2.4.2 The State

**Indicator – Percentage of Major Rivers Meeting Grades I-III Water Quality Standard 1990 - 2004**

63. This state indicator was developed to track the water quality of Yunnan river over time. It is an integrated expression of water quality. It measures the percentage of good water quality in pre-selected key segments of the rivers. Good water quality meets Grade I, II and III as defined by the National Standards of Surface Water (GB3838-2002) I (see Fact Sheet No. 3.1 for definition of quality grades).

64. Most of the major rivers in Yunnan province suffered from organic pollution, and particularly those flowing through or near urban areas. In terms of relative severity of pollution from severe to slight during the 1990s, the six large river systems were ranked as follows: the Nan Pang, the Jin Sha, the Lan Cang, the Honghe, the Nu and the Irrawaddy.

65. As shown in Figure 2.8, the quality of water in Yunnan’s major rivers deteriorated up to 1999 as the volume of untreated municipal and industrial wastewater discharged grew. After 1999, water quality began to improve as a result of pollution control measures such as commissioning of centralized wastewater treatment plants in major cities and greater efforts by industrial enterprises in response to the application of the pollution levy system.

66. In 2003, in the sections of the major rivers that were monitored, the percentages of good, lightly polluted and severely polluted water were 52.7%, 26.7% and 20.6% respectively. The percentage of major rivers meeting Grades I-III in 2004 was 53.3%, i.e. 16.3% higher than in 1990. The Tenth Five-Year Plan for Ecological Rehabilitation and Environmental Protection (2001) of Yunnan sets the target of 70% for the percentage of major rivers meeting Grade I-III Water Quality Standard by 2005. That target appears unlikely to be achieved despite major improvements in the last decade. Those improvements contrast with the quality of the Province’s lakes, not discussed in this report, that continued to stagnate.

**Suggested Rating:** Relatively poor but improving

**Justification:** The pollution of the major rivers was serious and become more serious until the end of the 1990. Since then major improvements have been achieved.

2.4.3 The Pressure

67. This indicator presents the trend of municipal wastewater generation from 1989 to 2004. Data point to an overall (and unsurprising) increase in discharges in Yunnan since the beginning of the period under review (see Figure 2.9). Increasing urbanization and migration of the rural poor in search of jobs and income resulted in increased consumption of water and, hence also, wastewater. With increasing attention paid to water conservation and waste discharges after 1995, the rise in municipal wastewater discharges slowed down somewhat since then. No convincing explanation other than a change of the statistical procedure is available for the massive decline in reported figures between 1995 and 1997.

**Figure 2.9:** Volume of Municipal Wastewater Discharge, 1899-2004

![Graph showing volume of municipal wastewater discharge from 1899 to 2004](image-url)
68. Total volume of municipal discharges is a not a particularly good indicator of pressure once (as in China in post-1995 period) the percentage of treatment begins to depart from the historical near-zero percent. The volume of total discharges will then begin to overestimate the real pressure of pollutants reaching the receiving bodies of water. The Tenth Five-Year Plan for Ecological Construction and Environmental Protection (2001) of Yunnan expects the rate of municipal wastewater treated in Yunnan’s major cities to reach at least 70% by 2005.

**Suggested Rating:** High and increasing  
**Justification:** Water consumption in Yunnan’s cities and consequently the municipal wastewater discharges were relatively low in per capita terms (by international standards) but growing. The rate of growth of municipal discharges slowed down since the introduction since mid-1990s of a variety of measures designed to improve the management of water resources.

2nd Indicator – The Volume of Untreated Industrial Wastewater Discharges 1993-2000

69. This indicator presents the trend of untreated industrial wastewater discharges from 1993 to 2000. It tracks the pressure of untreated industrial wastewater on natural water.

70. The main sectors responsible for industrial wastewater discharges in Yunnan were agro-processing, chemicals, paper-making, metallurgy, mining and ore-dressing. All these industries experienced strong growth during the period of assessment and continue to grow. The principal locations of industrial wastewater discharges included Kunming City, Honghe Prefecture and Quijing City. The main river basins of industrial wastewater discharge were those of the Nan Pang, Jin Sha and Lan Cang river systems.

71. As Figure 2.10 shows, the volume of untreated industrial wastewater discharges decreased from 192.0 million tons in 1993 to 55.8 million tons in 2000. The reduction was due to the implementation of many projects and measures, such as the Treatment and Prevention of Pollution of Nine Larger Plateau Lakes project, installation of more wastewater treatment facilities, greater water recycling and reuse by the industry in part reflecting higher water tariffs etc. By 2003, the combined capacity to treat industrial wastewater in Yunnan had increased to 0.15 million tons/day suggesting that recycling of water began to play an important part in the overall efforts.

**Suggested Rating:** Medium and decreasing  
**Justification:** Efforts by the government and enterprises resulted in a significant increase in the percentage of industrial wastewater treated prior to discharge and in greater water re-use.

Indicator – Percentage of Industrial Wastewater Treated Prior to Discharge 1993 - 2000

2.4.4 The Response

72. This indicator is intended to capture the efforts of the government and the industry to alleviate the pressure on the receiving water bodies.

![Figure 2.10: Volume of Untreated Industrial Wastewater, 1993-2000](image-url)
73. A number of projects targeting improved wastewater management in the province have been designed and some already executed. These typically combine action taken by the industry as well investments by the State and municipalities. In March 2003, the State Council endorsed the Tenth Five Year Plan for Pollution Treatment and Prevention in Lake Dianchi. By the end of 2003, 15 engineering and research projects had started (or 57.7% of a total 26 projects envisaged in the Plan), and 11 projects began preparatory work. In addition, 147 projects were planned under “Contracts on Target Responsibility System for Environmental Protection (2003-2005)” focusing on Lakes Erhai, Fuxian, Xingyun, Qilu, Yangzonghai, Yilong, Chenghai and Lugu county. Of these, 6 (or 4.1%) have been completed, and 64 (43.5%) have started. A further 77 (52.4%) projects have entered a preparatory phase.

74. In 2003, investments in pollution treatment of the nine large plateau lakes reached RMB557 million, of which RMB104 million was allocated for Lake Dianchi. The total investment to date in treatment and prevention of pollution of the nine lakes was RMB4,865 million of which RMB3,536 million was for Lake Dianchi.

**Suggested Rating:** Average and consistent

**Justification:** Efforts by the government and enterprises resulted in a significant increase in the percentage of industrial wastewater treated prior to discharge and in greater water re-use.

### 2.4.5 Conclusions

75. In Yunnan, rivers and lakes in close vicinity of population centers have traditionally suffered from high levels of pollution and eutrophication in the case of lakes. The Tenth Five-Year Plan for Pollution Treatment and Prevention in Lake Dianchi’s marked a turning point. By 2003, 15 of the 26 planned wastewater management projects had been implemented. Combined with enterprise-level investments in wastewater treatment, most rivers registered notable improvements. Large investments were also made to improve water quality in 9 principal lakes of the Province but the results are believed to be much more modest. Government expenditure in wastewater management is on the rise.

### Table 2.6: Expenditure on Industrial Wastewater Treatment

<table>
<thead>
<tr>
<th>Year</th>
<th>Expenditure on Industrial Wastewater Treatment (RMB10,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>14276.1</td>
</tr>
<tr>
<td>2002</td>
<td>9465.2</td>
</tr>
<tr>
<td>2001</td>
<td>7191.0</td>
</tr>
</tbody>
</table>
2.5 Inadequate Waste Management

2.5.1 The Context
76. The rapid growth of population and urbanization has led to increased waste generation in Yunnan. Waste management occupies an important place in The Tenth Five-Year Plan for Ecological Rehabilitation and Environmental Protection (2001) of Yunnan.

2.5.2 The State

1st Indicator: Percentage of Non-Recycled Industrial Waste 1989 – 2004

77. This indicator presents the trend in the volume of industrial solid waste directly discharged into the environment as a percentage of the total volume of industrial waste generated.

78. The growth in Yunnan’s economy over the past 15 years has resulted in greater levels of solid waste generated by the industry. As shown in Figure 2.12, the volume in 2004 was nearly 2.5 times that of 1989. The volumes of waste discharged (i.e. not re-cycled) changed little in 1990s but began to decrease rapidly thereafter. As a result, the percentage of non-recycled waste fell even more rapidly.

79. The turning point appears to have been the period 1993-1998 and especially the promulgation of the Law on the Prevention and Control of Environmental Pollution by Solid Waste in 1996.

Suggested Rating: Unknown State and improving
Justification: The volume of industrial solid waste directly discharged into environment has been decreasing over the past 15 years in part thanks to legislative efforts of the government.

2nd Indicator – Percentage of Municipal Solid Waste Safely Disposed of in the Total Municipal Solid Waste Generated 2000 – 2004

Figure 2.12: Percentage of Non-recycled Industrial Solid Waste in the Total Generated, 1989-2004
80. This indicator (see Figure 2.13) measures the amount of municipal solid waste collected and deposited in designated facilities ("treated") expressed as a percentage of the the total amount of waste generated. The indicator does not capture the environmental adequacy of these facilities and the term "safe disposal", when used in this context, refers merely to the “right” destination of the waste.

81. Although the period for which data are available is relatively short, it is reasonable to describe performance as a stagnating one in recent years following a promising improvement in 2001. The total volume of municipal solid waste kept increasing while the volume of solid waste properly disposed of remained largely unchanged.

82. By 2005, the percentage of municipal waste safely disposed of should be over 65% in the Province’s top-tier cities according to The Tenth-Five Year Plan for Ecological Rehabilitation and Environmental Protection of Yunnan (2001). The data suggest that the target is almost being met but the margin for comfort is very small and the target itself appears to be soft by international comparisons.

**Suggested Rating:** Unknown state and deteriorating

**Justification:** While the industry has significantly improved its waste disposal performance the same cannot be said of the municipalities. The percentage of municipal solid waste properly disposed of remains low with no signs of improvement.

### 2.5.3 The Pressure

**1st Indicator – Volume of Municipal Waste Generated 2000 - 2004**

**2nd Indicator – Volume of Industrial Solid Waste Generated 1989 - 2004**

(Note: The values of two above indicators are contained in the relevant fact sheets)

83. Total volumes of municipal and industrial solid waste generated are logical indicators of pressure in this context. In the former case, available estimates largely reflect the growth of population and increasing incomes both of which result in greater volumes of municipal waste (as well as changes in its composition). The latter mirror the expansion of industry. The trends in the value of both indicators are plotted in Figures 2.14 and 2.15 below. Although the data for municipal solid waste are available for 5 years, both of the indicators show a slowly increasing trend.

**Figure 2.13: Percentage of Municipal Solid Waste safely disposed of in the Total Municipal Solid Waste Generated, 2000-2004**
Suggested Rating: Medium and increasing  
Justification: The volume of solid waste generated in Yunnan broadly matched the rate of economic growth but was proportionately faster for the municipal than the industrial category.

2.5.4 The Response

Indicator –Percentage of Industrial Solid Waste Re-Cycled 1989 - 2004

84. This indicator tracks the efforts to re-cycle industrial solid waste. As shown in Figure 2.16, the percentage of recycled industrial solid waste increased steadily from approximately 20% in the early 1990’s to 40% in 2004.
85. The Government efforts to encourage waste recycling by enterprises saw the adoption of the Law of the Prevention and Control of Environmental Pollution by Solid Waste in 1996 that requires enterprises to reduce the production of solid waste. The central government has also urged the use of economic incentives and improved management to foster greater recycling and reuse of solid waste. Nevertheless a coherent approach to recycling of waste, in line with the “3R” spirit—reduce, reuse, recycle—is yet to be formulated.

86. According to The Tenth Five-Year Plan for Environmental Portection of Yunnan province, 2003, 40% of industrial solid wastes should be recycled and reused by 2005. As can be seen, the target for 2005 has been achieved.

**Suggested Rating:** Non-comparable and consistent

**Justification:** The measures and projects on recycling industrial solid waste have had their intended effect and the 2005 targets were met already in 2004.

2.5.5 Conclusions

87. The volume of industrial and municipal waste generated has been growing in Yunnan due to increasing urbanization and further growth of the industry. While the solid waste discharge performance of the industry improved significantly during the last decade, no such improvement has been achieved in dealing with municipal waste. The poor performance by the municipal segment may be due to the difficulties and high cost of developing safe landfills.

**Suggested Rating:** 2 STARS for the industry and 1 STAR for the municipal sector

**Justification:** The response by the industry to the waste discharge problem has been strong and positive. By contrast the management of municipal solid waste remained poor.

2.6 Forest Resources

2.6.1 The Context

88. Forest resources are crucial to maintaining the natural environment and biodiversity in Yunnan and are a significant complement of economic growth. Forest resources are threatened by over-cutting and by high local energy demand that is met in part by firewood. Steps are being taken by the government towards conserving forests. A large number of forest conservation and afforestation projects have been implemented during the past decade.
2.6.2 The State

1st Indicator – Percentage of Forest Cover 1960 – 2002

Forest cover of Yunnan province has steadily increased since the 1990’s. The Yunnan Forest Inventory and Planning Institute has been monitoring forest cover since 1960. Complete inventories were conducted in 1975 and 1979. Since 1987, the Institute has conducted forest cover inventories every five years. Figure 2.17 shows the changes in forest cover from 1960 to 2002. In 2002, the total forest area in Yunnan was 15.0 million ha. This included 12.5 million ha of natural forest, 1.1 million ha of plantation forest area and 1.4 million ha of other forest. Including shrubland, forests covered 50.2% of the total land area of the province in 2002. The comparison of forest areas with the estimates of the standing volume (see Fact Sheet 5.1) shows that the growth of standing stock lagged behind that of the area. There were more forests in Yunnan with, however, a low average standing volume. This may not be serious if the principal function of the forests in Yunnan is shifting from production to environmental protection.

The severe floods in Eastern China in 1998 resulted in PRC’s government taking resolute steps towards forest conservation. From 1999, many environmental rehabilitation (“ecological construction”) projects were started and the positive outcomes of these projects began to be noticeable. These included natural forest conservation projects and conversion of inappropriately cultivated land to forest. Natural forest conservation projects began in 1999. All natural forests are subject to a logging ban. Protection of biodiversity and associated ecological functions of these forests is the principal management objective. Projects supporting conversion of “wrong” farmlands—usually steep slopes—to forestry (afforestation) started in 1999 with the objective of reducing soil erosion.

The target of 48% forest cover contained in the Tenth Five-Year Plan for Ecological Rehabilitation and Environmental Protection of Yunnan was exceeded in 2002. Investment in forest protection also increased in the the last 6 years (1998-2004) to a cumulative 6,700 million RMB.

**Figure 2.17: Percentage of Forest Cover, 1960-2002**

<table>
<thead>
<tr>
<th>Year</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>20</td>
</tr>
<tr>
<td>1975</td>
<td>30</td>
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<tr>
<td>1979</td>
<td>40</td>
</tr>
<tr>
<td>1987</td>
<td>50</td>
</tr>
<tr>
<td>1992</td>
<td>60</td>
</tr>
<tr>
<td>1997</td>
<td>70</td>
</tr>
<tr>
<td>2002</td>
<td>80</td>
</tr>
</tbody>
</table>

**Suggested Rating:** Average and improving

**Justification:** The environmental rehabilitation projects are effective and the percentage of forest cover has been steadily increasing in Yunnan. The increase in forest area has been faster than the increase in the forest’s standing volume.
2.6.3 The Pressure

Indicator – Ratio of Wood Consumption to Forest Standing Stock Increment 1960 – 2002

92. This indicator is developed to describe the sustainability of forest management by comparing the volume of wood removed with the annual increment of the standing forest stock. Values of the indicator in excess of 1 indicate depletion of the forest and vice versa.

93. Figure 2.18 plots the value of this ratio since 1960 suggesting that depletion, very serious in the early part of the studied period not least because of the policies of the Cultural Revolution, was reversed around the middle of the 1990s. The improvements since then can be attributed to various forest conservation and afforestation projects undertaken by the state and provincial government, as well as increased availability of modern (non-fuelwood) sources of energy in some locations as described earlier.

Suggested Rating: Average and improving
Justification: By the middle of the 1990s a variety of forest conservation and afforestation projects implemented by the government contributed to the reversal of the trend towards forest depletion. The improvements have continued since then.

2.6.4 The Response

1st Indicator – Afforested Area 1999 – 2004

94. This indicator gives the area of land unsuitable for farming that was converted to forests over the period 1999 to 2003. The indicator does not capture the quality of the afforested areas and parameters such as seedling survival.

95. Cultivation of unsuitable lands (typically, steep slopes) quickly degrades the land and causes serious water and soil losses. Converting inappropriately cultivated land to forest can improve the ecological functions of the lands in question, slow down the rate of soil erosion and avoid off-site losses (siltation etc.) 1999 (Figure 2.19). Environmental rehabilitation projects began in 1999 and the land area afforested each year has increased substantially since then.

96. The 1998 Provincial Afforestation Plan required a total of 346,700 ha afforested by 2003, consisting of of 166,700 ha of inappropriately cultivated land and 180,000 ha of abandoned and mountainous areas. By 2003, a total of 345,500 ha had been forested, broadly in line with the expectations. The Plan is largely implemented by local communities supported in cash and kind by the Government. Some 117 tons of grain, RMB74 million in cash and RMB233 million for seedlings were distributed to the local communities during the period 1999 to 2003. Despite this achievement, it is important to bear in mind that the 345,000 ha afforested during the period 1999 to 2003 represented no more than 2% of the total forest area of the province albeit the environmentally essential 2%.

Figure 2.18: Ratio of Wood Consumption to Forest Standing Stock Increment, 1960-2002
Suggested Rating: Significant and intermittent
Justification: A steady progress has been made in re-claiming inappropriately farmed lands to

forest.2nd Indicator – Area under Forest Conservation Programs 2000-2004

97. This indicator tracks the cumulative area under forest conservation programs in the province. There are currently two types of forest conservation programs in Yunnan, each with own targets and implementation mechanisms. The first is the protection and management of natural forest. The second is the establishment of artificial woodlands for public usage, referred to in Yunnan as public welfare forestry.

98. As shown in Figure 2.20, the total area under both programs increased from approximately 12 million ha in 2000 to almost 13 million ha in 2004. The bulk was accounted for by natural forests where the 2005 target of 12.0 million ha (set out in The Tenth Five-Year Plan for Ecological Rehabilitation and Environmental Protection of Yunnan) was met right from the outset of the program in 2000 (raising questions about how the target was set in the first place). The 2010 target set out in Yunnan Natural Forest Conservation Project remains pegged at 12.0 million ha.

99. The area under public welfare forests is a relatively small percentage of the total forest under conservation (Figure 2.20). The 2010 target of the Yunnan Natural Forest Conservation Project for this type of forest is 1.8 million ha. Based on the progress so far, the 2005 target of 810,000 ha (featuring in the Tenth Five Year Ecological Rehabilitation and Environment Protection Plan of Yunnan(2001)) appears to be achievable.

Suggested Rating: Average and consistent
Justification: Efforts by government and participating communities have resulted in consistent progress in expanding the protection given to natural forest and establishment of people welfare forests.

2.6.5 Conclusions

100. Forest resources are essential for the maintenance of environmental functions of the Yunnan province besides their direct economic contribution. A large number of natural forest conservation, afforestation, forest rehabilitation and reforestation projects have been implemented in the province over the past decade. The areas of afforestation, natural forest, and public welfare forests have been steadily increasing as has the overall forest cover.

Suggested Rating: 3 STARS
Justification: A decisive turnaround appears to have been achieved in Yunnan in the management of forest resources. The area under forest continues to increase and the depletion of the resource overall has been arrested and reversed. Some doubts exist concerning the quality of the forest
2.7 Natural Disasters

2.7.1 The Context
101 Because of its location and geography, Yunnan is prone to natural disasters. Various forms of natural calamities affect the province including climatological disasters (heavy winds, hailstone, snow-related disasters, floods, droughts); and geological disasters (earthquakes, mud- and rock slides, etc). Although the majority of disasters is truly natural, there is a varying man-made element affecting the scale and severity of some categories of disasters. This includes activities such as unsuitable and unauthorized location of housing, poor quality of housing and infrastructure, removal of protective vegetative cover exacerbating the impact of landslides, unsafe storage of hazardous waste, etc. Managing natural disasters including its man-made component and mitigating the economic losses associated with them is a major challenge for Yunnan’s authorities and population.

2.7.2 The State


102 This indicator (Figure 2.21) shows the population affected by natural disasters. “Affected population” is defined by the provincial authorities as those who receive compensation for disaster.
The population affected by natural disasters in Yunnan province averaged around 16 million each year. In 2000, this number exceeded 25 million. This was due to a severe frost and snow disaster event that occurred that year in the province followed by four very strong and destructive earthquakes which attacked Yaoan, Qiubei, Mile, Wuding, Longchuan Country.

Suggested Rating: Relatively poor and undetermined

Justification: The percentage of population affected by natural disasters in Yunnan remained relatively stable during a period witnessing wide variations in the frequency and severity of natural disasters.


This indicator tracks the economic losses caused by natural disasters between 1992 to 2003 as percentage of the provincial GDP. If plotted over a sufficiently long period, a declining trend of the value of this indicator would suggest greater success of local authorities in preventing and mitigating the impact of natural disasters, including their man-made component (and vice versa) through measures such as improved warning systems, land stabilization measures and others.

As shown in Figure 2.22, the percentage values fluctuated with no clear trend. The high values between 1996 and 2000 can be explained by well defined natural phenomena. On 3 February 1996, Lijiang was affected by an earthquake of grade 7.0. 11 counties in Lijiang prefecture, Dali prefecture, Diqing prefecture, and Nujiang prefecture were affected. In January 1997, an earthquake of grade 5.1 and 5.5 struck Mengla-Jinghong and Jinghong-Jiangcheng. In October of the same year, an earthquake of intensity 5.3 struck the barely recovering Lijiang. Between October and December 1998, there were 5 earthquakes measuring more than 5.0 in Yunnan. Another earthquake of grade 5.2 struck Chengjiang in 1999. In January 2000, a series earthquakes of intensity 5.9 and above hit Yaoan-Dayao, 13 counties were affected.

Figure 2.22: Economic Losses caused by Natural Disasters as a Percentage of Provincial GDP, 1992-2003
Suggested Rating: Unknown state and undetermined trend

Justification: Economic losses caused by natural disasters are affected by the frequency and magnitude of such disasters but also the size of the economy. The available series of data is probably too short to allow us to say whether the decline in natural disaster-associated damage expressed as a percentage of the provincial GDP observed since 1999 is a reflection of greater disaster preparedness in Yunnan or mainly the result of a temporary reduction in the intensity of the disasters themselves.

Indicator – Provincial GDP at Constant Prices 1991 – 2003

2.7.3 The Pressure

106. The true natural disasters are defined by their near-unpredictability and there would be little point in constructing indicators attempting to capture the disasters’ intensity over time. Instead, we have used the data of the provincial GDP at constant prices as a proxy for the value of assets that are at risk from natural disasters. The higher the GDP, the greater is likely to be the damage caused by a natural disaster of a given intensity. Since (at least in the unsentimental world of economics) the value of human life and economic cost of injuries tend to be positively correlated with GDP per capita, the indicator may not be as flawed as it may at first appear, though it will not capture other non-monetary values such as damage to scenic areas.


Suggested Rating: Average and increasing

Justification: The rapidly increasing GDP increasing the risk of damage associated with natural disasters of a given magnitude and frequency.

2.7.4 The Response

Indicator – Expenditure on Disaster Relief and Preparedness 1992 – 2003

108. This indicator measures the expenditure on disaster management.

109. Figure 2.24 shows that after 1994, the expenditure on disaster relief increased rapidly. This was the year that Yunnan experienced several disasters including floods, drought, earthquakes, mud flow, and land slides.

Figure 2.23: Provincial GDP at Constant Prices

![Graph showing Provincial GDP at Constant Prices from 1991 to 2003](image)

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP (RMB 100 million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1991</td>
<td>500</td>
</tr>
<tr>
<td>1992</td>
<td>600</td>
</tr>
<tr>
<td>1993</td>
<td>700</td>
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</tr>
<tr>
<td>2002</td>
<td>1600</td>
</tr>
<tr>
<td>2003</td>
<td>1700</td>
</tr>
</tbody>
</table>
The results point to a poor match between the economic losses sustained and the expenditure on relief. Part of the explanation may lie in the combined nature of the expenditure with its preparedness component remaining relatively steady while the relief component fluctuates according to perceived needs. There may well be further links and lags between expenditure on disaster preparedness and the expenditure on relief but they are not explored here.

Climatological disasters tend to be more frequent in Yunnan than the geological disasters and the expenditure on disaster relief and preparedness reflects this. Part of the expenditure captured in the indicator goes to improving the Geological Disaster Forecasting and the Disaster Prevention and Relief Service. A new network of geological disaster prevention and forecasting for the whole province has been in operation since 2003. In 2003, 209 disasters were successfully anticipated resulting in a successful evacuation of about 7,500 people and an economic loss avoided of RMB130 million.

Suggested Rating: Non-Comparable and Consistent
Justification: Expenditure on disaster relief is affected by the frequencies and risks of natural disasters

2.7.5 Conclusions

Natural disasters caused large economic losses in Yunnan during the period under review. Given the Province’s vulnerability to natural disasters, Yunnan’s rapid economic growth and infrastructural development are likely to result in higher absolute value of such losses in future. The Government’s objective must be to reduce the long-term average of such losses as a percentage of the Province’s economic wealth. This can be achieved through better designed and executed disaster preparedness measures.

Suggested Rating: 2 STARS
Justification: Yunnan has traditionally suffered from disaster-related losses. The magnitude of such losses reflects not only the frequency and intensity of natural disaster phenomena but also the size and the economic assets under threat and the scale and quality of disaster preparedness efforts of the Government. No evidence exists to suggest that the vulnerability of Yunnan’s citizens to natural phenomena has diminished during the last decade or so.

2.8 Climate Change

2.8.1 The Context

Industry is an important economic sector in Yunnan. The key industries include beer, cement, cigarettes, phosphates, jade ornaments, garments, tin, and machine tools. They are located mostly in Kunming and the industrial towns of Yuxi and Qijiang. Collectively, they are a significant source of greenhouse gas (GHG) emissions. Other GHG sources include domestic users of coal and fuelwood and segments of the livestock and rice-growing sectors.
114. China is formulating the National Strategy for Climate Change in which the low energy efficiency will feature importantly.

2.8.2 The State
115. The state of the global climate is determined in complex ways through the interplay of national and local GHG emissions. No attempt is made here to engage in the sophisticated work required to construct indicators of the state of the global climate.

2.8.3 The Pressure

**Indicator – Coal Consumption for Energy Generation 1991 – 2003**

116. The increase in global energy consumption resulting in greater burning of hydrocarbons is a key factor contributing to global climate change. Besides hydro power, coal consumption is a main source of primary energy in Yunnan and was considered a suitable pressure indicator for our purposes.

117. Yunnan is among the coal-rich provinces of South China. There are an estimated 70 billion tons of coal reserves in Yunnan with proven reserves of 34.4 billion tons. 63% of the reserves is lignite, suitable for generating electricity but high in pollution content.

118. During the past 15 years, coal accounted for 60% of primary fossil energy consumption in the province (Figure 2.25). With the growth in the economy, coal consumption grew until 1997 (see Figure 2.26) and has stabilized since. Its share in the Province’s output of primary energy total began to decline at about that time. The 2003 decision of Yunnan’s Provincial Government to accelerate the development of small and medium hydropower as the main thrust of future energy development in Yunnan is indicative of likely future trends. By 2002, hydropower accounted for one third of electricity generation in Yunnan Province, supplying power to 64% of rural population in the province.

**Figure 2.25: Percentage of Coal in Primary Fossil Energy Consumption in Yunnan, 1991-2003**


**Figure 2.26: Coal Consumption, 1991-2003 (10,000 tons)**

![Graph showing coal consumption in Yunnan from 1991 to 2003.](image1)

**Figure 2.27: Energy Intensity, 1991-2003 (tons of coal equivalent/RMB10,000)**

![Graph showing energy intensity in Yunnan from 1991 to 2003.](image2)

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**Suggested Rating:** High and steady  
**Justification:** Coal remains a major source of energy in Yunnan. There are signs however of a gradual decline in the relative importance of coal.

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**2.8.4 The Response**


119. Energy intensity (or energy consumption per unit of Yunnan’s gross domestic product) is used here as an indicator of provincial efforts to control GHG emissions.
120. The energy intensity of Yunnan declined rapidly in the first half of the 1990s but remained largely unchanged since 1996. The policies and actions implemented to reduce or more effectively manage the energy consumption had a major positive effect, not surprisingly given the general energy inefficiency characterizing China (including Yunnan) until then. However, the improvements were only modest in Yunnan in the latter part of the 1990s and initial years of the current decade. The easiest options associated with the early phase of industrial modernization clearly had been fully used and progress became more difficult to achieve since then.

121. Apart from the previously mentioned support for hydropower development that address GHG emissions indirectly, direct initiatives of the Provincial Government include provincial pilot applications of the Clean Development Mechanism (CDM). All of are currently at a design stage (e.g. Lijiang Dianximingzhu applications of solar energy or Maguan Hydro Project). The total estimated emission reductions under CDM pilot projects are 37,100 tons of CO2 during the first phase (2004-2010).

122. Yunnan Provincial Economic Committee is set to support technology innovation projects for industrial enterprises during 2005-2007 under which “clean” natural gas, and renewable forms of energy such as solar will be promoted. Research on cleaner energy development, energy saving and promoting production efficiency in metallurgy and chemistry industries is also being carried out.

**Suggested Rating: Average and consistent**

**Justification:** Declining energy intensity in a province that continues to depend on coal for the bulk of its primary energy shows the positive impact of several government initiatives undertaken to bring about a reduction in air emissions including those of GHGs.

### 2.8.5 Conclusions

132. With the development of industry and rising demand for energy, coal consumption in Yunnan shows no sign of losing its traditional position of prominence. It remained largely the same in volume terms since the late 1990s, even if its share in the total consumption of primary energy declined slightly. At a time of rapidly growing provincial GDP, this translated into initially rapidly improved energy intensity (until 1996) and continuing to decline albeit at a much slower rate since then. Yunnan has currently no specific targets of GHG reduction. Nonetheless, the government’s efforts to improve energy efficiency had both an air-quality and GHG-reduction dimensions.

**Suggested Rating 2 STAR**

**Justification:** There has been a significant improvement in Yunnan in the efficiency with which coal is used to generate electricity. The consumption of coal has remained largely unchanged since 1997. Energy intensity declined rapidly until 1996 and the emissions of GHG, though not estimated directly in this EPA, can be presumed to have declined in line with this improvement.