ANALYSIS

# The Genuine Progress Indicator
## A New Measure of Economic Development for the Northern Forest

By KENNETH J. BAGSTAD and MARTA CERONI

### Introduction

The well-being of the Northern Forest of New York, Vermont, New Hampshire, and Maine depends on the economic vitality of its communities as well as its natural resource wealth, social interactions, health, and knowledge. Yet, classical measures of progress, such as the gross domestic product (GDP), are based solely on economic output. GDP is still often used as a measure of society's welfare despite growing evidence that more wealth and economic output do not always improve quality of life or well-being for individuals or society (Kahneman et al. 2004; Easterlin 2005). Economists and politicians, including some of the original architects of GDP accounting, have also noted that GDP is a poor measure of economic well-being.

Since at least the late 1960s, economists have attempted to adjust GDP to better measure society's well-being. Daly and Cobb (1989) developed the Index of Sustainable Economic Welfare, which was later revised as the Genuine Progress Indicator (GPI). The GPI starts with a measure of personal consumption, weighted to account for income inequality, and adds or subtracts monetary value associated with various components that are expected to affect human well-being positively or negatively. Growth in capital and foreign borrowing, along with nonmonetary contributions to welfare (e.g., household labor, volunteer work) are added to GPI. Items subtracted from GPI include defensive private expenditures (e.g., pollution control), depletion of social networks (e.g., cost of crime, family breakdown, lost leisure time), costs of environmental degradation, and depletion of natural capital (Table 1). These capital types complement each other and are typically summarized as four stocks, each of which provides important contributions to human well-being (Ekins 1992):

- Built capital, the infrastructure including buildings, roads, factories, and machines that contribute to human economic production processes;
- Human capital, the physical labor and knowledge that people bring to their work and home lives;
- Social capital, the connections, institutions, rules, and norms that allow people to interact productively in all parts of their lives; and
- Natural capital, the land and natural resources that provide various ecosystem services needed for economic production, daily life, and rest and relaxation.

By accounting for the quantity and quality of these capital assets, GPI is better suited than GDP to addressing economic questions about distribution, societal well-being, and sustainability. Many studies have found that GPI grows along with GDP, but not as quickly and only up to a point, beyond which GPI stagnates or declines (Jackson and Stymne 1996). Max-Neef (1995) calls this the "threshold hypothesis"—that economic growth improves quality of life up to a point, but eventually erodes environmental and social quality, reducing quality of life.

GPI is one of many "alternative" economic indicators that have recently been developed. Haggerty et al. (2001) evaluate these alternative economic indicators against criteria including public policy relevance, strength of theoretical foundation, and data availability and quality. Other quality of life measures focus more on human health, economic domains, or life satisfaction surveys. GPI broadly includes built, human, social, and natural capital, and is one of few measures to aggregate its components into a monetary value. Hanley et al. (1999) compare different economic sustainability indicators and note that different measures give different messages about whether the economy is moving in a sustainable direction.

Some authors have questioned the GPI's theoretical framework (Neumayer 2000; Haggerty et al. 2001), including the reliability, validity, and sensitivity of the economic methods used to estimate the value of certain GPI components. This demonstrates the importance of finding high quality data to improve GPI estimates.

Like nations, states, counties, and communities are increasingly interested in developing policies to support social well-being. Although many policy choices take place at the national level, local jurisdictions also make important decisions about taxation and spending, land use and resource extraction, and environmental and social goals. Since GPI aggregates a broad suite of economic, social, and environmental indicators, it can be used as a tool, for example, to compare the economic well-being of two or more regions with different policies. In particular, the costs and benefits of

Kenneth J. Bagstad, kbagstad@uvm.edu, is a Ph.D. candidate at the Rubenstein School of Environment and Natural Resources and Gund Institute for Ecological Economics, University of Vermont. Dr. Marta Ceroni, marta.ceroni@uvm.edu, is a Research Assistant Professor at the Gund Institute for Ecological Economics and Department of Plant Biology at the University of Vermont.

economic growth are not distributed evenly across a nation. Certain regions may maintain their social capital, pursue stronger environmental protection, have a more even income distribution, or import pollution-intensive manufactured goods or energy from elsewhere. Understanding these regional differences has fueled recent interest in developing local-scale GPI studies. In the United States, GPI was recently calculated for nine counties in the San Francisco Bay area (Venetoulis and Cobb 2004) and at the state, county, and city level for Vermont (Costanza et al. 2004). These studies found GPI to be consistently higher than the national average in these areas. This may be due to efforts by Vermont and the San Francisco Bay area to develop strong local economies while preserving environmental quality and social cohesion.

Local GPI studies have also taken place outside the United States, as discussed further by Bagstad and Ceroni (2007). Both national and international studies showed limitations with using GPI at local or regional scales. In this country, most data needed to estimate GPI are readily available at the national level. However, national statistics agencies were not originally designed to collect such data at local scales. In the United States, historical data are often available only for decennial census years, and state and local data may simply not exist. In such cases, researchers typically scale down national or state values based on variables such as population or land area. While this method provides "filler" estimates, it also obscures the local differences that are important to local quality of life, the main reason for undertaking these studies. To develop truly useful and comparable local studies, consistent methods should be developed and data gaps identified, with improved measurement, survey, and accounting methods to better assess local well-being. This process is underway in Canada, where the organization GPI Atlantic has been a leader in developing surveys to collect local data on GPI-relevant quality of life attributes for Canada's maritime provinces.

In this study, we estimated the GPI for seven northern Vermont counties from the years 1950 to 2000, and use this case study to explore differences in well-being between urban and rural counties and as compared with nonmonetary assessments of well-being. We also identify methods needed to construct rigorous GPI estimates, and the benefits that these estimates can provide in measuring local and regional well-being.

**Study Area and Methods**

Six Vermont counties—Caledonia, Essex, Franklin, Lamoille, Orleans, and Washington—are included in the Northern Forest (Figure 1), which stretches from New York to Maine. These counties share low population density, abundant forest cover, and a settlement pattern of small New England town centers. The Northern Forest economy was traditionally centered around farming, forestry, and production of forest products. Tourism and outdoor recreation have become increasingly important in recent years, and many Northern Forest towns today are working to improve local employment opportunities while preserving their environmental and cultural character. The three easternmost counties of Caledonia, Essex, and Orleans constitute a fairly homogeneous and geographically isolated area in Northeastern Vermont known as the Northeast Kingdom. Efforts are ongoing to brand this area as a tourist destination. By contrast, Chittenden County, the subject of a past local GPI study, is relatively urban by Vermont and Northern Forest standards. Chittenden County is Vermont's most populous county. It includes the state's largest city, Burlington, as well as the largest employers in the state.

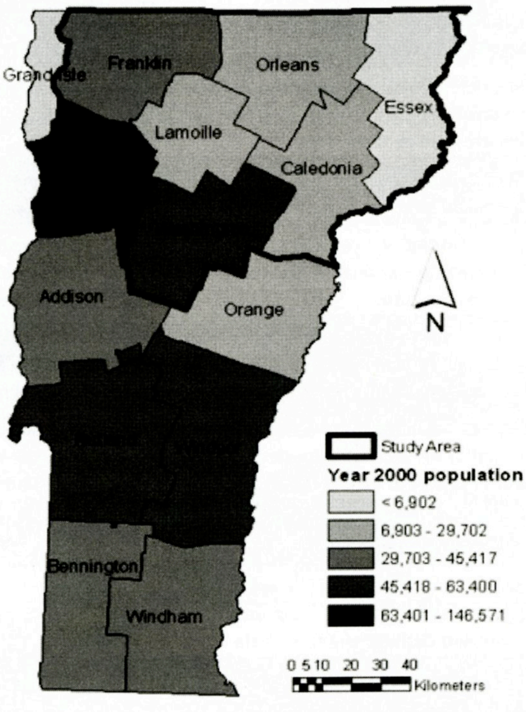


**Figure 1.** *Vermont counties within the Northern Forest*

To calculate the GPI for these counties, we followed the methods of Costanza et al. (2004), who adjusted past national GPI methods to the local level. When improved data sources or methods were available, we noted these changes. Following Costanza et al., we calculate values for the decennial years 1950 to 2000, for the 26 GPI components in the six Northern Forest counties in Vermont. Where there were changes in methods or data sources, we also recalculated values for Chittenden County to allow comparison between this relatively urban county and the more rural counties of northern Vermont. As such we discuss GPI results from seven of Vermont's 14 counties. We adjusted dollar values for inflation using the Consumer Price Index from the U.S. Bureau of Labor Statistics, with 2000 as the base year. GPI components and methods are summarized in Table 1. Detailed methods and data sources used to calculate each of the 26 GPI components are available online at http://www.uvm.edu/giee/special/gpi.htm.

**Table 1.** *Components and calculation methods for northern Vermont GPI*

| GPI component | Contribution | Calculation method | Regional estimate |
|---|---|---|---|
| A. Personal consumption | + | Per capita income × national ratio of consumption expenditure to income | County level income data; national level ratio of consumption to income |
| B. Income distribution | + or – | (Gini coefficient in year/Gini coefficient in 1970) × 100 | County income distribution data |
| C. Consumption adjusted for inequality | + | Column A/Column B | Calculated |
| D. Household labor | + | Hours of housework based on gender and employment × hourly wage for domestic workers | Housework based on national figures using local employment and gender data; local domestic worker wage data |
| E. Volunteer work | + | Volunteer hours × average hourly wage rate | Volunteer hours based on national figure for volunteerism using local education level data; local wage rate data |
| F. Household capital | + | Cost of consumer durables (item L) × depreciation rate of 12.5% | Consumer durables spending from item L; depreciation rate of 12.5% based on eight-year life span |
| G. Highways and streets | + | Stock value of highways and streets × 7.5% annual value | County level roads data; assuming 10% of net stock is the annual value and 25% of miles driven are commuting (defensive expenditure) |
| H. Crime | – | Direct costs of property crime + defensive expenditures to prevent crime | Local crime data × national level cost data; national level defensive expenditures scaled by population |
| I. Family breakdown | – | Cost of divorce + social cost of television viewing | County level divorce data × national cost data; local TV ownership × national viewing data × cost for families with children |
| J. Leisure time loss | – | Employment level × lost leisure hours × hourly average wage rate | County employment data; national leisure time loss data; local wage rate |
| K. Underemployment | – | Number of underemployed persons × unprovided hours/constrained worker × hourly average wage rate | Underemployment calculated using county unemployment data and national ratios; local wage rate |
| L. Cost of consumer durables | – | Per capita personal income × percent spending on consumer durables | Personal income from item A; regional estimates of spending on consumer durables |
| M. Commuting costs | – | Cost of vehicles × percent vehicle use for commuting + cost of public transit + cost of commuting time | State level vehicle registration scaled by county population; county level transit expenditure data; county level commute data × local wage rate |
| N. Household pollution abatement | – | Cost of automotive air filters and catalytic converters + cost of sewage and septic systems + cost of solid waste disposal | State level vehicle registration scaled by county population; county level housing served by septic and sewer; county level solid waste production × local and national cost estimates |
| O. Car crashes | – | Number of crashes × cost per crash (property damage, health care, lost wages) | County level car crashes; national level cost estimates |
| P. Water pollution | – | County level water quality × benefit of unimpaired water | County level water quality data; national level cost estimates |
| Q. Air pollution | – | State level pollution data × population, forest, and farmland × cost/unit of air pollution damage to these assets | State level pollution data; county level population, forest, farmland data; national level pollution cost data |
| R. Noise pollution | – | Urbanization level × WHO estimate of noise pollution costs | County level urban population data; national cost data |
| S. Wetland loss | – | Total ha wetland lost × value/ha | County level wetland loss; global estimate of wetland value/ha |
| T. Farmland loss | – | Farmland ha lost to urbanization × estimated farmland value per ha | County level farmland loss; state and national level costs |
| U. Nonrenewable resource depletion | – | Total consumption of nonrenewable resources × cost to replace with renewables | State level energy consumption data |

**Table 1.** (continued)

| GPI component | Contribution | Calculation method | Regional estimate |
|---|---|---|---|
| V. Climate change damage | – | Tons of fossil fuel, wood, waste burned × marginal social cost of $CO_2$ emissions in a given year (see Talberth et al. 2007) | State level energy consumption data |
| W. Ozone depletion | – | Release of ozone depleting chemicals × cost/kg | Ozone depleting chemical production at national scale |
| X. Forest loss | – | Area of forest loss × forest ecosystem service value/ha | County forest cover data; global estimate for temperate forest value/ha |
| Y. Net capital investment | + or – | Scaled-down national values based on population | Scaled-down national values based on population |
| Z. Net foreign lending/borrowing | + or – | Not used; difficult to conceptualize at local scales | Not used; difficult to conceptualize at local scales |

**Results**

We report our results similarly to Costanza et al. (2004), who organized the 26 GPI components into eight groups: (1) income (components A–C), (2) households (components D, E, F, L, N), (3) mobility (components G, M, O), (4) social capital (components H–K), (5) Pollution (components P–R), (6) land loss (components S, T, X), (7) natural capital (components U–W), and (8) net investment (components Y, Z). Per capita results for these eight component groups are shown in Table 2 and discussed below.

Vermont's per capita GPI is greater than the U.S. average, and Chittenden County has the highest GPI of any Vermont county (Figure 2). Interestingly, GPI in the most rural counties (Caledonia, Essex, Orleans) was below the U.S. average in 1950 but had risen above the national average by 2000. For all Vermont counties, per capita GPI has increased faster than the U.S. average, suggesting that Vermont's economic development has produced less of the inequality, social, and environmental costs that have caused U.S. GPI growth to slow.

General observations on the main components of GPI were as follows:

- Income in Vermont is generally below the U.S. average, with the exception of Chittenden County, but inequality is also below the U.S. average. This makes adjusted personal consumption in some counties approach the national level. Not surprisingly, the generally poorer rural counties have personal consumption levels below the state average.
- County-level household work and capital did not differ greatly from national and state-level values. Costs and services

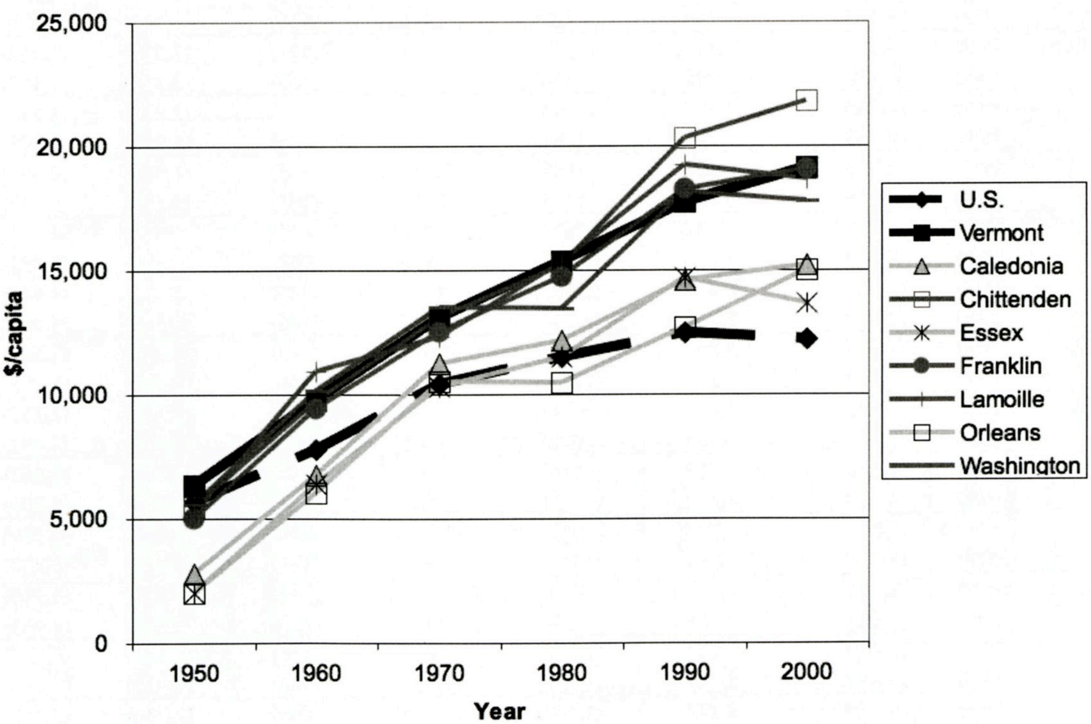


**Figure 2.** *GPI per capita for United States, Vermont, and seven Vermont counties for 1950–2000*

**Table 2.** *Summary indicators (per capita, 2000 US$)*

| | Year | Income A, B, C | Households D, E, F, L, N | Mobility G, M, O | Social capital H, I, J, K | Pollution P, Q, R | Land loss S, T, X | Natural capital U, V, W |
|---|---|---|---|---|---|---|---|---|
| Caledonia County | 1950 | 4,747 | 5,591 | (253) | (1,223) | (1,414) | (2,446) | (2,252) |
| | 1960 | 6,858 | 7,344 | (460) | (917) | (1,134) | (2,521) | (2,492) |
| | 1970 | 11,531 | 8,088 | (291) | (614) | (1,062) | (2,457) | (4,442) |
| | 1980 | 12,410 | 7,776 | (392) | (1,278) | (390) | (2,174) | (4,306) |
| | 1990 | 14,849 | 8,161 | (290) | (1,627) | (653) | (1,975) | (4,389) |
| | 2000 | 15,561 | 7,937 | (471) | (2,283) | (465) | (1,776) | (5,297) |
| Chittenden County | 1950 | 6,646 | 5,438 | (1,109) | (1,207) | (1,782) | (259) | (2,252) |
| | 1960 | 9,104 | 7,241 | (1,573) | (865) | (1,331) | (267) | (2,492) |
| | 1970 | 13,332 | 7,410 | (1,646) | (600) | (1,096) | (234) | (4,442) |
| | 1980 | 15,251 | 7,567 | (1,772) | (1,316) | (370) | (230) | (4,306) |
| | 1990 | 20,029 | 8,189 | (1,544) | (1,728) | (497) | (258) | (4,389) |
| | 2000 | 21,988 | 7,721 | (1,609) | (2,495) | (421) | (251) | (5,297) |
| Essex County | 1950 | 3,985 | 5,293 | (122) | (1,165) | (1,931) | (1,879) | (2,252) |
| | 1960 | 6,731 | 6,571 | (288) | (895) | (1,581) | (1,721) | (2,492) |
| | 1970 | 10,402 | 7,892 | 36 | (605) | (1,682) | (1,754) | (4,442) |
| | 1980 | 10,738 | 7,919 | (78) | (1,168) | (390) | (1,526) | (4,306) |
| | 1990 | 13,901 | 8,662 | 80 | (1,557) | (653) | (1,484) | (4,389) |
| | 2000 | 13,668 | 8,032 | (369) | (2,196) | (465) | (1,420) | (5,297) |
| Franklin County | 1950 | 5,365 | 5,434 | (393) | (1,158) | (1,353) | (694) | (2,252) |
| | 1960 | 8,056 | 7,061 | (646) | (834) | (1,103) | (663) | (2,492) |
| | 1970 | 11,833 | 7,537 | (603) | (633) | (1,062) | (581) | (4,442) |
| | 1980 | 13,991 | 7,315 | (714) | (1,205) | (396) | (467) | (4,306) |
| | 1990 | 17,804 | 7,846 | (816) | (1,646) | (650) | (407) | (4,389) |
| | 2000 | 19,207 | 7,400 | (1,090) | (2,336) | (459) | (354) | (5,297) |
| Lamoille County | 1950 | 6,186 | 5,293 | (892) | (1,116) | (1,504) | (588) | (2,252) |
| | 1960 | 9,783 | 7,579 | (1,417) | (954) | (1,212) | (452) | (2,492) |
| | 1970 | 12,006 | 7,679 | (1,392) | (643) | (1,072) | (313) | (4,442) |
| | 1980 | 15,093 | 7,651 | (1,493) | (1,458) | (362) | (336) | (4,306) |
| | 1990 | 18,549 | 8,377 | (1,108) | (1,760) | (608) | (346) | (4,389) |
| | 2000 | 19,132 | 7,748 | (1,722) | (2,465) | (419) | (303) | (5,297) |
| Orleans County | 1950 | 3,995 | 5,411 | (153) | (1,111) | (1,521) | (2,394) | (2,252) |
| | 1960 | 6,130 | 7,098 | (316) | (837) | (1,269) | (2,354) | (2,492) |
| | 1970 | 10,763 | 7,827 | (93) | (601) | (1,210) | (2,223) | (4,442) |
| | 1980 | 10,465 | 7,599 | (181) | (1,211) | (425) | (1,993) | (4,306) |
| | 1990 | 12,830 | 8,221 | (141) | (1,648) | (725) | (1,956) | (4,389) |
| | 2000 | 14,834 | 8,166 | (224) | (2,222) | (501) | (1,759) | (5,297) |
| Washington County | 1950 | 5,756 | 5,632 | (694) | (1,232) | (1,255) | (459) | (2,252) |
| | 1960 | 8,509 | 7,446 | (1,072) | (876) | (987) | (420) | (2,492) |
| | 1970 | 12,565 | 7,854 | (1,107) | (573) | (929) | (363) | (4,442) |
| | 1980 | 12,697 | 7,743 | (1,214) | (1,269) | (346) | (362) | (4,306) |
| | 1990 | 17,395 | 8,207 | (972) | (1,671) | (573) | (371) | (4,389) |
| | 2000 | 17,540 | 7,820 | (1,041) | (2,438) | (421) | (365) | (5,297) |
| Vermont (state) | 1950 | 7,289 | 5,458 | (590) | (549) | (1,346) | (740) | (2,252) |
| | 1960 | 8,804 | 6,805 | (940) | (605) | (1,187) | (681) | (2,492) |
| | 1970 | 12,586 | 7,715 | (919) | (595) | (1,138) | (582) | (4,442) |
| | 1980 | 14,124 | 8,210 | (1,022) | (1,164) | (411) | (528) | (4,306) |
| | 1990 | 17,029 | 7,971 | (909) | (1,546) | (686) | (506) | (4,389) |
| | 2000 | 18,338 | 7,763 | (1,093) | (2,296) | (491) | (470) | (5,297) |
| United States | 1950 | 7,734 | 4,739 | (919) | (378) | (749) | (892) | (3,940) |
| | 1960 | 9,360 | 5,969 | (873) | (474) | (783) | (982) | (4,445) |
| | 1970 | 12,989 | 7,282 | (1,042) | (658) | (879) | (1,163) | (6,322) |
| | 1980 | 15,680 | 8,231 | (1,374) | (1,591) | (742) | (1,415) | (7,018) |
| | 1990 | 18,474 | 8,272 | (1,747) | (2,145) | (606) | (1,734) | (7,357) |
| | 1997 | 19,088 | 7,765 | (1,789) | (2,068) | (523) | (1,781) | (8,183) |

of consumer durables are less in rural counties with lower incomes, as was the cost of household pollution abatement.

- Mobility costs are greatest in Chittenden County and least in the most rural counties. This reflects greater per capita value of services of highways and streets in rural counties combined with lower costs of commuting and crash rates in highly rural areas.
- Social capital costs do not differ greatly among the six counties. Vermont has less crime and family breakdown than the national average, but more underemployment and leisure time loss than the national average. Rural counties had consistently lower crime rates but higher costs of underemployment.
- Per capita pollution costs were actually greater than the national average in some Vermont counties. This is due to high costs of air pollution damage to abundant forest resources, combined with low population. Thus, although rural Vermont counties may have low pollution levels, per capita damage costs may be high.
- Land loss per capita was similarly high for the most rural counties, owing to their small populations and high per capita costs of wetland and farmland loss. The rate of land loss has been slow since the 1950s, however, and costs are steadily decreasing.
- Finally, natural capital depletion in Vermont was much less than the U.S. average. This is driven by Vermont's below-average fossil fuel consumption. Unfortunately, we lack county-level consumption data, so we cannot identify county-level consumption patterns in northern Vermont. We also note that using our method for valuing costs of climate change, the "threshold" effect that has been found at the national level in past U.S. GPI studies is less influential. As the damage caused by future emissions continues to rise, however, the threshold effect may become more evident. This highlights the importance of the cost of climate change component in contributing to the overall GPI results.

## Discussion

*Interpreting GPI results for northern Vermont.* Our study is the first local GPI calculation for a U.S. rural area. While we cannot generalize our findings to other regions, rural Vermont generally had lower income (hence, lower personal consumption), less air, water, and noise pollution, less forest and wetland loss, and generated less solid waste, though not all these patterns held on a per capita basis. Due to their lower personal consumption, GPI was lower in rural counties than more urban Chittenden County, but rural counties lost less welfare due to environmental damage. This highlights the fact that GPI remains largely driven by personal consumption. Other highly influential components that added or deducted $1,000 or more to per capita GPI included the value of household labor, services of household capital, leisure time loss, consumer durables spending, costs of air pollution, wetland loss, and depletion of nonrenewable resources. Minimally influential components that added or deducted less than $100 per capita GPI included volunteer work, cost of crime, water pollution, noise pollution, farmland loss, and ozone depletion (Figure 3).

Unfortunately, data limitations obscure many of the local patterns that we

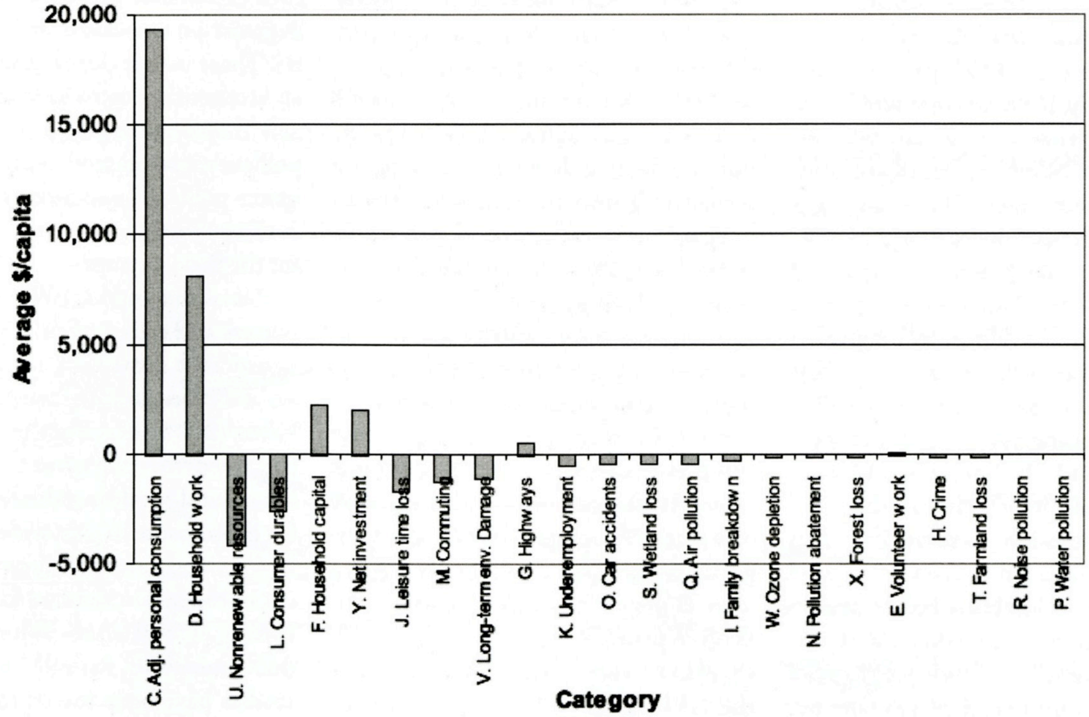


**Figure 3.** *Relative contribution of components of Vermont county GPI (2000 US$)*

expect exist in rural areas. We believe social capital (including household labor, volunteer work, crime, and leisure time loss) may be greater in rural areas than urban areas. While rural areas have less crime, we did not have other local-level social data (hours of household labor, volunteer work, or on the job, and defensive spending to deter crime). For many components, surveys could be used to collect such data on rural versus urban quality of life. Lastly, as noted, rural areas had much less air, water, and noise pollution than urban areas. The methods used were problematic, however, and designed for use in larger urban areas, especially for air and noise pollution.

Various nonmonetary indicators have been developed to monitor socioeconomic well-being in the Northern Forest. Nonmonetary assessments provide an important benchmark for comparing and confirming general GPI trends. For example, the Northern Forest Wealth Index, an array of nonmonetary indicators developed by the Northern Forest Center (2000), measures social capital as percent of registered voters. Voter participation was consistently higher in Northern Forest counties across New York, Vermont, New Hampshire, and Maine during the 1998 general election. Similarly, lower income and lower property and violent crime rates were reported for all Northern Forest counties across the four states. The most comprehensive study comparing a Northern Forest region with more urbanized areas outside the Northern Forest was conducted for the Adirondack region in New York State (Northup 1997). Not surprisingly, the study stressed the high quality of natural assets and social capital in Adirondack Park, with the lowest crime and divorce rates in the state. Health care though, a crucial indicator that is not included in the GPI, scored lower in this Northern Forest region than elsewhere in the state, with the highest percentage of teen pregnancies and lowest number of physicians per capita. Poverty levels were higher and the percentage of individuals holding college degrees was lowest. These studies faced difficulties in aggregating the values for different indicators across multiple dimensions of well-being, a challenge to which GPI is well suited.

*The value of GPI in estimating local well-being.* Given the importance of regional and local policy on well-being, local GPI measurements can help identify areas where different policy choices result in observed differences in components of well-being. While it is difficult to link changes in well-being to any individual policy choice, GPI can identify areas where a region is performing more strongly than nearby regions or the national average. In many regions, qualitative sets of well-being indicators are being developed. These indicators span the range of social, economic, and environmental performance. GPI can complement existing indicators, offering an integrative, quantitative measure of well-being.

The GPI framework can also be used to more comprehensively understand the consequences of local policy decisions (Lawn and Clarke 2006). Generally, policies that effectively balance employment with protection of natural and social capital will produce positive GPI results. For example, the choice to develop local transportation based on new roads, highway construction, and automotive dependence might be viewed in a limited economic framework as providing beneficial temporary employment gains, along with increased mobility. Using the GPI framework, such policies might also result in more car crashes, greater commuting time as traffic increases, increased air pollution, and loss of open space. Taking a more comprehensive view of such economic tradeoffs, the economic value of more compact development or reducing transportation demand might be shown as a more desirable choice. Although it is difficult to precisely predict changes in GPI that result from such policy tradeoffs, the GPI framework can give citizens, stakeholders, and policymakers a more complete understanding of the effects of such decisions.

*Using GPI for interregional comparisons.* If applied carefully, interregional GPI comparisons may be of value to researchers, policymakers, and citizens alike. To make meaningful comparisons between regions, studies must use the same methods and local data that avoid use of scaled-down data, which obscure local differences. GPI should be compared on a per-capita basis, since total GPI will usually be larger in more populous areas. Because some GPI components like net capital investment and net foreign borrowing are difficult to measure or conceptualize at the local scale, comparisons between local and national per capita GPI should be done carefully.

GPI does not explicitly account for transboundary impacts and interregional flows of "nonmarket" goods and services (Clarke 2007). For example, Vermont lacks a heavy industrial base and imports many manufactured goods from elsewhere. Because of this, the high forest cover and clean air and water Vermonters enjoy come partly from importing more pollution-intensive goods from other parts of the world. These places in turn experience greater environmental degradation associated with such industry. These interregional flows make GPI an interesting way to identify "winners" and "losers" in the global economy. Since pollution and natural capital depletion ignore political boundaries, regional GPI studies should take care in accounting for the their impacts.

*Developing robust GPI datasets.* Supporters and critics of the GPI alike recognize that some GPI calculations rely on dated economic studies or data. Lawn (2005) describes in more detail the need for consistent, consensus-based, and modern valuation methods for the measure to gain wider acceptability. Socioeconomic and environmental data needed to calculate GPI are often lacking at local scales. When faced with such limitations, the authors of past local studies have been forced to scale down national values based on population, land

area, income, or other variables. These scaled estimates limit the value of local GPI studies, as presumed local patterns are lost. For our northern Vermont case study, data for several components were particularly poor at the local level, forcing us to also rely on scaled-down data. Time use data are particularly poorly measured at the local scale. Census data has also been available only every 10 years, limiting the ability to develop annual GPI estimates.

Yet this situation is improving. For example, the American Time Use Survey, begun in 2003, provides improved time use data, which Talberth et al. (2007) used in their recent national GPI update. For many other variables, federal agencies and state economic, transportation, labor, agriculture, and natural resource agencies are now compiling and reporting annual data. The American Community Survey, for example, now provides population, social, and economic data estimates between the decadal census years.

For many components, data from earlier decades are available only at coarser spatial scales or simply do not exist (Figure 4). In many cases, we extrapolated data backward to obtain values for earlier decades. This gives us less confidence in GPI estimates from earlier decades, especially before 1980. From 1990 onward, however, we obtained increasingly localized data for more components of interest.

Unfortunately, even our recent estimates relied heavily on scaled-down national and state level data (Figure 4). This was especially true for the components that contributed the most value to GPI, including personal consumption, household work, net investment, nonrenewable resource depletion, climate change damage, and consumer durables and household capital. Because of this scaling, even our year 2000 values should be interpreted carefully.

The growing availability of commercial market research data, however, has the potential to provide accurate local values for many of these important components. These data, compiled by commercial research firms, are available for purchase. The cost of such data should be considered upfront by researchers in future local GPI studies. We note that commercial data are not included in our Vermont GPI estimates in this study.

This spending data would give accurate local estimates for critical items including overall consumer spending, spending on energy, consumer durables, and indirect costs of crime. Commercially available data greatly increases the number of variables with data available at the county level (Figure 4). These data also represent four of the five most important components in terms of contribution to total GPI (Figure 3). When commercial data are combined with recent GPI estimates, the percent contribution to total GPI from local data sources rises from 11 percent to 75 percent, and scaled-down national data falls from 67 percent to 24 percent of the total. Thus, most of the problems with data quality and availability concerns could be addressed, and high-quality local GPI estimates would be possible.

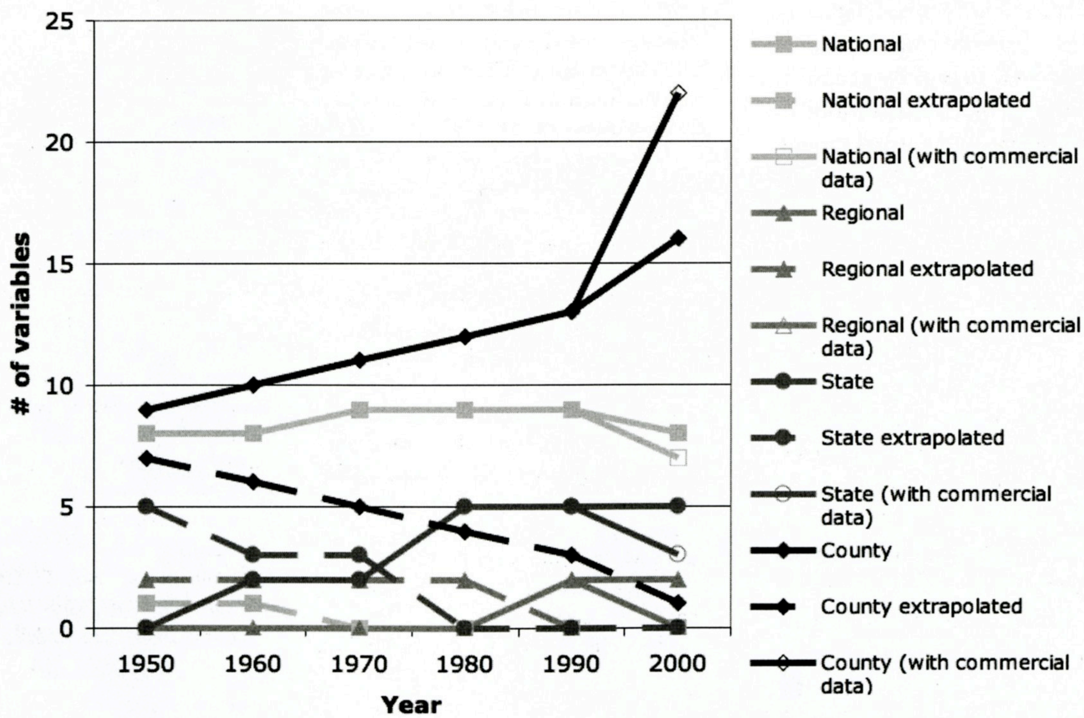


**Figure 4.** *GPI data availability by spatial scale. Values on the Y axis indicate the number of variables for which datasets are available.*

## Conclusions

The Northern Forest Alliance and Northern Forest Center provide good current examples of efforts to build sustainable local economies while protecting and restoring the region's natural setting. Part of this vision includes a future where "the traditional patterns of land ownership and use are maintained to provide future generations with the same benefits we enjoy today" (Northern Forest Lands Council 1994). Widely used economic measures based on consumption and production fail to account for sustainability or quality of life, while measures like the GPI hold promise in measuring what matters for quality of life in Northern Forest communities. Although our current GPI results for northern Vermont have some important data limitations, they show a pattern of greater well-being than the U.S. average based on less income inequality and higher social and natural capital than the national average. When data needs are properly addressed in local GPI studies, the results can provide improved estimates of local well-being. By accounting more fully for the contributions of built, human, social, and natural capital, measures like the GPI can help to guide fairer and more sustainable choices that promote quality of life.

**Although our current GPI results for northern Vermont have some important data limitations, they show a pattern of greater well-being than the U.S. average based on less income inequality and higher social and natural capital than the national average. When data needs are properly addressed in local GPI studies, the results can provide improved estimates of local well-being.**

## Acknowledgments

The Northeastern States Research Cooperative grant "Monitoring Socioeconomic Well-being in the Northern Forest" provided support for this project. We are grateful to numerous individuals, primarily at the University of Vermont and within various agencies of Vermont's state government, for providing assistance with data acquisition and discussion of methods. Brent Bleys, Phil Lawn, John Talberth, and an anonymous reviewer provided valuable suggestions to improve this paper.

## References

Bagstad, K. J. and Ceroni, M. 2007. Opportunities and challenges in applying the GPI/ISEW at local scales. *International Journal of Environment, Workplace, and Employment* 3(2): 132–153.

Clarke, M. 2007. Is the GPI really genuine? Considering well-being impacts of exports and imports. *International Journal of Environment, Workplace, and Employment* 3(2): 91–102.

Costanza, R., Erickson, J., Fligger, K., Adams, A., Adams, C., Altschuler, B., Balter, S., Fisher, B., Hike, J., Kelly, J., Kerr, T., McCauley, M., Montone, K., Rauch, M., Schmiedeskamp, K., Saxton, D., Sparacino, L., Tusinski, W., and Williams, L. 2004. Estimates of the Genuine Progress Indicator (GPI) for Vermont, Chittenden County, and Burlington, from 1950 to 2000. *Ecological Economics* 51: 139–155.

Daly, H. E., and Cobb, J. B., Jr. 1989. *For the common good: Redirecting the economy toward community, the environment, and a sustainable future.* Boston, MA: Beacon Press.

Easterlin, R. A. 2005. Feeding the illusion of growth and happiness: A reply to Hagerty and Veenhoven. *Social Indicators Research* 74(3): 429–443.

Ekins, P. 1992. A four-capital model of wealth creation. *In*: P. Ekins and M. Max-Neef (eds.), *Real-life economics: Understanding wealth creation,* 147-155. London: Routledge.

Haggerty, M. R., Cummins, R. A., Ferriss, A. L., Land, K., Michalos, A. C., Peterson, M., Sharpe, A., Sirgy, J., and Vogel, J. 2001. Quality of life indexes for national policy: Review and agenda for research. *Social Indicators Research* 55: 1–96.

Hanley, N., Moffatt, I., Faichney, R., and Wilson, M. 1999. Measuring sustainability: A series of alternative indicators for Scotland. *Ecological Economics* 28: 55–73.

Jackson, T., and Stymne, S. 1996. Sustainable economic welfare in Sweden: A pilot index 1950–1992. London: Stockholm Environment Institute, The New Economics Foundation.

Kahneman, D., Krueger, A. B., Schkade, D., Schwarz, N., and Stone, A. 2004. Toward national well-being accounts. *The American Economic Review* 94(2): 429–434.

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 (SNBI). *Environment, Development and Sustainability* 7: 185–208.

Lawn, P. A. and 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.

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

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: 347–361.

Northern Forest Center. 2000. *Northern Forest wealth index: Exploring a deeper meaning of wealth.* Concord, NH: Northern Forest Center.

Northern Forest Lands Council. 1994. *Finding common ground: The draft recommendations of the Northern Forest Lands Council.* Concord, NH: NFLC.

Northup, J. 1997. *The Adirondack condition: Economic, environmental & social well-being.* Albany, NY: Environmental Advocates.

Talberth, J., Cobb, C., and Slattery, N. 2007. *The genuine progress indicator 2006: A tool for sustainable development.* Oakland, CA: Redefining Progress.

Venetoulis, J. and Cobb, C. 2004. *The genuine progress indicator 1950–2002 (2004 update).* San Francisco, CA: Redefining Progress.