CHAPTER 6

THE SUSTAINABLE LIVELIHOOD SECURITY INDEX: DEVELOPING AND APPLYING A COMPOSITE INDICATOR

The new call is for sustainable development. But two questions remain. First, is such development simply a sustainable increase in product, or should it be a sustainable improvement in human welfare? Second, how can it be measured? (Cobb, 1990, p. 106)

CREATING A LITMUS TEST FOR SUSTAINABILITY

This chapter outlines the approach used to develop a simple but information-efficient index known as the Sustainable Livelihood Security Index (SLSI). The SLSI has the potential to function as a litmus to check whether or not certain necessary conditions essential for sustainable development are present in a given region or ecosystem. The practical utility of this particular index as an evaluation and policy tool, and also as an educational tool, is demonstrated by applying it to the evaluation of the relative sustainability of the 15 agro-climatic zones of India, each of which represents a mosaic of ecosystems. Although the SLSI is applied here in a regional context, it can equally well be generalized for evaluating the relative sustainability implications of different uses of a given resource or ecosystem, or for analyzing specific project or policy interventions.

This chapter is intended to illustrate some of the challenges involved in the exercise of designing and applying a composite index of sustainability. Although its methodology is simple, some difficult problems were encountered in calculating and operationalizing the Index. Many of the problems, unresolved issues, and limitations of the SLSI are typical of the problems encountered in calculating any composite index; perhaps some general lessons can be learned by examining the process of developing, calculating, and applying this particular index. Limitations posed by informational gaps are overcome to a certain extent by the simplicity of the SLSI itself, but other problems remain. These include selecting the variables with which to define the different components of the Index and applying an appropriate weighting scheme to these variables. In spite of these concerns, the Index can be a powerful tool to identify the presence or absence of the required conditions for sustainability in a region, to indicate the specific areas for concern, to test the effectiveness of proposed projects and policy interventions, and to define sustainable use patterns for a particular resource or ecosystem.

EXISTING INDICATORS OF WELFARE: A REVIEW

Ever since the United Nations' System of National Accounts (SNA) was adopted by most countries in the 1930s, the per capita Gross Domestic Product (GDP) — a measure of a nation's productive capacity relative to its population — has been used as a summary indicator of welfare. However, there is a growing consensus among economists and
others that GDP has been inappropriately applied in many instances, and that it is inherently incapable of providing an accurate assessment of overall welfare. GDP is an index of production rather than of consumption and distribution, which, in fact, are more influential as determinants of a nation’s economic and nutritional security. It is inappropriate to use GDP to measure social welfare, security, or the quality of human life. Further, as discussed elsewhere in this book, GDP does not encompass activities related to household work, nor does it provide the means to assess the status of environmental assets and resource depletion, on the grounds that these and related activities are extra-market in character.

Initially, the disenchantment with GDP as an indicator of welfare led to the development of “poverty indexes,” determined by the income level corresponding to the cost of an identified “commodity basket.” Poverty indexes can be very useful tools in evaluating to what extent certain groups are excluded from the ongoing process of economic growth. However, the widespread utility and applications of poverty indexes are limited by the fact that they are, again, purely economic measures. The search for more realistic and more inclusive measures of economic and social welfare led to a series of attempts to develop social and environmental indicators that can be used either in lieu of, or in conjunction with, GDP. Broadly, these efforts went in two directions:

- development of specific indicators, focusing on the hitherto neglected social and environmental dimensions of development; and

- strengthening of the existing SNA, with the incorporation of environmental and other extra-market activities into traditional accounting procedures.

A pioneering effort to develop an alternative indicator of development began at the United Nations Research Institute for Social Development (UNRISD) in Geneva. In the UNRISD approach, several indicators covering various social and economic aspects are correlated with each other and used jointly in an econometric context to determine a “threshold level of development,” which is then used to classify countries as developed or underdeveloped (UNRISD, 1972).

The excessive complexity of the UNRISD approach and its orientation towards overall development rather than human development motivated Morris (1979) to propose the Physical Quality of Life Index (PQLI) as a measure of the physical well-being of a population. The PQLI has just three components: infant mortality, life expectancy, and basic literacy. Interestingly, an empirical evaluation of PQLI for some 150 countries revealed that countries with low GDP do not all have low PQLI, and high GDP countries do not all have high PQLI. Recently, the United Nations Development Program (UNRDP) has come out with the Human Development Index (HDI), which is similar in many respects to the PQLI, but with different components: life expectancy at birth, literacy, and per capita income in constant U.S. dollars. The empirical application of HDI for evaluating some 160 countries demonstrates that “there is no automatic link between economic growth and human progress” (UNRDP, 1990, p. 43). In its most recent modification of the HDI (1992), the UNDP made a bold and somewhat controversial attempt to incorporate some measures of human freedom into the Index. The major drawback associated with both the PQLI and the HDI is that they are not responsive to the ever-increasing environmental deterioration underlying the current growth process.

The most comprehensive index available so far is the Index of Sustainable Economic
Welfare (ISEW), developed by Daly and Cobb (1989). It takes into account not only average consumption, but also its distribution across social groups and, importantly, the long-term deterioration in environmental assets like soil, water, air, and ozone. Empirical calculation of the ISEW for the United States during the period 1950-1988 reveals a marked divergence between GDP per capita and ISEW, especially subsequent to 1976. The major limitation of the ISEW lies in its very strength, that is, in its comprehensive nature. Comprehensiveness implies information intensity, requiring time series data on a number of social, economic, and environmental variables. This automatically limits the application of ISEW to developing countries, where much crucial information is lacking.

To account for the obvious discrepancies between GDP and economic welfare and environmental health, there have also been attempts to reorient the actual methodology for calculating GDP itself (see Chapter 10 for further discussion). For instance, Nordhaus and Tobin (1973) constructed an experimental Measure of Economic Welfare (MEW) by modifying the existing SNA in three major ways: (1) complete reclassification of expenditures; (2) value imputation for the services of household activities; and (3) adjustment for disamenities of industrialization and urbanization. Notably, the environmental capital stock is considered neither explicitly nor completely in the construction of MEW. Recently, there has been substantial progress in the construction and application of a comprehensive Natural Resource Accounting (NRA) system that explicitly incorporates the depletion of environmental capital — the "environmental debt" — into the System of National Accounts (Repetto and Magrath, 1988; Repetto et al., 1989; Solorzano et al., 1991).

This brief review of existing indicators and approaches to the development of indicators suggests an important lesson: any approach that attempts to capture everything about the development process in a single index risks falling into disuse, because of excessive methodological complexities and data limitations. Most often it is simplicity, not complexity, that determines the utility and applicability of a given index or measure. Each of the indicators reviewed above has its own strengths and weaknesses, but one major limitation shared by all is that they are essentially "macro" in character, measuring the relative performances of countries. There is a strong need for a highly flexible index that could capture the relative performances of different village economies, resources, and ecosystems, and development projects, policies, and interventions. In these circumstances, existing approaches are obviously of very limited use. An ideal index of sustainable development should also be information efficient, requiring easily available, basic data. Therefore, the need exists for a simple index with greater practical and, at the same time, conceptual appeal, especially applicable to conditions in developing countries.

DEFINING SUSTAINABILITY IN THE CONTEXT OF AN INDEX

A variety of definitions and interpretations of the concept of sustainability has emerged in recent years, largely as a consequence of the work of the World Commission on Environment and Development (WCED); see, for example, Dixon and Fallon (1989), Pezzey (1989), or Lele (1991), among many others. The WCED defined sustainable development as "development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs" (1987, p. 8). It is important to recognize that the ability to meet the needs
of both present and future generations is a direct function of the health and capability of the supporting ecosystems. Focusing on both the human and biophysical foundations of sustainability, a joint report of the World Conservation Union, United Nations Environment Program, and World Wide Fund for Nature defined sustainable development as "improving the quality of human life while living within the carrying capacity of the supporting ecosystems" (IUCN/UNEP/WWF, 1991, p. 211).

Intractable problems are encountered — particularly in the form of scientific and statistical information gaps — in attempting to quantify such comprehensive concepts of sustainability in a practical context. The quality of human life is influenced by a complex interplay of innumerable psychological, ecological, economic, social, and technological factors. Similarly, carrying capacity of an ecosystem is determined by the interactive effects of ecological, technological, and biophysical, as well as demographic, factors. Information about these two sets of complex interactions are wholly inadequate even in the most technologically advanced countries, let alone in the developing countries.

THE CONCEPT OF SUSTAINABLE LIVELIHOOD SECURITY

Our current state of knowledge and information does not permit an objective evaluation of sustainability in all its diverse and complex aspects. What can be accomplished at best, at present, is to develop a kind of litmus to test whether or not certain basic and necessary conditions essential for achieving the principles of sustainability are present in a given region or ecosystem.

What are the basic and necessary conditions for sustainability? Swaminathan (1991a) characterizes sustainability in terms of three critically interrelated dimensions:

- ecology;
- economics; and
- ethics.

Similarly, the three interacting dimensions of sustainability are illustrated in Figure 6.1, which is based on a diagram by Sadler (1988). A recent joint report of the World Resources Institute, United Nations Environment Program, and United Nations Development Program portrays sustainability as having four interacting dimensions: the environmental dimension, economic dimension, human dimension, and technological dimension (WRI/UNEP/UNDP, 1992, pp. 4-8). This conceptualization is consistent with that of Swaminathan (1991a), provided the technological dimension is fixed by considering a given technological regime.

If ecology, economics, and ethics are the three interrelated dimensions of sustainability, then the three basic conditions crucial for sustainable development are ecological security, economic efficiency, and social equity. Ecological security is critical to maintain and improve the resource basis of the economy. Economic efficiency is essential to guide the use of resources — both human and natural — under current technological conditions to meet the present developmental needs of society. And social equity is fundamental to ensure a more broad-based distribution of economic benefits — both at present and in the future — in the form of secured livelihoods, especially for disadvantaged economic and social groups. Environment and economic development are not necessarily in conflict; there are also strong win-win possibilities, especially when development is geared towards equity-enhancing programs like poverty reduction, health, and sanitation, etc. (World Bank, 1992). Furthermore, the existence and magnitude of the conflict (or complementarity) between environment and economic development are
dependent upon the current status of environmental health.

A closely related concept of livelihood security known as Rural Livelihood Security (RLS), recently proposed by Chambers and Conway (1992), also has three components: capability, equity, and sustainability. The equity and sustainability components of RLS are consistent with the concept of sustainable development as we have characterized it. Capability is interpreted as the human capacity to cope with shocks and stress, and to perceive and act upon livelihood opportunities. The abstract nature of the concept of capability eludes operationalism (Murray, 1991). This conceptual abstractness stems from a misplaced focus on capability per se, rather than its effects, which are relatively easier to capture and quantify. If concern is placed on the effects of capability, it becomes possible to encompass them in a meaningful way within the concept of economic efficiency.

**OPERATIONALIZING AN INDEX OF SUSTAINABLE LIVELIHOOD SECURITY**

The Sustainable Livelihood Security Index (SLSI) is an operational measure proposed by Swaminathan (1991b) to check whether or
not the conditions essential for sustainability are present in a given region or ecosystem. Consistent with the three-dimensional concept of sustainability, the SLSI has three interacting components: ecological security, economic efficiency, and social equity. In developing the SLSI, the following major factors were considered.

- The index should be a composite one, to take stock not only of the conflicts between the three aspects of sustainability, but also of the intrinsic synergy between them.
- It should be simple, flexible, and information efficient.
- It should be easy to construct and understand, not only by policy makers and local-level administrators, but by the general public as well.
- It should be useful as a tool for policy making, as well as for public education.

The index was specifically designed with regional applications in mind. Thus, each of the three components of the index is calculated for each of a given set of regions. The composite SLSI can then be calculated either as a weighted average or a simple average (i.e., equal weights) of the three components. For a detailed discussion of the operational approach to the SLSI, refer to the box Operationalization of the SLSI.

Each of the three components of the Index — ecological security, economic efficiency, and social equity — can be represented by one or more variables. The choice of the specific candidate variables to represent different components are influenced, among other things, by:

- data availability;
- the appropriateness and capacity of the variable(s) to represent a given component; and
- the level at which the SLSI is constructed, i.e., regional or resource/ecosystem or project/policy intervention levels.

In a regional context, for instance, the ecological sustainability of a given region can be represented by such variables as forest cover, soil and water quality parameters, air pollution, groundwater depletion, and so on. Similarly, the economic efficiency of a given region can be represented by such variables as land productivity, labor productivity, marketable surplus, input-output ratio, and so on. Social equity can be represented by such variables as land/asset/income distribution, people above the poverty line, female literacy, and so on. When more than one variable is selected to represent a given component of SLSI, the index for that component can be formed by taking either the simple or the weighted average of the individual indexes of the representative variables.

AN ILLUSTRATIVE EMPIRICAL APPLICATION OF SLSI

The SLSI is intended primarily as a comparative tool, facilitating the evaluation of conditions for sustainable development at both macro and micro levels. For the purpose of demonstrating its utility in this context, the methodology is applied to an evaluation of the relative agricultural sustainability of the 15 agro-climatic regions of India, shown in Figure 6.2 (see Table 6.1 for a key to these zones). These 15 zones, defined by the Planning Commission of India based on their soil features, climatic and rainfall pattern, and geographical factors, represent a mosaic of ecosystems ranging from forest ecosystems to urban ecosystems.
Table 6.1 — Variables Selected to Represent the Three SLSI Components by Agro-Climatic Regions of India, 1984-85.

<table>
<thead>
<tr>
<th>Zone No.</th>
<th>Agro-climatic Region</th>
<th>Forest Cover (%)</th>
<th>Net Sown Area (%)</th>
<th>Land Productivity (Rs/ha)</th>
<th>Area Under Cereals (%)</th>
<th>People above Poverty Line (%)</th>
<th>Female Literacy (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Western Himalaya</td>
<td>45.30</td>
<td>18.20</td>
<td>3516</td>
<td>91.75</td>
<td>79.60</td>
<td>23.10</td>
</tr>
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<td>2</td>
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<td>3411</td>
<td>91.37</td>
<td>69.90</td>
<td>27.20</td>
</tr>
<tr>
<td>3</td>
<td>Lower Gangetic</td>
<td>11.00</td>
<td>63.80</td>
<td>4743</td>
<td>83.07</td>
<td>61.00</td>
<td>31.80</td>
</tr>
<tr>
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<td>Middle Gangetic</td>
<td>8.70</td>
<td>62.80</td>
<td>3043</td>
<td>74.02</td>
<td>51.00</td>
<td>12.20</td>
</tr>
<tr>
<td>5</td>
<td>Upper Gangetic</td>
<td>4.50</td>
<td>70.10</td>
<td>5125</td>
<td>77.36</td>
<td>58.60</td>
<td>15.10</td>
</tr>
<tr>
<td>6</td>
<td>Trans Gangetic</td>
<td>3.20</td>
<td>80.90</td>
<td>4672</td>
<td>71.74</td>
<td>82.20</td>
<td>32.10</td>
</tr>
<tr>
<td>7</td>
<td>Eastern Plateau</td>
<td>35.20</td>
<td>35.90</td>
<td>2528</td>
<td>83.51</td>
<td>50.20</td>
<td>15.60</td>
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<tr>
<td>8</td>
<td>Central Plateau</td>
<td>14.20</td>
<td>45.00</td>
<td>20.89</td>
<td>65.61</td>
<td>54.50</td>
<td>14.20</td>
</tr>
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<td>9</td>
<td>Western Plateau</td>
<td>11.80</td>
<td>59.70</td>
<td>2202</td>
<td>61.40</td>
<td>58.70</td>
<td>27.40</td>
</tr>
<tr>
<td>10</td>
<td>Southern Plateau</td>
<td>17.10</td>
<td>48.40</td>
<td>3388</td>
<td>61.57</td>
<td>61.80</td>
<td>32.60</td>
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<tr>
<td>11</td>
<td>Eastern Coast</td>
<td>18.70</td>
<td>43.30</td>
<td>5480</td>
<td>74.21</td>
<td>61.90</td>
<td>30.30</td>
</tr>
<tr>
<td>12</td>
<td>Western Coast</td>
<td>29.00</td>
<td>37.20</td>
<td>5453</td>
<td>80.39</td>
<td>75.60</td>
<td>56.20</td>
</tr>
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<td>13</td>
<td>Gujarat</td>
<td>10.90</td>
<td>51.40</td>
<td>3013</td>
<td>45.93</td>
<td>72.10</td>
<td>32.70</td>
</tr>
<tr>
<td>14</td>
<td>Western Drylands</td>
<td>1.20</td>
<td>47.70</td>
<td>659</td>
<td>65.68</td>
<td>67.20</td>
<td>9.60</td>
</tr>
<tr>
<td>15</td>
<td>Islands</td>
<td>88.10</td>
<td>4.20</td>
<td>5892</td>
<td>35.80</td>
<td>71.80</td>
<td>39.10</td>
</tr>
</tbody>
</table>


To illustrate the information-efficient nature of the SLSI, its construction in this example is based on easily available ecological, economic, and social information, using only two variables to represent each component. To gauge the ecological dimension of sustainability, the first parameter selected was forest cover, i.e., the proportion of total geographical area of each region under forest. Note that forest cover per se is clearly not a consistent or uniform measure of the actual quality of canopy cover, since the term "forest cover" includes areas with different degrees of forest degradation. Also, the nature and significance of forest cover varies across regions, depending on their geographic and topographic conditions. Forest cover will, naturally, be high in a mountainous region but very low in the plains. This means that the "critical minimum" forest cover essential for ensuring ecological security should vary depending upon the geophysical condition of the region. The Food and Agricultural Organization (FAO) has suggested the critical minimum forest cover be 20 percent, 33.3 percent, and 66.6 percent for the plains, plateau and hills, and mountainous regions, respectively. For the purpose of constructing the SLSI in this example, a given region was considered to be ecologically

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Figure 6.2 — India Agro-Climatic Zones

secure if the actual forest cover observed is greater than or equal to the appropriate critical minimum figure given by the FAO.

The possibility of conflicts or synergies between the various interacting aspects of sustainability also complicates the choice of variables to represent each of the three SLSI components. Although greater area under forest could imply greater ecological sustainability of the region, it also implies less area available for the cultivation of food and fiber crops. This reflects the existence of some conflicts between ecological security and agricultural expansion, and hence, economic efficiency. To capture this conflict in the index, another variable was also selected to represent the ecological sustainability component of the index: the proportion of Net Sown Area (NSA). Thus, the forest cover adjusted to the FAO critical minimum figures and the NSA expressed as a percent of the total geographical area of a given region were selected to jointly represent the ecological component of the index.

For evaluating the economic efficiency of the agricultural systems of the different

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**Table 6.2 — Indexes of the Variable Representing the Three SLSI Components by Agro-Climatic Regions of India: 1984-85.**

<table>
<thead>
<tr>
<th>Zone No.</th>
<th>Agro-climatic Region</th>
<th>Ecological Indices</th>
<th>Economic Indices</th>
<th>Equity Indices</th>
<th>Sustainable Livelihood Security Index</th>
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<tr>
<td></td>
<td></td>
<td>Forest Cover</td>
<td>Net Sown Area</td>
<td>Land Product</td>
<td>Cereal Area</td>
</tr>
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<td>0.55</td>
<td>1.00</td>
</tr>
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<td>0.19</td>
<td>0.53</td>
<td>0.99</td>
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<td>0.85</td>
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<td>9</td>
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<td>14</td>
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<td>15</td>
<td>Islands</td>
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</tr>
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</table>

### The Challenge of Sustainability

#### Table 6.3 — Ranking the Agro-Climatic Regions by SLSI

<table>
<thead>
<tr>
<th>Zone No.</th>
<th>Agro-climatic Region</th>
<th>Ecological Security Index</th>
<th>Economic Efficiency Index</th>
<th>Social Equity Index</th>
<th>Sustainable Livelihood Security Index</th>
<th>SLSI Ranks</th>
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<tr>
<td>1</td>
<td>Western Himalaya</td>
<td>0.43</td>
<td>0.77</td>
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</tr>
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<td>0.80</td>
<td>0.40</td>
<td>0.58</td>
<td>5</td>
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<tr>
<td>12</td>
<td>Western Coast</td>
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<td>0.90</td>
<td>0.80</td>
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<td>0.32</td>
<td>0.59</td>
<td>0.45</td>
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<tr>
<td>14</td>
<td>Western Drylands</td>
<td>0.28</td>
<td>0.27</td>
<td>0.27</td>
<td>0.27</td>
<td>15</td>
</tr>
<tr>
<td>15</td>
<td>Islands</td>
<td>0.50</td>
<td>0.50</td>
<td>0.65</td>
<td>0.55</td>
<td>7</td>
</tr>
</tbody>
</table>


Agro-climatic regions, the variable land productivity measured in Rupees/hectare (Rs/ha) was selected. Notice that the monetization of productivity will not affect the analysis since the main concern here is either (1) the relative rather than the absolute performance of a region, or (2) temporal changes. The selected unit of measure can capture not only the physical performance as affected by soil productivity and farm technology, but also the economic performance as affected by the marketing and other agricultural-related institutional structures of the regions. Although the unit of measure has significant advantages, it does have the potential to bias the evaluation in favor of regions specialized in higher-valued cash crops. To minimize this bias, as well as to capture the regional potential for overall food and nutritional security, another variable was selected to adjust and augment the agricultural productivity variable: the percentage of NSA under cereal production.
Operationalization of the SLSI

In order to make the SLSI into an operational concept, we follow a slightly modified version of the relativist approach used by UNDP for developing the HDI on an inter-country basis (UNDP 1990 and 1992). To facilitate the exposition of the approach as it is used here, let us assume that we are evaluating the relative sustainability status of a set of regions. Let $I_i$ be the index measuring the performance of the jth region in the ith component of SLSI, and let $X_{ij}$ be the value of the variable representing the ith component of SLSI for the jth region. Now, the relative performance of the jth region in the ith component of SLSI can be represented as:

$$I_i = \frac{X_{ij} - \min_j X_{ij}}{\max_j X_{ij} - \min_j X_{ij}}$$

i = 1,2,3 and j = 1,2,3,..., n.

Notice that since the numerator indicates the extent by which $X_{ij}$ deviates from its minimum value and the denominator represents the range, which is a simple statistical measure of variability, $I_i$ basically expresses the variability of the jth region as a ratio of the total variability in the ith component. Thus, the greater the variability of the jth region, the better its performance in the ith component and vice versa. Having calculated the index for all three components of SLSI, the composite SLSI can be calculated either as a weighted or simple average (i.e., equal weights) of the indexes representing the three components.

The raw data are used to calculate indexes for each of the six variables. In this case, in calculating the forest cover index, the regional-specific critical minimum forest cover suggested by the FAO has been taken as the maximum, and the actual forest cover of the Western Dryland region has been taken as the minimum. Since the maximum forest cover varies with regions (66.6 percent for the two Himalayan regions and the Island region, 20 percent for the four Gangetic regions and the Western Drylands, and 33.3 percent for the remaining regions), the scale defined by the range is not uniform for all regions. Whenever the actual forest cover is greater than or equal to the critical minimum forest cover, the forest cover index will be 1.0. Otherwise, the index is based on the regional-specific scale defined by the range. Thus, for instance, the forest cover indexes of the Island and Eastern Plateau regions are 1.0, as their respective actual forest covers of 88.1 percent and 35.2 percent exceed the respective critical minimum figures of 66.6 percent and 33.3 percent. However, the indexes for the remaining five variables emerged from a straightforward application of the formula noted above.
Two variables were also chosen to represent the equity component of the SLSI; the proportion of people above the "poverty line" and female literacy. The first variable sheds light on the extent to which resources are distributed equitably across economic and social groups. The strength of the poverty variable lies in its ability to capture the effects of employment opportunities, as well as the relative availability and distribution of food and other necessities of life. But its main weakness arises from its primary focus on economic aspects. Consequently, the poverty variable was augmented with the inclusion of a female literacy variable. The level of female literacy should be a good indicator of the extent of, and potential for, active social and economic participation by women.

To summarize, the following are the six variables chosen to represent the three components of the SLSI:

- ecological security:
  - forest cover
  - Net Sown Area (NSA)
The Sustainable Livelihood Security Index

- Economic efficiency:
  - Land productivity
  - Area under cereals

- Social equity:
  - People above the poverty line
  - Female literacy

Table 6.1 depicts the raw values of the six variables for each of the 15 agro-climatic regions of India, for the triennium ending 1984-85. As expected, the values of the representative variables display an enormous variability across the agro-climatic regions, since each region has a distinct climate and rainfall pattern, soil characteristics, topography, cropping systems, and so on. While the Islands region tops the list in terms of both forest cover and land productivity, it remains at the bottom when the NSA and cereal area are considered. Although the Western Drylands, covering the desert areas of Rajasthan, has the dubious distinction of being the lowest in terms of forest cover, land productivity, and female literacy, interestingly enough it has a relatively high proportion of people above the poverty line compared to some of the more well-endowed regions. The relatively greater distributive impact in the Western Drylands is due to an essentially grain-based agricultural production system geared more towards home consumption than towards the market. The two Himalayan regions have a dominant position in cereal area, notwithstanding their lower positions in NSA, since almost all of their NSA is devoted to cereal production. The Trans Gangetic region covering Punjab and Haryana, though it has a very low forest cover, stands first in terms of both NSA and people above the poverty line. The Western Coast region, covering Kerala, Goa, and the advanced enclaves of Karnataka and Maharashtra, has the highest level of female literacy, and its performance in terms of the other variables is also relatively high.

The raw information given in Table 6.1 is used to calculate an index for each of the six variables. The index for forest cover was calculated with respect to a non-uniform, region-specific scale delineated by the FAO-defined critical minimum forest cover for the region as a maximum, and the actual forest cover of the Western Drylands as a minimum. Calculation of indexes for the other five variables proceeded according to the detailed methodology outlined in the box on page 123, and calculated values for all six variables are given in Table 6.2. This table also illustrates the way certain variables can function either to neutralize a potential bias or to augment other variables. For example, in the case of the Islands region, the forest cover index alone (1.0, because the observed forest cover exceeds the maximum in the range defined for that region) does not give a complete picture of the agricultural sustainability of this region. However, the inclusion of the NSA index helps not only to capture the inverse relationship between forest cover and NSA, but also to focus on the potential for agricultural expansion. This applies equally to the other two sets of variables essential for the construction of the indexes of economic efficiency and social equity.

The three component indexes — ecological security, economic efficiency, and social equity — of the SLSI are formed by averaging the indexes for each of the six representative variables. The SLSI itself, which is a composite index, is calculated as an arithmetic mean of the three component indexes. The results of this step are given in Table 6.3, and illustrated in the form of a bar graph in Figure 6.3. Not surprisingly, the SLSI ranking indicates that the region having the best conditions for sustainable livelihood security is the Western Coast. This is followed by the Trans Gangetic region where
Green Revolution technology has had its greatest impact in India. On the other hand, the regions having the least desirable conditions for sustainable livelihood security are the Western Drylands and Central Plateau. Regions with the lowest SLSI rankings are those that are often described as backward or disadvantaged using other economic and social indicators. Similarly, the regions with higher SLSI are generally described as advanced or developed. That is, the SLSI ranking appears to characterize the different regions effectively, consistent with general impressions given by other indicators.

While the SLSI portrays the overall performance of a region, its component indexes
can serve to show how the region fares in each of the three dimensions of sustainability (as shown in Figure 6.4). For instance, although the Western Coast has the highest overall SLSI, its ecological security index is not the highest. Also, a comparison of its three component indexes shows that its ecological security index is not as good as its economic efficiency and social equity indexes. This applies equally to the Trans Gangetic region. Similarly, in the least-performing regions, although all three dimensions of sustainability may need strengthening, the relative emphasis required may not necessarily be the same for all three. For instance, in the case of the Eastern Plateau region, distributive policies might be given top priority, since the equity component is weaker than the other two components.

GENERAL APPLICABILITY OF THE SLSI

A regional application of the SLSI has been explored in this chapter, for the purpose of demonstrating the methodology involved in its construction. But the approach can be generalized to other micro-level applications, such as evaluations of resources or ecosystems, or project/policy interventions. For example, in the case of a single resource system, sustainable management policy requires the identification of a set of uses that ensures sustainable livelihood security. Use patterns can be evaluated by constructing the SLSI for each particular use, based on its ecological, economic, and equity effects. A set of ecologically sustainable, economically efficient, and socially equitable use patterns can be identified, and policy interventions can be designed to promote sustainable uses while eliminating unsustainable ones. In the same way, the SLSI approach can be used to evaluate the relative implications of different projects and policy interventions with respect to sustainable livelihood security.

Notice that the most effective set of projects or policies may differ, depending on the region for which the analysis is being carried out.

The three levels of evaluation noted above — regional, resource/ecosystem, and project/policy — are actually the three phases of a comprehensive or holistic evaluation methodology for sustainability. In practice, once the regions requiring immediate attention have been identified through the regional application of the SLSI, the component indexes will reveal in which dimension the attention should be focused. Based on this first-level evaluation, projects and policy interventions can be formulated to strengthen those components with lower indexes. A project-level evaluation will indicate the most effective set of projects and policies to promote. If the ecological security of a region is weak, projects should focus on improving the regional ecological health. A resource/ecosystem evaluation will not only indicate which resources or ecosystems need immediate attention, but will also identify a set of sustainable uses and practices for them.

Limitations and Unresolved Issues

While the SLSI methodology is simple and conceptually sound, it faces the same problems often encountered in the construction of any composite index. The most important of these arise in:

- choosing the component variables, and
- assigning appropriate weights to the different components.

Aside from the problems of selecting variables and assigning appropriate weights, the major limitation of the SLSI is that it has been developed on a relative basis; its applicability
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is limited if the set to be evaluated is very small.

The choice of variables to represent the different components of the composite index presents serious problems in view of the variations in preference of planners and policy makers. Naturally, the SLSI — and hence the sustainability evaluation — carried out by two different individuals will not be the same. The choice of variables will also differ depending upon the level — whether regional or resource/ecosystem or project/policy intervention — at which the SLSI methodology is applied. Data limitations also naturally circumscribe the choice of variables.

The second problem relates to the assignment of an appropriate weighting scheme in calculating the SLSI. The calculation and analysis of the SLSI presented here is based on an unrealistic assignment of equal weights to all three components, as well as to the variables representing each component. The relative importance of economic, ecological and equity factors obviously varies not only across regions, but also over time for the same region. This points to the need for assigning differential weights to the three components for each region, and to each component across the regions. Further consideration of possible approaches to the weighting problem is presented in the box on page 123.

SLSI: A POWERFUL TOOL

The simple index presented here can be a powerful tool with which to check the presence or absence of the necessary conditions for sustainable development at three interrelated evaluation levels, i.e., regions, resources/ecosystem, and project/policy interventions. The practical significance of the SLSI is that it can:

- identify and characterize regions with low sustainable livelihood security;
- indicate a set of projects and policies that can be implemented to address the problem areas;
- define sustainable use patterns for different resources and ecosystems; and
- specify uses that should be promoted, regulated, or eliminated.

Although the composite nature of the index presents problems, particularly with respect to weighting, it nevertheless facilitates consensus among different groups by balancing their individual concerns.

The strengths and shortcomings of existing composite indicators of sustainability suggest that an ideal index should be:

- simple to construct;
- flexible in scale of applicability; and
- information efficient.

The SLSI fits these requirements. As a policy tool, the SLSI can identify not only the regions requiring immediate attention but also the specific areas on which efforts should be focused. Since it draws attention to the conflicts as well as the potential synergies between ecology, economics, and ethics, the SLSI can function also as an educational tool, promoting a holistic perspective among planners, administrators, and the general public.
Questions for Review

1. Describe some of the more successful attempts at developing a composite index of sustainability. What are their strengths? What are their weaknesses?

2. What are the key components of the SLSI?

3. What are some of the practical problems encountered in operationalizing a composite index such as the SLSI?

4. What are some indexes that now influence investment and management decisions?

Questions for Discussion and Research

1. What are the chief reasons for creating a composite index? How can such an index be applied? What are some of the advantages over using individual indicators or sets of indicators?

2. What are the main concerns over the use of a composite index? What does it show? What can it hide?

3. How are composite indexes used in your sector or region?

4. Do you think it is a strength or a weakness that the SLSI portrays sustainability in a relative context, rather than on an absolute scale?

5. If you were going to apply the SLSI to your region or nation, what would you choose as component indicators to represent ecological security, economic efficiency, and social equity?
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REFERENCES


