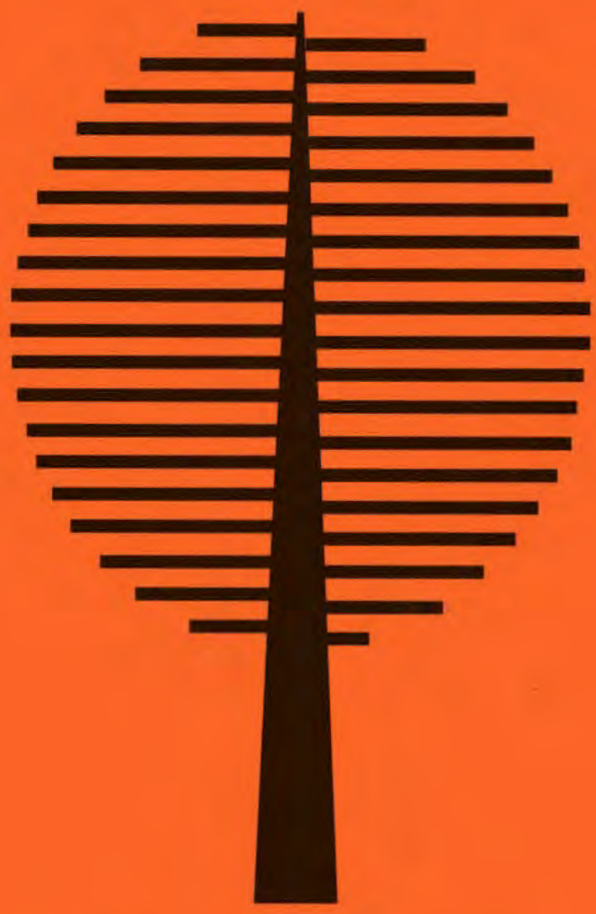
AN APPROACH TO ASSESSING PROGRESS TOWARD SUSTAINABILITY

Tools and Training Series

Barometer of Sustainability

Measuring and communicating wellbeing and sustainable development



Robert Prescott-Allen

May 1997

IUCN
The World Conservation Union

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The booklet draws on ongoing work by PADATA, a project of the Commission on Resources and Environment to report on the sustainability of British Columbia (Canada); and the project on assessing progress toward sustainability of the IUCN supported by the International Development Research Centre (IDRC). The IUCN/IDRC project used the Barometer locally in India and Zimbabwe and nationally in Zimbabwe. The British Columbia project used the Barometer provincially to develop a synthesis and draw conclusions about human and ecosystem wellbeing and progress toward sustainability. Additional information on the Barometer of Sustainability is available from:

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This work was carried out with the aid of a grant from the International Development Research Centre, Ottawa, Canada. These publications are one outcome of the project on assessing progress towards sustainability of IUCN (World Conservation Union) supported by IDRC. The project started by bringing together an international working group to discuss the problems of monitoring and evaluating sustainable development. The group soon realised that there was little point in monitoring and evaluating unless one had an idea of where one wanted to go, and that this understanding could best be developed through a questioning approach. A set of methods and tools, including the early drafts of this booklet, were developed and tested in pilot field trials in Colombia, India and Zimbabwe.

Print production of this booklet has been assisted by grants from the International Development Research Centre (IDRC, Canada) and the Swiss Agency for Development Cooperation (SDC).

About the Series

This series of eight volumes has been developed by a cross-disciplinary team for people interested in assessing progress toward sustainability. Despite differences in emphasis, the materials share a common framework and key principles. We suggest that there are four basic linked steps to understanding sustainable and equitable development:

1. Wholeness. People are an inextricable part of the ecosystem: people and the environment need to be treated together as equally important. Interactions among people and between people and the environment are complex and poorly understood. Thus we need start by...

2. Asking questions. We must recognize our ignorance, and ask questions. We cannot assess anything unless we know which questions to ask. To be useful — to help make progress — questions need a context. Therefore we need...

3. Reflective institutions. The context for the questioning approach is institutional: groups of people coming together to question and to learn collectively. The process of reflection will, we suggest, lead inevitably to an approach that is...

4. People-focused. People are both the problem and the solution. Our principal arena for action lies in influencing the motivation for human behaviour.

The series starts with the summary document, *Overview of Methods, Tools and Field Experiences: Assessing Progress Toward Sustainability.* The other seven volumes fall into three sets:

Methods of system assessment (people and the ecosystem)

- Participatory and Reflective Analytical Mapping (PRAM)
- Assessing Rural Sustainability
- Planning Action for Rural Sustainability

Methods of self assessment (for organizations and communities to examine their own attitudes, capacities and experiences)

- Reflective Institutions

Tools (for use in conjunction with any of the methods or with other methods)

- Barometer of Sustainability
- Community-based Indicators
- Questions of Survival

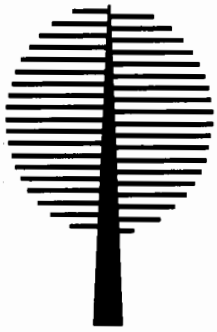
Assessing Rural Sustainability and *Planning Action for Rural Sustainability* are designed to be used together. They can also be used with *Participatory and Reflective Analytical Mapping (PRAM)*, although this is conceived as a separate method. *Barometer of Sustainability* and *Community-based Indicators* may be used with any method of system assessment. *Questions of Survival* may be used with any method of system assessment or self assessment.

Methods and tools may have to be adapted to local circumstances, and some may not be relevant. Solutions must be people-focused to be sustained. We urge the user, when using these documents, to keep in mind the underlying approach:

- recognize the wholeness of people and the ecosystem together;
- decide which questions to ask before searching for indicators; and
- create opportunities for groups to reflect and learn as institutions.

Contents

Tables and Figures



Introduction

What this booklet is about

The Barometer of Sustainability is a tool for measuring and communicating a society's wellbeing and progress toward sustainability. It provides a systematic way of organizing and combining indicators so that users can draw conclusions about the conditions of people and the ecosystem and the effects of people-ecosystem interactions. It presents those conclusions visually, providing anyone — from villager to head of state — with an immediate picture of human and ecosystem wellbeing.

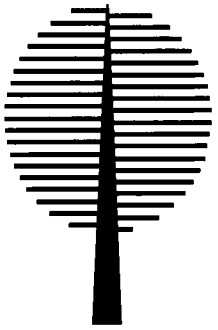
This booklet describes:

- uses of the Barometer of Sustainability;
- why combine indicators;
- combining indicators with a performance scale;
- implications of a performance scale for the choice of indicators;
- key features of the Barometer of Sustainability;
- the Barometer scale;
- organization of indicators;
- setting the scale;
- controlling the scale;
- calculating indicator scores;
- combining indicator scores;
- a caution; and
- the Barometer of Sustainability as a communication tool.

Uses of the Barometer of Sustainability

The main use of the Barometer is to combine indicators — enabling users to draw broad conclusions from an array of often confusing and contradictory signals. As such it can be employed in a variety of assessment methods. An additional use is as a communication tool, helping people to consider people and the ecosystem together.

This booklet is devoted to showing how to use the Barometer to combine indicators. Using it for communication is briefly described at the end.



Combining Indicators

Why combine indicators?

Assessing the state of people and the environment and progress toward sustainable development requires indicators of a wide range of issues. The issues may include health, population, basic needs, income, employment, business success, the economy, education, crime, soil erosion, water quality, air quality, greenhouse gases, protected areas, species diversity, energy consumption, food supply, resource use, and so on.

Each indicator can show what is happening to the issue it represents. But unless the indicators are organized and combined in a coherent way, the signals they give will be highly confusing. For example, Table 1 gives the results for just 10 indicators of the state of people and the ecosystem in Madagascar. Some show good performance, others bad, and some are in between. With high percentages of threatened species, moderate rates of land degradation and forest loss, low pressure on water supply, and low emissions of greenhouse gases, how well is Madagascar's ecosystem? With moderate life expectancy, low incomes and literacy, low rates of violent crime, and fairly good gender equity in school enrolment, how well are Madagascar's people? And how does the state of the people compare with the state of the ecosystem?

Table 1. Issues and indicators, Madagascar

Issue	Indicator	Result
ecosystem		
land quality/ degradation	degraded land as percentages of total modified and cultivated land area	1% lightly degraded 16% moderately degraded 19% strongly degraded
pressure on water supply	water withdrawals as a percentage of supply	4.8%
greenhouse gases	carbon dioxide emissions per person	0.02 tonnes
species diversity	threatened animal species as a percentage of total animal species	mammals 44%; 14% reptiles birds 7%; amphibians 1%
pressure on forests	annual change in forest area	minus 0.8%
people		
health	life expectancy at birth	56.5 years
income	real gross domestic product (GDP) per person per year	PPP$700 (PPP$ adjusted for differences in purchasing power: PPP means purchasing power parity)
literacy	children reaching grade 5	28%
personal security and civil order	violent crime rate (per 100,000 population)	1.2 homicides, 1.1 rapes, 18.1 assaults, 0.3 robberies
gender equity and education	male/female difference in combined primary/secondary school enrolment ratios	male enrolment 3% higher than female enrolment

To answer these questions and get a picture of the whole system, it is necessary to combine the indicators. If they are not combined, the indicators produce a lot of noise — a jumbled stream of data — but no clear message. By combining indicators, we can make them do more than tell us about the particular issues they represent. They can show if we are making progress toward sustainable development — if we are improving and maintaining the wellbeing of people and the ecosystem together.

Combining indicators with a performance scale

Indicators measure completely different things. Combining them is like combining apples and oranges. A common unit is needed that does not distort what we value about apples or oranges. "Citrus units" would favour oranges. "Pome units" would favour apples.

The most widely used common unit is money. Money is good for measuring things that are traded in the market, but it distorts the value of things that are not traded. It reflects the market price of apples and oranges, not their taste, nutritional content, or cultural value. Most of the issues and indicators in an assessment of wellbeing and sustainability have no market price: human life, security, fresh air, the existence of a species. If you are an insurer you attach a dollar value to a person's life; but you don't pretend that money can express more than a fraction of the value of that life to the person's spouse, parents or children.

An alternative to money is the performance scale. This type of scale is used in the United Nations Development Programme's Human Development Index and by the Dutch in their assessment of the environment. A performance scale measures how good an orange is at being an orange and how good an apple is as an apple. "Best" or "good" is defined at one end of the scale, and "worst" or "bad" at the other end. The position of the indicator can then be plotted on the resulting scale.

A performance scale allows us to use whatever measurement is most appropriate to the issue concerned. Income and value added are measured in money. But health is measured in disease and death rates, employment is measured in jobs, species diversity in percentages of threatened species, and so on. Then we define what are good and bad income levels, death rates, unemployment rates, percentages of threatened species, etc. The result is a set of performance measurements, all using the same scale and therefore able to be used together and combined.

Setting a performance scale by defining good and bad may strike some people as excessively "subjective". It is in fact no more subjective or objective than attaching a monetary value or any other measurement method. Its advantage is that it is transparent. In the Gross Domestic Product, we cannot tell what values are buried in those ranks of dollars and zeros. In performance measurement, we have to make explicit what we think are good levels of education or water quality and what are unacceptably bad levels.

More important, defining good and bad performance for each indicator helps to improve understanding of the nature of sustainable development. Pondering and discussing key issues for sustainable development, indicators of each issue, and desirable and unacceptable performance for each indicator, are critical for each society to build consensus on the nature and relationship of human and environmental wellbeing.

Implications of a performance scale for the choice of indicators

Ways to select indicators are described fully in a companion booklet on system assessment titled Participatory and Reflective Analytical Mapping (PRAM). However, since the Barometer of Sustainability is a performance scale, a comment is necessary on the type of indicator that can be combined on a performance scale.

A performance scale can combine only those indicators to which one can attach a performance value. Indicators are chosen if it is possible to define

values for them that would be desirable, acceptable or unacceptable with respect to human or ecosystem wellbeing. Indicators that are neutral or of unknown significance are excluded.

For example, the quantity of a nutrient (such as nitrogen or phosphorus) in a litre of water is a valid performance indicator because it is possible to define acceptable (unpolluted) and unacceptable (polluted) levels. Similarly, income per person is a valid performance indicator because it is possible to judge (for example) how much income would make a person rich, not rich but comfortable, not comfortable but not poor, or poor.

Many potential performance indicators may have to be dropped because there is no telling what is a good or bad performance. An example, is percentage of the population in urban areas. There may be an optimum ratio of rural to urban populations, or a society may decide that there is. But until a desirable ratio is discovered, or agreed on, the indicator cannot be used.

Purely descriptive indicators — wind patterns, monthly rainfall, or mineral content of rocks — are not suitable because they measure background conditions. They are part of the context. People can be more or less successful in coping with them, but there is very little they can do to change them.

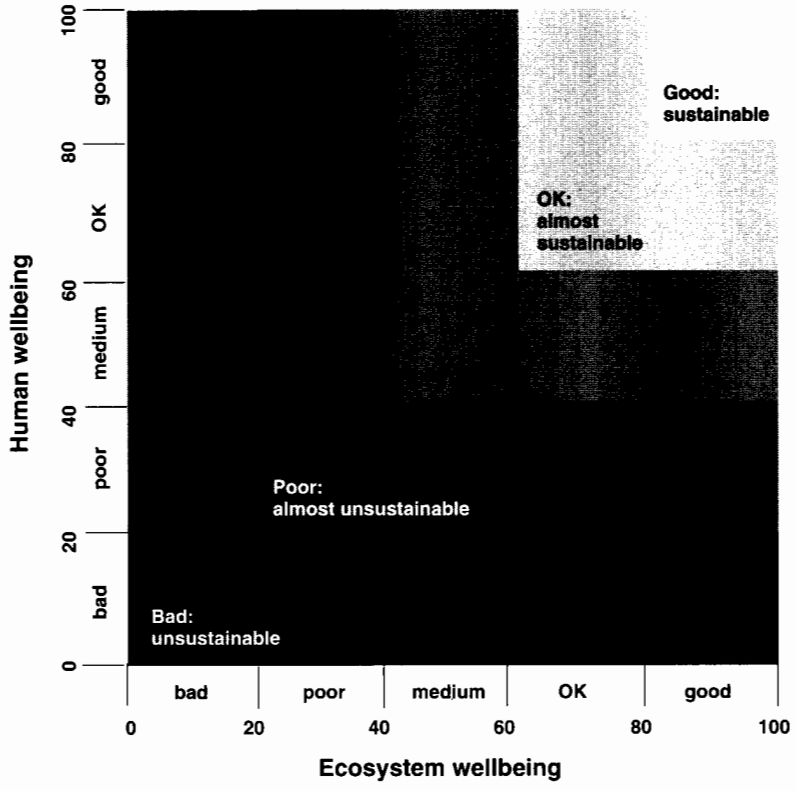
This does not mean that such indicators should be left out altogether. Trying to define values for indicators that are difficult to put on a performance scale can illuminate the assessment and improve understanding of human and ecosystem wellbeing. Context setting is part of assessment, so descriptive indicators also have their place. Their place is simply not on a performance scale.

Some important issues may not be covered adequately if the indicators that best represent them are dropped because performance values cannot be assigned to them. It is essential that all participants in the assessment (and all users of the assessment) are as aware of what has been omitted as of what has been included.

Barometer Basics

Key features of the Barometer of Sustainability

Figure 1. Barometer of Sustainability



The Barometer of Sustainability (Figure 1) is a performance scale with three special features:

1. Equal treatment of people and the ecosystem

The Barometer treats people and the environment together and as equally important. The scale has two axes, one for human wellbeing, the other for ecosystem wellbeing. This ensures that an improvement in human wellbeing does not mask a decline in ecosystem wellbeing, or vice versa.

Conclusions about the condition of people are expressed as a point on the human wellbeing axis: an index of human wellbeing. Conclusions about the condition of the ecosystem are expressed as a point on the ecosystem well-being axis: an index of ecosystem wellbeing. The intersection of the two points provides a reading of overall wellbeing and progress toward sustainability.

A lower score on one axis overrides a higher score on the other: the reading of overall wellbeing and sustainability is based on whichever subsystem (the society or the ecosystem) is in worse condition. This is to prevent an improvement in ecosystem wellbeing being read as compensating for a drop in human wellbeing, or vice versa. It reflects the view that people and the ecosystem are equally important and that sustainability is a combination of human wellbeing and ecosystem wellbeing.

2. Five-sector scale

The scale is divided into five sectors. The user can control the scale by defining the range of performance appropriate for each sector. This feature — explained in the following section on the Barometer scale — gives users an unusual degree of flexibility: in other performance scales only the end points are defined.

Defining the sectors of the scale extends a series of judgments that starts with definitions of sustainable development, ecosystem wellbeing and human wellbeing, and continues through the choice of issues to be assessed and the selection and interpretation of indicators. This process of value-based judgments is not peculiar to the Barometer. It is common to all decision making and assessment — but perhaps not sufficiently acknowledged.

3. Ease of use

Converting indicator results to the scale involves simple calculation. Formulae accessible only to people trained in statistics or indices have been deliberately avoided. Ease of use by a wide range of users is preferred to mathematical sophistication.

The Barometer scale

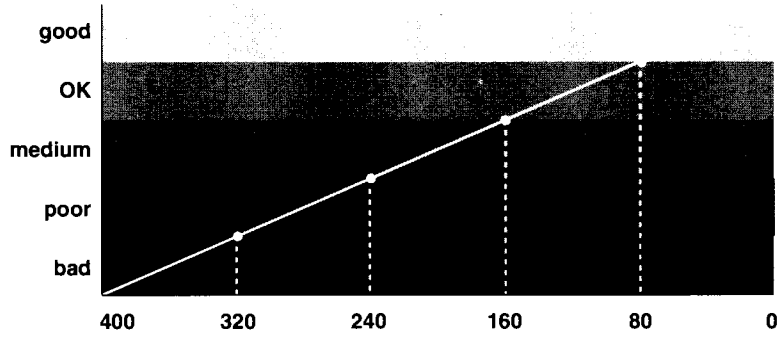
The Barometer has a 100-0 scale, consisting of 100 points plus a base of zero. It is divided into five sectors of 20 points each, plus the base of zero:

Sector	Points on scale
good	81-100
OK	61-80
medium	41-60
poor	21-40
bad	1-20
	0

Dividing the scale into five sectors allows the user to control the scale by defining one or more of the sectors. If a good income is considered to be $20,000 or more and a bad income to be $1,000 or less, the scale can be set accordingly.

This feature makes the Barometer a more powerful performance scale than if only the end points were defined. When only the end points are defined, results can be odd or even absurd. For example, child mortality rates range from 5 deaths per 1,000 live births (Finland today) to 400 deaths per 1,000 (Mali in 1960). If best is defined as 0 deaths and worst as 400 deaths, then a country with 75 deaths per 1,000 would still fall in the top fifth of the scale (the good sector); and only a country with 320 or more deaths per 1,000 would fall in the bottom fifth (the bad sector).

Figure 2. Child mortality: deaths per 1000 live births



This would not matter if the only purpose of the scale were to rank societies — to see which ones perform best. But the main purpose is not to see if a society is doing better than others but if it is doing well. Being in the top ten is small comfort if everyone is doing terribly.

Converting indicators to the Barometer scale maintains a process of more clearly defining what we mean by human wellbeing and ecosystem wellbeing. It obliges people to state explicitly their assumptions about the significance of the indicator for human or ecosystem wellbeing, and the levels of achievement that would be ideal, desirable, acceptable, unacceptable, or disastrous. To do otherwise would be to let the scale make the decisions rather than thinking things out for ourselves.

It would be possible to control the scale without dividing it up into sectors. A formula could be applied that would adjust the distribution of scores. But sectors labeled "good", "bad", etc., are preferable to a formula for two reasons. First, they are easier to understand and calculate (see "Calculating indicator scores", page 22) — so they are more open to scrutiny. Second, they make it obvious that judgments are being made and they keep the judgments transparent.

Organization of indicators

Ways to organize indicators are described in detail in the handbook on system assessment. Here it is assumed that participants in the assessment have organized their indicators hierarchically. The Barometer requires a subsystem level, which consists of two subsystems: the ecosystem; and people (or the society). Within that framework it can accommodate any hierarchical arrangement of indicators.

For example, the indicator hierarchy of the United Nations Commission on Sustainable Development (CSD) has four levels:

1. System (country);
2. Category (social; economic; environmental; institutional);
3. Agenda 21 chapter; and
4. Indicator.

To use the Barometer, the subsystem level is added as a new level 2. The CSD's indicator hierarchy would then look like Figure 3.

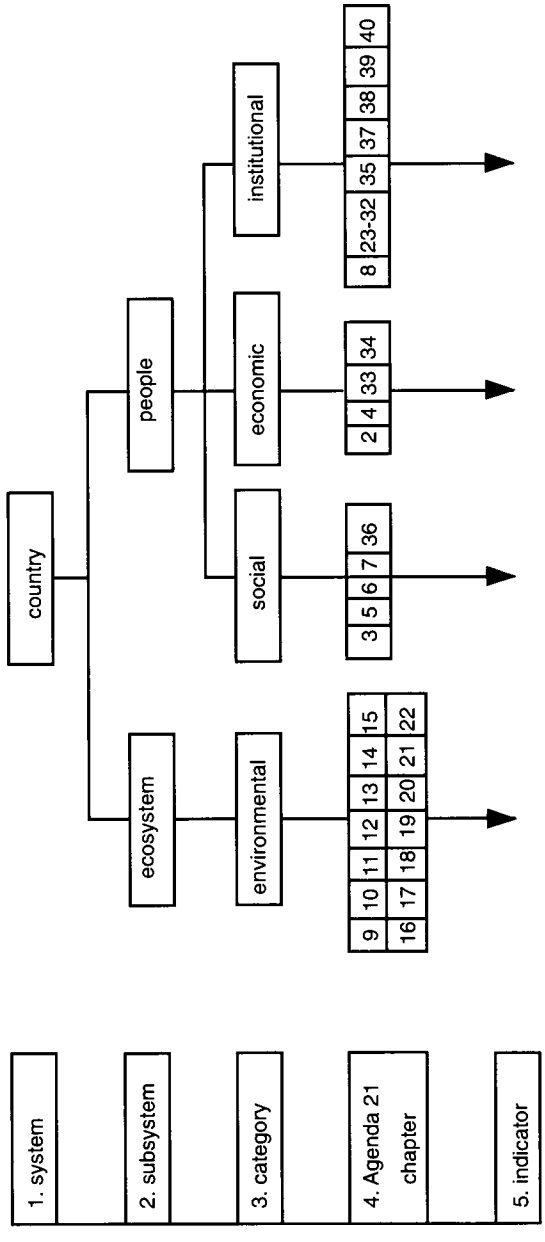
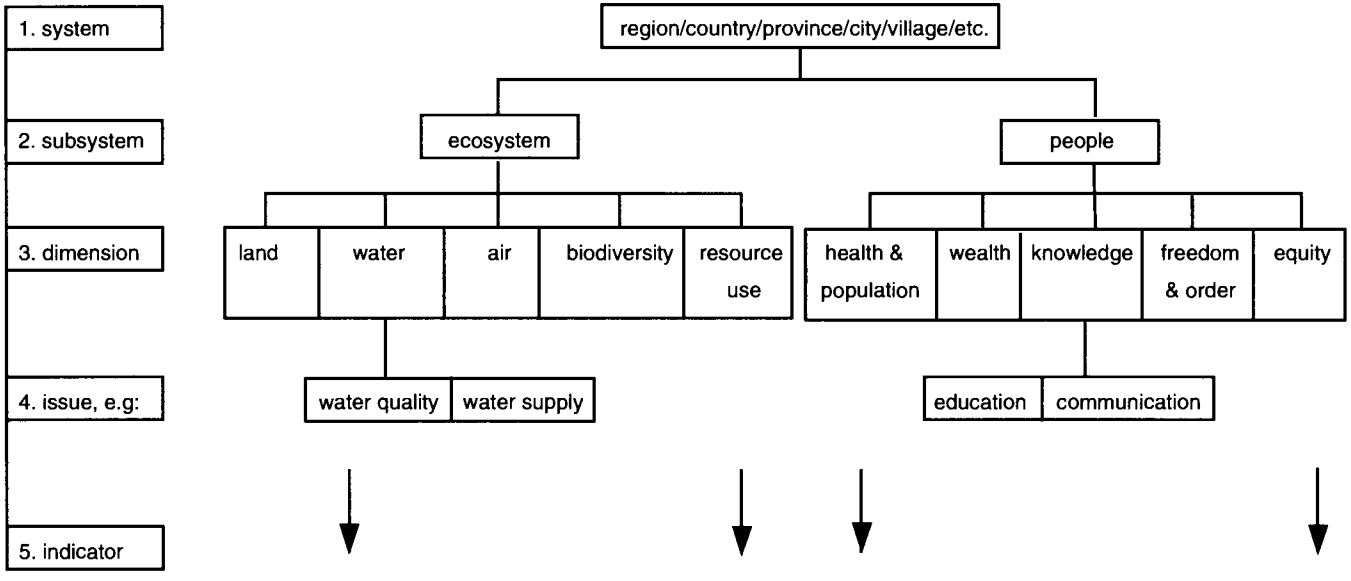


Figure 3. Commission on Sustainable Development (CSD) indicator hierarchy

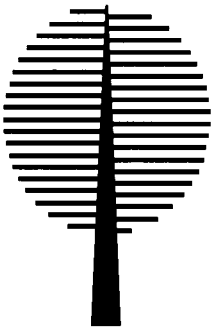
In The Wellbeing of Nations (an assessment of the wellbeing and sustainibility of 180 countries), the hierarchy looks like Figure 4.

Figure 4. Wellbeing of Nations indicator heirarchy



Only a few issues are included in this example, and the indicators have been left out of both.

Any assessment method can use the Barometer to combine indicators, provided it uses performance indicators and organizes them hierarchically. It does not matter how many levels make up the indicator hierarchy, or what the levels are called, provided the top two levels are system and subsystem, and the subsystems are the society (people) and the ecosystem.



Setting and Controlling the Scale

Setting the scale

The scale needs to be set for each indicator. This involves defining best and worst values for the indicator. The end points strongly influence where an indicator reading falls on the scale. For example, an income of $20,000 would be near the middle of a $50,000-$0 scale, near the top of a $25,000-$0 scale, and near the bottom of a $100,000-$10,000 scale.

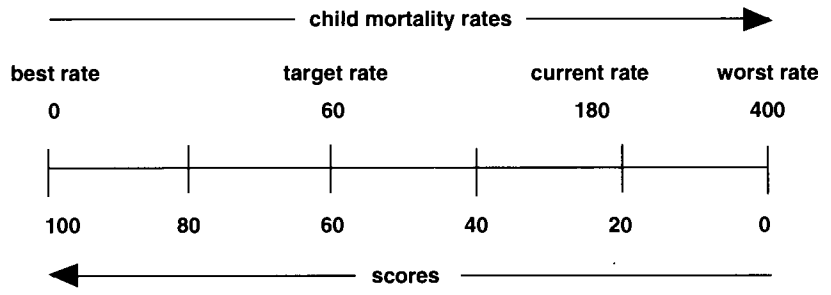
A fairly objective way of setting the end points of the scale is to choose best and worst values that encompass the range of performance that has been experienced in the recent past and could be experienced in the foreseeable future. Performance in other countries can be included, if international data are available.

The end points need not always encompass the full range of values. If an exceptionally good or bad performance would unduly distort the scale, the scale can be capped (cut off at the top) or truncated (cut off at the bottom). For example, carbon dioxide emissions per person in the US Virgin Islands are almost 22 tonnes and were more than 49 tonnes in 1978. To encompass this, zero would have to be set at 59 tonnes. Instead, it is more convenient to truncate the scale and set zero at 20 tonnes, because the next worst performance is well under this, and emissions higher than 10 tonnes per person are unusual.

A performance worse than the worst value is given a zero score. Similarly, a performance better than the best value receives a score of 100.

Best values are not necessarily targets. A country with a child mortality rate of 180 deaths per 1,000 live births might set the best value at 60 deaths because an international target is to reduce child mortality rates by two-thirds by 2015. However, 60 deaths per 1,000 live births is still quite high: most developed countries have rates under 20 deaths, and the best performance is 5 deaths. It would be preferable to define the best value as 0 deaths, making 60 deaths a target.

Figure 5. Child mortality rates

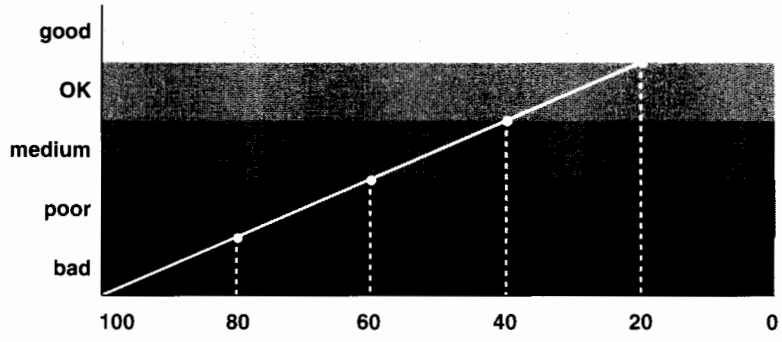


Controlling the scale

The scale can be either uncontrolled, partially controlled, or fully controlled. In an uncontrolled scale only the two end points are defined and the intervals between them are equal. Whether an indicator reading falls in the good, OK, medium, poor or bad sector is determined by the end points of the scale and not by whether the level of performance that would fall into a particular sector is appropriate for that sector. This feature of an uncontrolled scale must be taken into account or the results may prove to be indefensible.

For example, if the unemployment rate were plotted on an uncontrolled scale set so that one end point was 0% (representing the best unemployment rate) and the other end point was 100% (representing the worst), a rate as high as 19% would be classified as good and only unemployment rates of 80% and higher would be classified as bad, as in Figure 6.

Figure 6. Unemployment rate (%): uncontrolled scale



The flaw in this arrangement comes from treating all five sectors (good, OK, medium, poor, bad) as equal. Sometimes, they are equal. But more often they are not. Usually, the most important sectors are good and OK, since they define human wellbeing and ecosystem wellbeing — the conditions of the good and sustainable life. Good performance means either ideal or desirable performance, or both. The good sector therefore needs to be defined exactingly.

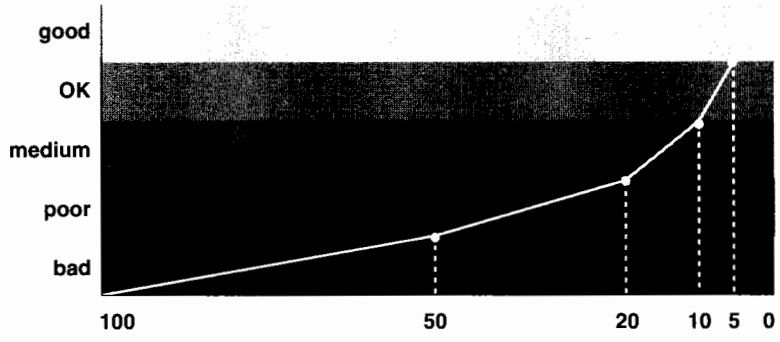
OK performance is acceptable, or better than acceptable performance. The boundary between good and OK may be thought of as the gateway to well-being; and the boundary between OK and medium as the gateway to the neighbourhood of wellbeing. OK performance must clearly be on the way to good performance.

When an uncontrolled scale is not appropriate, then a partially or fully controlled scale may be used. In a partially controlled scale, either the good sector or the bad sector (or sometimes both) is defined. In a fully controlled scale, all sectors are defined.

When the scale is partially or fully controlled, it ceases to be one scale with equal intervals throughout. Instead, it becomes a set of from two to five scales — depending on the number of sectors defined — each with its own end points and different intervals.

For example, if the unemployment rate were put on a fully controlled scale in which 0-4% was considered good, 5-9% OK, 10-19% medium, 20-49% poor, and 50-100% bad, the scale would look like Figure 7.

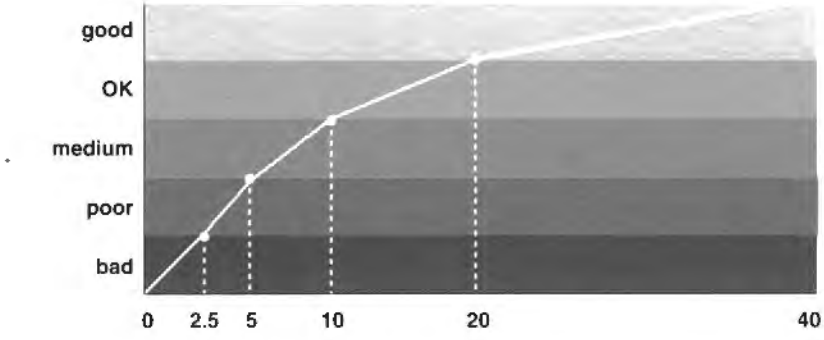
Figure 7. Unemployment rate (%): controlled scale



In partially or fully controlled scales, the good and OK sectors may include a narrower or a wider range of performance than the other sectors. A narrower range of performance occurs in indicators where the good (and sometimes OK) sector represents a high standard: the better the performance, the more difficult it is to make improvements. This is shown in the fully controlled unemployment rate scale above in which the good and OK sectors have a range of five percentage points each, the medium sector a range of 10 percentage points, the poor sector a range of 30 percentage points, and the bad sector a range of 50 percentage points.

When improvements in good performance bring diminishing returns, then the good sector may include a wider range of performance than the other sectors. Real (purchasing-power-adjusted) per capita gross domestic product (GDP) is an example. A real per capita GDP of $40,000-$20,000+ is considered good (range of 50%), $20,000-$10,000+ OK (range of 25%), $10,000-$5,000+ medium (range of 12.5%), $5,000-2,500+ poor (range of 6.25%), and $2,500-$0 bad (range of 6.25%).

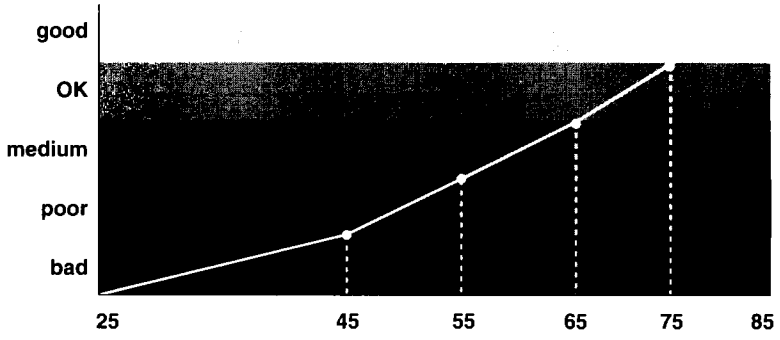
Figure 8. GDP per person: PPP $000



The choice of a partially or fully controlled scale involves two considerations. First, what is the most convenient way of ensuring that scores falling in the good or OK sectors are indeed good or OK. Second, whether it is desired to define the bad and poor sectors as carefully as the good and OK.

In the case of life expectancy at birth, a partially controlled scale has been chosen for its convenience. With best at 85 years and worst at 25 years, it is enough to control only the bad sector, defining it as 45-25 years. The remaining four sectors then automatically consist of 10 years each, 66-75 being OK and 76-85 being good.

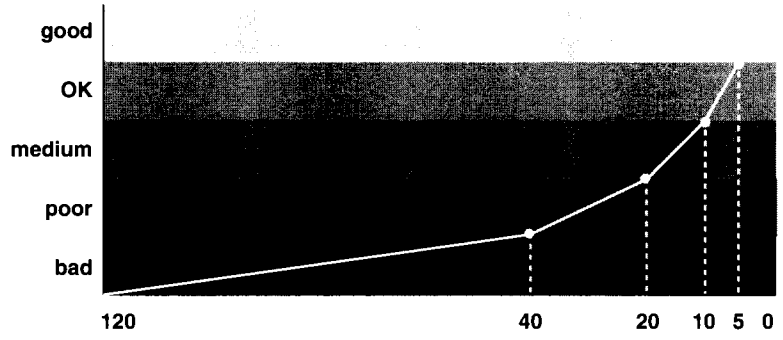
Figure 9. Life expectancy at birth



sector	points on scale	life expectancy (years)
good	81-100	76-85
OK	61-80	66-75
medium	41-60	56-65
poor	21-40	46-55
bad	1-20 (0)	26-45 (25)

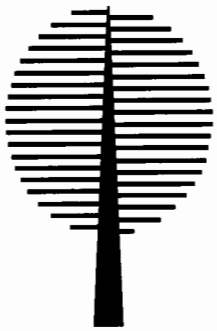
With the homicide rate full control is necessary to ensure that the good and OK sectors are reserved for very low homicide rates; and that the poor and bad sectors are not limited to extremely high rates. Best is set at zero homicides per 100,000 population and worst at 120 (to accommodate the highest rate — 118 — in Swaziland). If only the good and OK sectors were defined (1-9 homicides), then the lowest rate that would be classified as poor would be 46 per 100,000 population. Accordingly, all sectors have been defined.

Figure 10. Homicide rate per 100,000 population



sector	points on scale	homicides per 100,000 population
good	81-100	0-4
OK	61-80	5-9
medium	41-60	10-19
poor	21-40	20-39
bad	1-20 (0)	40-119 (120)

In the above example, good consists of 5 units per 20 points on the scale, OK 5 units/20 points, medium 10 units/20 points, poor 20 units/20 points, and bad 80 units/20 points. The sectors do not join smoothly. There is always a break where the intervals of one sector change to the intervals of another. This may be mathematically inelegant but it makes it easy to control the scale and calculate indicator scores for each sector. (A formula could be written to make the curve smooth, but this would make recalculation more difficult for non-mathematical users wishing to try out different assumptions and interpretations.)



Calculating Indicator Scores

When the scale is uncontrolled, the indicator reading is plotted on the scale, using the standard formula:

> **If best is the maximum value and worst the minimum:**
> ([actual minus minimum] divided by [maximum minus minimum]) multiplied by 100.
>
> **Or, if best is the minimum value and worst the maximum:**
> ([actual minus minimum] divided by [maximum minus minimum] subtracted from 1) multiplied by 100.

Main telephone lines per 100 inhabitants provide an example of the former. Best (maximum) is set at 80 main lines and worst (minimum) at 0 main lines. Iceland has 55.5 main lines per 100 inhabitants. Its position on the scale is calculated thus:

> 55.5 (actual) – 0 (minimum) = 55.5
> 80 (maximum) – 0 (minimum) = 80
> 55.5 ÷ 80 = 0.694
> 0.694 x 100 = 69.4 = 69

Water withdrawals as a percentage of supply is an example of an indicator in which best is the minimum value and worst the maximum. Best (minimum) is set at 0% and worst (maximum) at 100%. Zimbabwe's water withdrawals are 8.65% of its supply. Its score is calculated thus:

> 8.65 (actual) – 0 (minimum) = 8.65
> 100 (maximum) – 0 (minimum) = 100
> 8.65 ÷ 100 = 0.086
> 1 – 0.086 = 0.914
> 0.914 x 100 = 91.4 = 91

When the scale is controlled, each sector or group of sectors is calculated separately, but the method is the same as for the scale as a whole.

When the scale is partially controlled, the good (81-100) sector or the bad (1-20) sector is defined. With life expectancy at birth, for example, the bad sector is defined. This means that the scale now consists of two parts: the bad sector; and a group of sectors from poor through good. The end points for each part are:

sector	points on scale	life expectancy (years)
best-poor	21-100	46-85
bad	1-20	26-45
worst	0	25

A reading that equals any of the end points is simply given the corresponding score. For example, if life expectancy were 46 years it would be given a score of 21.

Life expectancies between 85 and 46 years are calculated in the usual way, except that the minimum is 45 (instead of 0), and the multiplier is 80 (instead of 100). The result is added to 20, since that is the zero point of that part of the scale. For example, the score for Guatemalans' life expectancy of 64.8 years is calculated as follows :

64.8 (actual) – 45 (minimum) = 19.8
85 (maximum) – 45 (minimum) = 40
19.8 ÷ 40 = 0.495
0.495 x 80 = 39.6
39.6 + 20 = 59.6 = 60

For life expectancies between 45 and 26, the maximum changes to 45, the minimum to 25, and the multiplier to 20. The result is added to 0. For example, the score for Afghanistan's life expectancy of 43.5 years is calculated as follows :

43.5 (actual) – 25 (minimum) = 18.5
45 (maximum) – 25 (minimum) = 20
18.5 ÷ 20 = 0.925
0.925 x 20 = 18.5
18.5 + 0 = 18

Scores are rounded to the nearest whole number; 0.5 may be rounded down or up. Usually it is rounded conservatively — whichever produces the lower score. In this case it is rounded down.

Note that when calculating scores within sectors (or within a group of sectors), the maximum is the maximum of the sector (or group) concerned but the minimum is the maximum of the sector below. This is because the minimum always corresponds to the zero position at the base of the scale.

Timber removals plus imports as a percentage of volume illustrates the case of a partially controlled indicator, in which best is the minimum value and worst the maximum. Best, worst and the bad sector is defined but the other sectors are not:

sector	**points on scale**	**timber removals + imports as % of volume**
best-poor	100-21	0-3.9
bad	1-20	4.0-9.9
worst	0	10

Japan's removals plus imports are 3.0% of volume, so it is placed in the best-poor (100-21) sector. Its score is calculated as follows:

3.0 (actual) – 0 (minimum) = 3.0
4.0 (maximum) – 0 (minimum) = 4.0
3.0 ÷ 4.0 = 0.75
1 – 0.75 = 0.25
0.25 x 80 = 20
20 + 20 = 40

Sri Lanka's removals plus imports are 9.3% of volume, so it falls in the bad (1-20) sector. Consequently, its score is calculated thus:

9.3 (actual) – 4.0 (minimum) = 5.3
10.0 (maximum) – 4.0 (minimum) = 6.0
5.3 ÷ 6.0 = 0.883
1 – 0.883 = 0.117
0.117 x 20 = 2.34
2.34 + 0 = 2

Note that when calculating scores within sectors (or within a group of sectors), the minimum is the minimum of the sector (or group) concerned but the maximum is the minimum of the sector below.

When the scale is fully controlled and all sectors are defined, the multiplier for each sector is always 20. The maxima, minima, and bases (zero) correspond to these points on the scale when best is the maximum value and worst the minimum:

sector	points on scale	maximum	minimum	base
good	81-100	100	80	80
OK	61-80	80	60	60
medium	41-60	60	40	40
poor	21-40	40	20	20
bad	1-20	20	0	0

When best is the minimum value and worst the maximum, the maxima, minima, and bases (zero) correspond to:

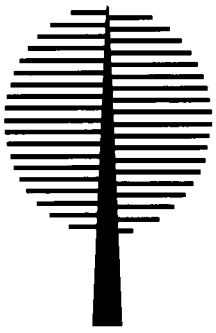
sector	points on scale	maximum	minimum	base
good	81-100	80	100	80
OK	61-80	60	80	60
medium	41-60	40	60	40
poor	21-40	20	40	20
bad	1-20	0	20	0

The child mortality rate illustrates the calculation procedure for a fully controlled scale. Costa Rica's child mortality rate is 16, so it falls in the OK (61-80) sector. Its score is:

16 (actual) – 10 (minimum) = 6
50 (maximum) – 10 (minimum) = 40
6 ÷ 40 = 0.15
1 – 0.15 = 0.85
0.85 x 20 = 17
17 + 60 = 77

Togo's child mortality rate is 132, so it falls in the poor (100-199) sector. Its score is:

132 (actual) – 100 (minimum) = 32
200 (maximum) – 100 (minimum) = 100
32 ÷ 100 = 0.32
1 – 0.32 = 0.68
0.68 x 20 = 13.6 = 14
14 + 20 = 34



From Indicator Scores to the Big Picture

Combining indicator scores

Indicator scores are combined up the hierarchy from the lowest to the highest level. If the levels are:

1. System
2. Subsystem
3. Dimension
4. Issue
5. Indicator

then they are combined from indicator to issue; from issue to dimension; and from dimension to subsystem. If they are

1. System
2. Subsystem
3. Category
4. Agenda 21 chapter
5. Indicator

then they are combined from indicator to Agenda 21 chapter; from chapter to category; and from category to subsystem.

Combining to the subsystem level yields two results (one for the ecosystem, the other for people): an index of ecosystem wellbeing; and an index of human wellbeing. These are combined into an index of sustainability or overall wellbeing by reading the intersecting points on the Barometer.

If an issue is represented by one indicator, the indicator's score is the issue's score. If an issue is represented by two or more indicators, the indicators have to be combined or aggregated. Standard procedures for aggregation are:

- if the indicators are considered to be equally important, they are added together and then the average is taken;

- if some are regarded as more important than others, they need to be weighted according to their relative importance before they are added and averaged; or
- if one indicator is judged to be critical, it can be given a veto function, overriding the other indicators.

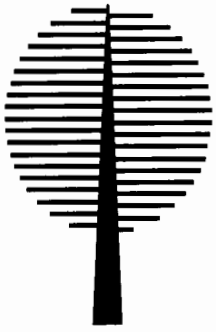
Similarly, if a dimension is represented by one issue, that issue's score is the dimension's score. If the dimension is represented by two or more issues, the issues have to be aggregated following the same procedure as for indicators. A comprehensive discussion of aggregation and weighting is given in the companion handbook on system assessment.

A caution

A Barometer reading is simply a means to an end, not the end itself. Its purpose is to stimulate people to pay more attention to the underlying issues. Consequently, the Barometer results need to be accompanied by an analysis of the key issues. Together, the results and the analysis will enable politicians, officials and the public to draw conclusions about the conditions of people and the ecosystem, the main interactions between people and the ecosystem, and priorities for action.

Assessment involves values and judgments, from the model of the system and the goal, through decisions about aggregation, to the interpretation of indicators. These values and judgments should be made clear, so that people who disagree with them can see how alternative judgments would alter the assessment. Every part of the assessment needs to be presented in a way that allows people to use different indicators or alternative arrangements. Users need to know what data support the indicators, the confidence in the data, and the interpretations and judgments involved in choosing, calculating and combining indicators.

The big picture is good to have. But what's behind the big picture is just as necessary and more revealing.



The Barometer of Sustainability as a Communication Tool

The Barometer can be used as a communication tool, focussing discussion on the meaning of human wellbeing and ecosystem wellbeing, their relationship to each other, and the importance of both for sustainable development.

Support teams helping villagers in Zimbabwe to prepare their own sustainable development action plans have used the Barometer mainly for this purpose. Villagers defined their own categories and labels for different levels of human and ecosystem wellbeing. Then they discussed where they were on each axis. They went on to assess their condition and the state of their ecosystem in more detail. At the end of the assessment they reviewed their position on the Barometer. Positions on the two axes were not calculated but were estimated qualitatively.

The value of the Barometer was that it helped the villagers to consider people and the ecosystem together; and to see progress as improving both the condition of people and the condition of the ecosystem.

Comparing community perceptions with technical data

The Barometer can also be used to compare where people perceive themselves to be in terms of ecosystem and human wellbeing, and where government institutions and available conventional data would place them.

The differences and similarities between the perception of people themselves and conventional data will soon become apparent. This can then act as a focus of discussion among resource managers, scientists, development workers and villagers to arrive at a common understanding of the problems of the area.

Founded in 1948 as the International Union for Conservation of Nature and Natural Resources, the IUCN brings together States, Government agencies and a diverse range of non-governmental organisations in a unique world partnership: over 900 members in all, spread across some 136 countries. As a Union, IUCN seeks to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable. The Union builds on the strengths of its members, networks and partners to enhance their capacity and to support global alliances to safeguard natural resources at local, regional and global levels.

The Strategies for Sustainability Programme of IUCN works to strengthen strategic planning, policy and implementation skills aimed at sustainable development at global, national and local levels. Working with networks of strategy practitioners from member governments, partner institutions and NGOs, the Programme assists in the conceptual development and analysis of experience in strategies, the development of a range of strategic planning and action planning skills, and improved methods of assessing human and ecosystem wellbeing.

Publications in this series:

Assessing Progress Toward Sustainability: An Overview

Participatory and Reflective Analytical Mapping (PRAM)

Questions of Survival

Reflective Institutions

Barometer of Sustainability

Assessing Rural Sustainability

Planning Action for Rural Sustainability

Community-based Indicators

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