23,103,513,532	0.372	***106.64***	$21,664,982,995	$12,434,766,337	$186,759,250	$3,229,022,540	$152,980,162	***$189,614,828***
	1960	$34,286,641,079	0.356	***102.11***	$33,577,246,981	$21,589,556,195	$271,168,830	$3,916,295,188	$234,570,565	***$384,772,395***
	1970	$61,583,885,646	0.349	***100.00***	$61,583,885,646	$33,877,814,559	$385,727,964	$7,062,916,723	$462,330,123	***$1,115,140,035***
	1980	$75,216,844,007	0.352	***100.86***	$74,575,791,359	$34,865,728,745	$548,218,499	$8,023,172,835	$601,461,147	***$1,429,118,161***
	1990	$113,730,354,523	0.384	***110.03***	$103,364,306,585	$47,799,214,675	$767,630,604	$12,289,269,864	$624,670,781	***$1,846,785,434***
	2000	$145,383,808,393	0.407	***116.62***	$124,665,722,676	$45,613,815,181	$966,546,830	$16,295,384,094	$818,647,082	***$1,700,672,214***
	2005	$173,377,426,235	0.433	***124.18***	$139,614,032,663	$46,630,556,832	$1,080,950,331	$17,812,161,939	$1,043,824,096	***$1,901,539,225***

Appendix A (*continued*)

	Cost of family breakdown	Loss of leisure time	Cost of underemployment	Cost of consumer durables	Cost of commuting	Cost of household pollution abatement	Cost of automobile accidents	Cost of water pollution	Cost of air pollution	Cost of noise pollution
	I	J	K	L	M	N	O	P	Q	R
Baltimore City	***$41,817,778***	***$719,501,911***	***$98,617,023***	***$738,405,524***	***$872,683,121***	***$133,257,722***	***$598,188,302***	***$4,533,830***	***$311,992,289***	***$84,333,992***
	$99,530,971	***$342,922,384***	***$162,082,922***	***$895,569,468***	***$789,944,974***	***$122,811,755***	***$591,458,819***	***$6,079,033***	***$287,653,192***	***$86,637,124***
	$154,101,310	***$0***	***$246,198,546***	***$1,615,131,720***	***$981,459,739***	***$125,101,620***	***$570,506,344***	***$7,951,574***	***$312,017,989***	***$94,013,054***
	$182,963,738	***$84,778,615***	***$345,465,728***	***$1,441,058,414***	***$1,069,730,346***	***$114,998,855***	***$495,562,427***	***$7,567,908***	***$241,711,471***	***$84,038,804***
	$162,727,496	***$160,884,994***	***$514,494,602***	***$1,689,139,888***	***$1,202,168,805***	***$106,884,240***	***$463,589,825***	***$7,079,643***	***$210,905,896***	***$77,256,628***
	$148,440,510	***$326,680,900***	***$733,655,711***	***$1,645,465,419***	***$1,249,921,323***	***$95,162,596***	***$408,540,210***	***$5,118,121***	***$176,250,176***	***$63,510,363***
	$135,992,202	***$410,924,599***	***$862,931,230***	***$1,736,997,129***	***$1,135,854,148***	***$95,607,864***	***$389,361,614***	***$4,565,384***	***$190,815,668***	***$62,719,027***
Baltimore County	***$12,075,645***	***$214,747,994***	***$16,994,386***	***$622,884,327***	***$244,485,937***	***$38,751,814***	***$141,456,083***	***$1,290,262***	***$115,424,587***	***$19,720,981***
	$62,192,494	***$188,602,081***	***$51,487,298***	***$755,460,474***	***$684,483,263***	***$70,812,363***	***$257,728,061***	***$3,187,870***	***$193,788,419***	***$38,696,373***
	$110,196,753	***$0***	***$102,587,868***	***$1,362,449,492***	***$915,990,357***	***$86,415,724***	***$325,060,660***	***$5,452,377***	***$273,858,711***	***$57,079,966***
	$167,725,814	***$84,831,204***	***$162,919,578***	***$1,548,832,928***	***$1,166,849,472***	***$96,204,504***	***$343,137,235***	***$6,306,293***	***$198,809,661***	***$64,529,923***
	$171,209,119	***$176,593,351***	***$332,213,396***	***$2,135,915,794***	***$1,139,432,577***	***$96,280,492***	***$362,250,631***	***$6,657,566***	***$181,565,199***	***$66,248,713***
	$202,862,696	***$451,522,220***	***$640,363,752***	***$2,771,950,071***	***$1,357,871,902***	***$106,269,252***	***$395,692,661***	***$5,965,716***	***$184,808,318***	***$69,257,986***
	$209,797,354	***$599,219,595***	***$790,582,568***	***$2,953,315,617***	***$1,513,810,380***	***$111,164,972***	***$403,117,946***	***$5,584,083***	***$213,513,384***	***$71,770,687***
Maryland	***$104,671,399***	***$1,818,359,554***	***$143,726,043***	***$3,690,311,475***	***$2,220,019,439***	***$308,660,165***	***$1,371,672,209***	***$11,185,300***	***$654,391,729***	***$143,491,964***
	$394,041,675	***$1,159,959,387***	***$316,283,103***	***$4,475,765,929***	***$3,696,195,220***	***$406,053,566***	***$1,815,248,448***	***$20,073,173***	***$800,524,562***	***$207,945,189***
	$689,890,055	***$0***	***$631,128,600***	***$8,071,904,826***	***$6,083,380,934***	***$572,985,302***	***$2,296,305,336***	***$34,434,378***	***$1,129,233,521***	***$311,792,766***
	$1,033,775,090	***$518,106,388***	***$1,151,353,068***	***$9,169,340,383***	***$7,944,422,979***	***$653,942,427***	***$2,468,760,112***	***$40,562,647***	***$1,082,149,769***	***$361,732,427***
	$1,139,051,654	***$1,221,887,817***	***$2,150,800,704***	***$14,044,879,845***	***$9,340,437,646***	***$755,015,825***	***$2,799,233,450***	***$45,992,447***	***$1,139,443,979***	***$408,153,804***
	$1,353,460,502	***$3,150,696,720***	***$4,349,084,597***	***$18,623,296,107***	***$10,431,910,101***	***$775,256,877***	***$2,899,233,151***	***$41,907,618***	***$1,216,890,283***	***$446,370,587***
	$1,450,814,952	***$4,205,865,697***	***$5,294,331,687***	***$20,356,756,502***	***$11,498,959,619***	***$828,778,134***	***$2,853,690,124***	***$39,751,697***	***$1,361,714,639***	***$468,755,294***

(*continued on next page*)

Appendix A (*continued*)

	Loss of wetlands	Loss of farmlands	Depletion of nonrenewable resources	Long-term Environmental damage	Cost of ozone depletion	Loss of forest cover	Net capital investment	Net foreign lending and borrowing	Total GPI	Population	Personal consumption per capita	GPI per capita
	S	T	U	V	W	X	Y	Z				
Baltimore City	***$88,059***	***$4363***	***$4,272,367,468***	$0	***$5,399,256***	−$26,750	$70,164,955	$0	$2,322,058,342	949,708	$4868	$2445
	$102,531	***$225,976***	***$4,379,454,806***	$0	***$14,805,306***	−$53,745	$54,054,542	$0	$6,391,663,394	939,024	$7306	$6807
	$122,253	***$390,082***	***$5,124,850,798***	***$283,874,182***	***$47,623,221***	***$201,395***	$364,243,540	$0	$11,802,195,622	905,759	$13,605	$13,030
	$144,801	***$470,910***	***$4,522,250,268***	***$556,758,955***	***$48,261,260***	***$487,980***	$344,436,089	$0	$9,977,802,016	786,775	$15,025	$12,682
	$161,328	***$690,767***	***$3,983,990,709***	***$891,960,625***	***$44,772,391***	***$552,208***	$294,243,355	$0	$11,585,452,092	736,014	$18,584	$15,741
	$177,206	***$756,087***	***$3,712,256,513***	***$1,020,915,825***	***$5,409,207***	***$613,720***	$1,096,152,387	$0	$9,222,235,300	648,615	$19,804	$14,218
	$187,796	***$754,906***	***$3,798,322,104***	***$1,190,641,960***	***$2,250,340***	***$467,380***	$879,664,075	$0	$9,335,204,706	640,064	$23,113	$14,585
Baltimore County	***$2,195,346***	***$520,702***	***$1,215,853,265***	$0	***$1536,54***	−$358,348	$19,967,919	$0	$3,082,454,959	270,273	$14,428	$11,405
	$2,570,562	***$18,051,959***	***$2,296,603,890***	$0	***$7,763,963***	−$718,682	$28,346,421	$0	$5,321,362,352	492,428	$11,752	$10,806
	$3,051,138	***$30,783,366***	***$3,514,099,180***	***$194,651,917***	***$32,655,140***	***$2,686,916***	$249,761,013	$0	$10,122,361,061	621,077	$16,737	$16,298
	$3,602,623	***$37,054,059***	***$3,768,364,665***	***$463,943,977***	***$40,215,825***	***$6,512,237***	$287,016,575	$0	$11,619,397,876	655,615	$19,379	$17,723
	$4,016,814	***$54,110,667***	***$3,746,471,433***	***$838,783,332***	***$42,103,131***	***$7,369,550***	$276,701,027	$0	$15,673,915,918	692,134	$24,989	$22,646
	$4,447,847	***$59,178,164***	***$4,327,031,123***	***$1,189,986,342***	***$6,305,008***	***$833,092***	$1,277,682,584	$0	$17,084,120,996	756,030	$28,622	$22,597
	$4,667,799	***$59,086,590***	***$4,645,862,602***	***$1,456,316,448***	***$2,752,471***	−$11,636,833	$1,075,948,357	$0	$17,732,856,582	782,885	$32,129	$22,651
Maryland	***$214,623,044***	***$10,017,521***	***$10,540,251,583***	$0	***$13,320,371***	−$7,481,474	$173,102,216	$0	$16,414,778,352	2,343,001	$9861	$7006
	$251,283,943	***$202,060,021***	***$14,461,107,855***	$0	***$48,887,622***	−$15,002,871	$178,489,924	$0	$31,142,128,467	3,100,689	$11,058	$10,044
	$298,268,350	***$472,941,021***	***$22,193,220,985***	***$1,229,320,172***	***$206,232,866***	***$51,984,075***	$1,577,360,531	$0	$59,561,872,325	3,922,399	$15,701	$15,185
	$352,182,204	***$606,360,021***	***$24,238,462,485***	***$2,984,129,638***	***$258,671,827***	***$127,820,700***	$1,846,116,583	$0	$66,039,598,840	4,216,975	$17,837	$15,660
	$392,958,084	***$808,510,021***	***$25,881,741,501***	***$5,794,565,299***	***$290,860,981***	***$144,647,811***	$1,911,533,183	$0	$98,551,659,393	4,781,468	$23,786	$20,611
	$434,925,435	***$854,864,431***	***$30,396,279,015***	***$8,359,347,517***	***$44,291,059***	***$160,872,855***	$8,975,391,026	$0	$112,096,147,820	5,310,916	$27,375	$21,107
	$456,570,489	***$883,429,641***	***$33,072,736,811***	***$10,367,153,472***	***$19,594,156***	***$122,590,065***	$7,659,407,923	$0	$118,657,901,579	5,573,163	$31,109	$21,291

References

Anielski, M., 2001. The Alberta GPI Blueprint: The Genuine Progress Indicator (GPI) Sustainable Well-being Accounting System. Pembina Institute for Sustainable Development, Calgary.

Anielski, M., Johannessen, H., 2009. The Edmonton 2008 Genuine Progress Indicator Report. Anielski Management, Edmonton.

Bagstad, K.J., Ceroni, M., 2007. Opportunities and challenges in applying the Genuine Progress Indicator/Index of Sustainable Economic Welfare at local scales. International Journal of Environment, Workplace, and Employment 3, 132–153.

Bagstad, K., Shammin, M., 2009. The Genuine Progress Indicator as a measure of regional economic welfare: A case study for Northeast Ohio. Paper presented at the 5th Bi-Annual Meeting of the US Society for Ecological Economics: Science and Policy for a Sustainable Future, May 31–June 3, Washington DC.

Bay Area Genuine Progress Indicator, 2006. Retrieved July 7, 2010 from www.regionalprogress.org/more_ca_bayarea.html 2006.

Berik, G, Gaddis, E., 2011. The Utah Genuine Progress Indicator (GPI), 1990 to 2007: A Report to the People of Utah. Available online at: www.utahpop.org/gpi.html.

Bleys, B., 2006. The Index of Sustainable Economic Welfare for Belgium. Vrije Universiteit Brussel, report MOSI 27.

Bleys, B., 2007. Simplifying the index of sustainable economic welfare: methodology, data sources and a case study for The Netherlands. International Journal of Environment, Workplace, and Employment 3, 103–118.

Bleys, B., 2008. Proposed changes to the index of sustainable economic welfare: an application to Belgium. Ecological Economics 64, 741–751.

Castaneda, B.E., 1999. An index of sustainable economic welfare for Chile. Ecological Economics 28, 231–244.

Clarke, M., Islam, S.M.N., 2005. Diminishing and negative welfare returns of economic growth: an index of sustainable economic welfare for Thailand. Ecological Economics 54, 81–93.

Clarke, M., Lawn, P., 2008. Is measuring genuine progress at the sub-national level useful? Ecological Indicators 8, 573–581.

Clarke, M., Shaw, J., 2008. Genuine progress in Thailand: a system-analysis approach. In: Lawn, P., Clarke, M. (Eds.), Sustainable Welfare in the Asia-Pacific. Edward Elgar, Northampton, MA, pp. 260–297.

Costanza, R., et al., 2004. Estimates of the Genuine Progress Indicator (GPI) for Vermont, Chittenden County and Burlington, from 1950 to 2000. Ecological Economics 51, 139–155.

Costanza, R., et al., 2009. Beyond GDP: The Need for New Measures of Progress. Pardee Papers no. 4. Pardee Center for Study of the Longer-Range Future, Boston.

Daly, H., Cobb, J., 1989. For the Common Good: Redirecting the Economy Toward Community, the Environment, and a Sustainable Future. Beacon Press, Boston.

Diefenbacher, H., 1994. The Index of Sustainable Economic Welfare for the Federal Republic of Germany. In: Cobb, C., Cobb, J. (Eds.), The Green National Product. University of Americas Press, Lanham, MD, pp. 215–245.

Dietz, S., Neumayer, E., 2006. Some constructive criticisms of the Index of Sustainable Economic Welfare. In: Lawn, P. (Ed.), Sustainable Development Indicators in Ecological Economics. Edward Elgar, Northampton, MA, pp. 186–206.

England, R.W., 1998. Measurement of social well-being: alternatives to gross domestic product. Ecological Economics 25, 89–103.

European Commission, 2009. GDP and beyond: measuring progress in a changing world. Communication from the Commission to the Council and the European Parliament. Retrieved 16 February 2010 from www.beyond-gdp.eu.

Forgie, V., et al., 2008. Calculating the New Zealand Genuine Progress Indicator. In: Lawn, P., Clarke, M. (Eds.), Sustainable Welfare in the Asia-Pacific. Edward Elgar, Northampton, MA, pp. 126–152.

Gil, S., Sleszynski, J., 2003. An index of sustainable economic welfare for Poland. Sustainable Development 11, 47–55.

Guenno, G., Tiezzi, S., 1998. The ISEW for Italy. Fondazione Eni Enrico Mattei working paper no. ENV-5.98.

Gustavson, K.R., Lonergan, S.C., 1994. Sustainability in British Columbia: The Calculation of an Index of Sustainable Economic Well-being. Centre for Sustainable Regional Development, Victoria, BC, Canada.

Hamilton, C., 1999. The genuine progress indicator methodological developments and results from Australia. Ecological Economics 30, 13–28.

Hamilton, C., Denniss, R., 2000. Tracking well-being in Australia. Discussion paper 35. The Australia Institute, Canberra.

Hanley, N., 1999. Measuring sustainability: a time series of alternative indicators for Scotland. Ecological Economics 28, 55–73.

Harris, J.M., 1997. Critiques of national income accounting and GNP. In: Ackerman, F., Kiron, D., Goodwin, N.R., Harris, J.M., Gallagher, K. (Eds.), Human Well-Being and Economic Goals. Island Press, Washington, D.C.

Hoffren, J., 2011. Measuring Sustainable Well-being on Sub-national Level with Genuine Progress Indicator (GPI) in Finland. Regional Council of Päijät Häme and Joint Authority of Kainuu Region, Finland. Available at: http://freshproject.eu/fresh-downloads/good-practice-reports.html.

Hong, V.X.N., et al., 2008. Genuine progress in Vietnam: impact of the Doi Moi reforms. In: Lawn, P., Clarke, M. (Eds.), Sustainable Welfare in the Asia-Pacific. Edward Elgar, Northampton, MA, pp. 299–330.

Jackson, T., et al., 1997. An Index of Sustainable Economic Welfare for the UK 1950–1996. University of Surrey Centre for Environmental Strategy, Guildford.

Jackson, T., et al., 2008. Measuring Regional Progress: Regional Index of Sustainable Economic Welfare (R-ISEW) for all the English Regions. New Economics Foundation, London.

Jackson, T., Stymne, S., 1996. Sustainable Economic Welfare in Sweden: A Pilot Index 1950–1992. Stockholm Environment Institute, Stockholm.

Lawn, P.A., 2003. A theoretical foundation to support the Index of Sustainable Economic Welfare (ISEW), Genuine Progress Indicator (GPI), and other related indexes. Ecological Economics 44 (1), 105–119.

Lawn, P.A., 2005. An assessment of the valuation methods used to calculate the Index of Sustainable Economic Welfare (ISEW), Genuine Progress Indicator (GPI), and Sustainable Net Benefit Index (SNB). Environment, Development and Sustainability 7 (2), 185–208.

Lawn, P., 2006. An assessment of alternative measures of sustainable economic welfare. In: Lawn, P. (Ed.), Sustainable Development Indicators in Ecological Economics. Edward Elgar, Northampton, MA, pp. 139–165.

Lawn, P., 2008a. Genuine progress in Australia: time to rethink the growth objective. In: Lawn, P., Clarke, M. (Eds.), Sustainable Welfare in the Asia-Pacific. Edward Elgar, Northampton, MA, pp. 91–125.

Lawn, P., 2008b. Genuine progress in India: some further growth needed in immediate future but population stabilization needed immediately. In: Lawn, P., Clarke, M. (Eds.), Sustainable Welfare in the Asia-Pacific. Edward Elgar, Northampton, MA, pp. 191–227.

Lawn, P., Clarke, M., 2006. Comparing Victoria's genuine progress with that of the rest of Australia. Journal of Economic and Social Policy 10 (2), 115–138.

Lawn, P., Clarke, M., 2008. Sustainable Welfare in the Asia-Pacific: Studies using the Genuine Progress Indicator. Edward Elgar, Northampton, MA.

Max-Neef, M., 1995. Economic growth and quality of life: a threshold hypothesis. Ecological Economics 15 (2), 115–118.

Makino, M., 2008. Genuine progress in Japan and the need for an open economy GPI. In: Lawn, P., Clarke, M. (Eds.), Sustainable Welfare in the Asia-Pacific. Edward Elgar, Northampton, MA, pp. 153–190.

Matthews, J., 2003. An Index of Sustainable Economic Welfare for Wales: 1990–2000. Cardiff School of Business, Cardiff.

Maryland Genuine Progress Indicator, 2010. An Index for Sustainable Prosperity Retrieved July 30, 2010 from www.green.maryland.gov/mdgpi 2010.

Minnesota Planning Agency, 2000. Smart signals: an assessment of progress indicators Retrieved August 12, 2010 from www.gda.state.mn.us/resource.html?Id=2419 2000.

Neumayer, E., 1999. The ISEW—not an Index of Sustainable Economic Welfare. Social Indicators Research 48 (1), 77–101.

Neumayer, E., 2000. On the methodology of ISEW, GPI and related measures: some constructive suggestions and some doubt on the 'threshold' hypothesis. Ecological Economics 34 (3), 347–361.

Nordhaus, W., Tobin, J., 1971. Is growth obsolete? In: Moss, M. (Ed.), The Measurement of Economic and Social Planning, Economic Growth. National Bureau of Economic Research, New York.

Nourry, M., 2008. Measuring sustainable development: some empirical evidence for France from eight alternative indicators. Ecological Economics 67 (3), 441–456.

Organization for Economic Cooperation and Development (OECD), 2010. Measuring the Progress of SocietiesRetrieved 16 February 2010 from www.oecd.org/progress 2010.

Oegema, T., Rosenberg, D., 1995. A Pilot ISEW for The Netherlands 1950–1992. Instituut voor Milieu - en Systeemanalyse, Amsterdam.

Pannozzo, L., Colman, R., Ayer, N., et al., 2008. The 2008 Nova Scotia Genuine Progress Index. GPI Atlantic, Glen Haven, NS, Canada.

Posner, S. 2010. Estimating the Genuine Progress Indicator for Baltimore, MD. Master's of Science thesis, University of Vermont, Burlington.

Pulselli, F.M., Ciampalini, F., Tiezzi, E., Zappia, C., 2006. The Index of Sustainable Economic Welfare (ISEW) for a local authority: a case study in Italy. Ecological Economics 60, 271–281.

Pulselli, F.M., Tiezzi, E., Marchettini, N., Bastiononi, S., 2008. The Road to Sustainability: GDP and Future Generations. WIT Press, Southampton.

Pulselli, F.M., Bravi, M., Tiezzi, E., 2009. On sustainability in practice: a possible interpretation through the application and use of the ISEW. Presented at "From GDP to Well-Being" international conference December 2009. Universitia Politecnica delle Marche, Italy.

Sametz, A., 1968. Production of goods and services: the measurements of economic growth. In: Sheldon, E., Moore, W. (Eds.), Indicators of Social Change. Russell Sage Foundation, New York.

Scasny, M., 2002. HDP alternatives — evaluation of precondition and use of the Index of Sustainable Economic Welfare in the Czech Republic. Toward Sustainability in the Czech Republic. Charles University Environment Center (in Czech).

Stiglitz, J., et al., 2009. Report by the Commission on the Measurement of Economic Performance and Social ProgressRetrieved on 29 May 2010 from www.stiglitz-sen-fitoussi.fr 2009.

Stockhammer, E., et al., 1997. The Index of Sustainable Economic Welfare as an alternative to GDP in measuring economic welfare. Ecological Economics 21, 19–34.

Talberth, D.J., Cobb, C., Slattery, N., 2007. The Genuine Progress Indicator 2006: A Tool for Sustainable Development. Redefining Progress, Oakland, CA.

Talberth, J., 2008. A new bottom line for progress. 2008 State of the World: Innovations for a Sustainable Economy. WW Norton & Company, New York.

Van den Bergh, J.C.J.M., 2009. The GDP paradox. Journal of Economic Psychology 30, 117–135.

Wen, Z., et al., 2008. Case study on the use of genuine progress indicator to measure urban economic welfare in China. Ecological Economics 63, 463–475.

Zolotas, X., 1981. Economic Growth and Declining Social Welfare. New York University Press, New York.