

Indicators of sustainable development: framework and methodologies

CSD Indicators of sustainable development

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Methodology Sheets

Population Change in Mountain Areas

Category: Environmental

1. Indicator

(a) **Name:** Population change in mountain areas.

(b) **Brief Definition:** A measure of population, (i) Density, (ii) Growth, and (iii) Migration, as indications of demographic changes in mountain areas.

(c) **Unit of Measurement:** Measurement units for population density, growth, and migration in mountain areas are respectively: (i) households and persons per unit area; (ii) numbers and percentage of households and persons involved in out-migration; (iii) growth or reduction of population and of migration numbers over time.

2. Placement in the Framework

(a) **Agenda 21:** Chapter 13: Managing Fragile Ecosystems: Sustainable Mountain Development.

(b) **Type of Indicator:** Driving Force.

3. Significance (Policy Relevance)

(a) **Purpose:** The purpose of this indicator is to show the extent to which overall population density, migration patterns, and other demographic measures affect sustainable mountain development, including resource availability and management.

(b) **Relevance to Sustainable/Unsustainable Development:** This indicator is relevant for policy decisions related to programs of rural education, health, land titling and decentralized natural resource management, and for

understanding migration, social unrest, poverty, and related socioeconomic factors.

The sustainable development of mountain ecosystems will depend, among other things, on the achievement of a self sustaining diversified mountain economy, with mountain areas receiving a fair return for indigenous resources and the goods and services produced. This is closely linked to conditions under which the mountain population, including the young, can remain in the mountains with an acceptable living standard. Status and change in population, and effects on resources often are the key driving force considerations in mountain areas.

Seasonal migrant labour and permanent out-migration, for example, can be factors in terms of draining labour, initiative, and cash income from mountain areas.

(c) Linkages to Other Indicators: This indicator is closely linked to those associated with poverty, population growth and migration, human settlements, and sustainable mountain development. Some specific examples would include: poverty gap index, population growth rate, net migration rate, percent of population in urban areas, and sustainable use of natural resources in mountain areas.

(d) Targets: International targets generally do not exist for this indicator, but it is suitable for the establishment of national targets. The indicator would relate closely to overall population targets.

(e) International Conventions and Agreements: The International Conference on Population and Development (Cairo), and the Fourth World Conference on Women (Beijing) are relevant to this indicator.

4. Methodological Description and Underlying Definitions

(a) Underlying Definitions and Concepts: The concepts are readily available in national population statistics. Mountains are extensive physiographic features which demonstrate clear altitudinal sequences in climate, soil, or natural vegetation. Mountain ecosystems as a whole can include mountain basins, valleys, and high plateaus, as well as the mountains themselves.

Mountains may also be defined in terms of population groups which represent social and economic living conditions related to the topography and distinct from areas defined as plains and lowlands. Some countries may need to delineate the appropriate mountain area for this indicator.

(b) Measurement Methods: The measurement of this indicator is outlined in population census and statistics related to labour movement.

(c) The Indicator in the DSR Framework: Population density, growth, and migration indicators are classified as Driving Force measures within the DSR Framework.

(d) Limitations of the Indicator: Good population and migration data are often lacking for mountain areas.

(e) Alternative Definitions: If specific population data are not available, estimates can be derived from national figures to give a general overview of demographic characteristics in mountain areas.

5. Assessment of the Availability of Data from International and National

Sources

(a) Data Needed to Compile the Indicator: Data on mountain population and labour migration, preferably gender specific, are required for this indicator.

(b) Data Availability: Good data are not usually available for mountain areas.

(c) Data Sources: Data for this indicator can be derived from population statistics, censuses, and migration and labour statistics.

6. Agencies Involved in the Development of the Indicator

(a) Lead Agency: The lead agency for the development of this indicator is the United Nations Food and Agriculture Organization (FAO). The contact point is the Assistant Director General, Sustainable Development Department, FAO; fax no. (39-6) 5225 3152.

(b) Other Organizations: The International Centre for Integrated Mountain Development (ICIMOD), The Mountain Institute, and other international mountain organizations will play a key role in the development of this indicator.

7. Further Information

(a) Further Readings:

A discussion document on this indicator will result from the third annual inter-agency meeting on Chapter 13, April 1996.

(b) Other Contacts:

International Centre for Integrated Mountain Development (ICIMOD)

Consortium for Sustainable Andean Development (CONDESAN)

The Mountain Institute within the Mountain Forum

LEAD AGENCY: FAO

SUSTAINABLE USE OF NATURAL RESOURCES IN MOUNTAIN AREAS

Category: Environmental

1. Indicator

(a) Name: Qualitative assessment of the condition and level of sustainable use of natural resources in mountain areas

(b) Brief Definition: This indicator is a composite of four sub-indices which describe in broad terms the state or condition of the natural resource base in a mountain area: namely (i) the extent of protection of soil; (ii) the area of hazard zones; (iii) the extent of degraded areas; and (iv) a measure of productivity.

(c) Unit of Measurement: The first three indicators above relate to land use or mis-use and can be measured in hectares of land area and expressed as the percentage of a mountain area. The fourth indicator measures yields of natural resource products (fuelwood, timber, wildlife food, non-wood forest products, etc.) which can be expressed in dollars, grain equivalent unit, or other values and compared to the replacement of these products in terms of reproduction and growth.

2. Placement in the Framework

(a) Agenda 21: Chapter 13: Managing Fragile Ecosystems: Sustainable Mountain Development.

(b) Type of Indicator: State.

3. Significance (Policy Relevance)

(a) Purpose: This indicator assesses the condition or degree of stability, which can be a clue of probable sustainability natural resource uses in mountain areas. Another purpose of the indicator is to identify obvious land degradation and misuses that need policy responses, in order for mountains to be returned to sustainable use.

(b) Relevance to Sustainable/Unsustainable Development: A natural resource base in a well-managed, protected, and productive state has a better

potential for sustainable use than a deteriorating or already degraded base.

The sustainable development of mountain ecosystems must be based on land uses for which mountains have a comparative advantage and which are compatible with long-term productivity in fragile upland ecosystems. This indicator relates directly to the land capability or suitability of the areas, since land uses exceeding the carrying capacity of an area are not sustainable. For example, land uses related to parks, eco-tourism, harvesting non-wood products from forests, biological preserves, etc are often sustainable uses in mountain areas, whereas cultivation on steep slopes without extra-ordinary conservation measures, or building housing in landslide hazard areas are not sustainable.

The indicator provides an approximation to determine if the land can potentially provide for adequate livelihood for the local people without degrading the natural resource base. Having information, at least an overview, on the status of land and resource use is the first step relevant to policy decisions related to fighting poverty in mountain areas, for land use planning, and overall rural development. Such a database is also essential for policy decisions on infrastructures, disaster planning, and economic development in mountain areas.

(c) Linkages to Other Indicators: This indicator has close association with several other environmental indicators pertaining to Chapters 10, 11, 13, and 15 of Agenda 21. These would include: land use change, land condition change, protected forest area as a percent of total forest area, population change in mountain areas, and protected areas as a percent of total area. In addition, the indicator is generally linked to other socioeconomic and institutional measures, such as population density and sustainable development strategies.

(d) Targets: Chapter 13 of Agenda 21 establishes objectives for sustainable development related to land productivity and appropriate use. The indicator is suitable for the setting of local targets. In some cases, it can relate to national targets for forestry and land use.

(e) International Conventions and Agreements: The Convention on Biological Diversity and the International Decade for Natural Disaster Reduction apply to this indicator.

4. Methodological Description and Underlying Definitions

(a) Underlying Definitions and Concepts: An actual measurement of sustainability of natural resource use is at best difficult. It requires a good data base and at least several growing seasons to measure. The indicator, therefore, is a simple measure of the probability of general sustainability in a mountain area. Many countries already have programs for land-use assessment, forest

assessment, soil inventory, and other monitoring and inventory data that can be used in this index.

In general terms mountains are extensive physiographic features which demonstrate clear altitudinal features in climate, soil, or natural vegetation, with high mountains being above the natural timber line. Mountain ecosystems include mountain basins, valleys, and high volcanic ring plains and high plateaus, as well as the mountains themselves. As the indicator is further refined, the more precise definition of mountains, hills, and related terms will follow FAO's Global and National Soils and Terrain Digital Databases (SOTER) procedures, which define various landforms in terms of slopes and relief intensity.

(b) Measurement Methods: For the sub-indices on soil protection, hazard zones, and degraded areas, many of the measurements of vegetation, soils, and land uses are standard procedures which draw on sources such as remote sensing, existing maps, geographic information system (GIS) databases, field observations, etc. to assess land use conditions. Forest assessment data and soil surveys, for example, may be used. Some of the measurements, such as identification of landslide hazard areas are somewhat more specific, but use the same measurement techniques. The sub-index on productivity takes volumetric units for yields of natural resource products (fuelwood, timber, wildlife food, non-wood forest products, etc.). This may also be converted to a standard unit of value, for example, to dollars or a grain equivalent type unit).

To calculate the composite indicator, rate the four components descriptions below for a mountain area, such as a watershed, and summarize the four scores for a combined index from 0 to 400.

(i) Soil Protection: Score approximate percentage of mountain area where this statement generally applies:

Protection against accelerated erosion is good in terms of adequate vegetative cover in forests, rangelands, parks, preserves or other wildlands;

conservation practices in agricultural or agro-forestry areas protect soil from accelerated water and wind erosion.

.....%

(ii) Hazard Areas: Score approximate percentage of mountain area where this statement does not apply:

Potential instable hazard areas exist where risk is high for landslides, avalanches, mudflows, wildfires, volcanic effects, flooding, and other hazards that endanger people and inhibit development in such areas.

.....%

(iii) Degraded Areas: Score approximate percentage of mountain area where this statement does not apply:

Degraded areas exist where the production of natural resource goods and development are obviously restricted and include: areas of accelerated surface erosion; zones with vegetation degraded by overgrazing; areas of chemical or other contamination; fire impacted areas; areas where some non-productive vegetation dominates; zones where water supply is now restricted from, for example, salt-water encroachment, ground water contamination, etc; and saline areas.

.....%

(iv) Evidence of Productivity: Score approximate percentage of mountain area where this statement applies:

For wildlands and rangelands: productivity or yields of timber, plants, fuelwood, wildlife meat, beef, and other products is sustainable in that present use approximately equals the replacement of these goods by reproduction and growth and the resource base is not being destroyed.

For small-scale agricultural and agro-forestry areas: levels of agricultural yields can probably continue approximately at present levels with the same farming practices and inputs (as opposed to situations where crop productivity is obviously declining due to excessive soil losses or other reasons).

For water: water use can continue at approximately present demand levels or additional water can be imported (as opposed to situations where ground-water mining, salt encroachment, contaminants, or other impacts threaten water supplies; or where the available water supply is generally restricted).

.....%

Index Total (0-400%).....

(c) The Indicator in the DSR Framework: Within the DSR Framework, this is a State indicator of land use and condition.

(d) Limitations of the Indicator: Often data are not readily available for mountain areas and may need to be collected. Productivity is a complex measurement to standardize. Surveys for productivity, if based on interviews, are subject to bias. The rationale for this index and its aggregation has its limitations and may not apply to all countries. Attempts to extrapolate data into mountain areas are not advisable. Hazard zones, such as landslide areas, require techniques specific to mountain areas.

(e) Alternative Definitions: Not available.

5. Assessment of the Availability of Data from International and National

Sources

(a) Data Needed to Compile the Indicator: Land use, forest, and range assessment data, such as vegetation, erosion, sedimentation, overgrazed and burned areas, contaminated lands, water resources, and hazard areas, are required. The data should be compatible with the United Nation Food and Agriculture Organization's (FAO) Global Forest Resource Assessment methods to facilitate data sharing.

(b) Data Availability: In some countries, a data base will be available for mountain areas, but often these are the zones least well assessed. Remote sensing and GIS will be important tools for many of the areas.

(c) Data Sources: National data sources can be based on remote sensing data; field observations; interviews; agriculture census; existing surveys, maps and available reports; economic studies.

6. Agencies Involved in the Development of the Indicator

The lead agency for the development of this indicator is the United Nations Food and Agriculture Organization (FAO). The contact point is the Assistant Director General, Sustainable Development Department, FAO; fax no. (39-6) 52253152.

7. Further Information

(a) Further Readings:

A discussion document on this indicator will result from the third annual inter-agency meeting on Chapter 13, April 1996.

(b) Other Contacts:

International Centre for Integrated Mountain Development (ICIMOD)

Consortium for Sustainable Andean Development (CONDESAN)

The Mountain Institute within the Mountain Forum

LEAD AGENCY: FAO

WELFARE OF MOUNTAIN POPULATIONS

Category: Environmental

1. Indicator

(a) Name: Welfare of mountain populations.

(b) Brief Definition: This indicator focuses on the nutritional anthropometry of children and adults in mountain populations as a measure of their overall welfare or well-being, their levels of prosperity or poverty, and changes in their welfare status.

(c) Unit of Measurement: Weight in kilograms, height in centimeters.

2. Placement in the Framework

(a) Agenda 21: Chapter 13: Managing Fragile Ecosystems: Sustainable Mountain Development.

(b) Type of Indicator: State.

3. Significance (Policy Relevance)

(a) Purpose: Nutritional status as indicated by anthropometry is an overall, simple measure of human welfare and development. Nutritional status is the end result of a wide range of effects and conditions beyond food, including factors such as availability of clean water and access to health services.

(b) Relevance to Sustainable/Unsustainable Development: This indicator is relevant for policy decisions related to setting priorities and determining the location for programs of rural development, education, health, agriculture and natural resource management. It is particularly relevant for policy decisions where poverty and malnutrition need a primary focus.

The sustainable development of mountain ecosystems will depend, among other things, on the development of a self sustaining diversified mountain economy.

This development is closely associated with human welfare and ecological conditions that allow mountain populations to live in their homelands and attain adequate nutrition, health care, education, an adequate income, and other basic human needs. This indicator is also useful to assess the impact of intervention programs over time.

(c) Linkages to Other Indicators: This indicator is closely linked to those associated with poverty, population growth and migration, human health, human settlements, international cooperation, and sustainable mountain development. Some specific examples would include: poverty gap index, population growth rate, net migration rate, and infant mortality rate, percent of population in urban areas, Gross Domestic Product per capita, and sustainable use of natural resources in mountain areas.

(d) Targets: International targets for minimum nutritional levels apply to this indicator. Rural development targets may also exist for some regions and countries.

(e) International Conventions and Agreements: The upcoming World Food Summit (Rome November 1996), the International Conference on Nutrition and various other nutrition conferences, the International Conference on Population and Development (Cairo), and the Fourth World Conference on Women (Beijing) are relevant to this indicator.

4. Methodological Description and Underlying Definitions

(a) Underlying Definitions and Concepts: The definitions and concepts related to nutrition are well known and readily available. Nutritional status is a synoptic indicator, reflecting the level of welfare in general, including access to food, health services, and other needs. It is a sensitive indicator while at the same time its response is relatively non-specific.

Thus, it is appropriate for monitoring changes in the overall welfare situation and for evaluating welfare status. Normally, it is used in conjunction with other indices, such as infant mortality (see section 3c above).

(b) Measurement Methods: Nutritional status of children may be determined by calculating how far the indicators deviate from international reference values for growth status using weight and height. Nutritional status of adults may be determined by calculating their Body Mass Index (BMI) which is a ratio of weight to height squared. Low numbers indicate malnutrition and poor well-being, moderate numbers are desirable levels, and the highest numbers reflect obesity. Lower cut-off points and goals can be established quantitatively.

(c) The Indicator in the DSR Framework: This is a State indicator within the DSR Framework reflecting Driving Forces such as population pressures, and declining land productivity of the land, environmental impacts, and other factors. It is a measure of the general development level of an area.

(d) Limitations of the Indicator: The indicator works best for comparisons over time. It has some limitation for comparison from one ethnic group to another, due to variation in natural body configurations. The indicator itself can be quantitatively defined quite easily, however, its interpretation is somewhat more complex in that bias can occur when comparing one ethnic group to another or possibly one region to another. Therefore, interpretation and use to set goals or targets requires care. The BMI, for example, should be defined for each major ethnic group to have meaning.

(e) Alternative Definitions: Not available.

5. Assessment of the Availability of Data from International and National

Sources

(a) Data Needed to Compile the Indicator: Simple anthropometric measurements of height, weight, sex and age are required for this indicator.

(b) Data Availability: Some of the data for the indicator may be available in national institutions. Where this is not the case, data can be generated through rapid assessment procedures and monitoring in the field.

(c) Data Sources: See section 5b above.

6. Agencies Involved in the Development of the Indicator

(a) Lead Agency: The lead agency for the development of this indicator is the United Nations Food and Agriculture Organization (FAO). The contact point is the Assistant Director General, Sustainable Development Department, FAO; fax no. (39-6) 5225 3152.

(b) Other Organizations: The International Centre for Integrated Mountain Development (ICIMOD), The Mountain Institute, and other international

mountain organizations will play a key role in the development of this indicator.

7. Further Information

(a) Further Readings:

Food and Agriculture Organization. Body Mass Index: A Measure of Chronic Energy Deficiency in Adults. FAO Food and Nutrition Paper No. 56. Rome 1994. A discussion document on this indicator will result from the third annual inter-agency meeting on Chapter 13, April 1996.

(b) Other Contacts:

International Centre for Integrated Mountain Development (ICIMOD)

Consortium for Sustainable Andean Development (CONDESAN)

The Mountain Institute within the Mountain Forum

Lead Agency: FAO

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