GLOBAL WARMING AND THE COASTAL ZONE
(Some Effects on Sites and Activities)

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Abstract. Updated from a background paper for the Villach September 1987 Workshop on 'Developing Policies for Responding to Climatic Change', the article first deals with varying effects on fish production in the coastal zone. Assessment of the extent and direction of these effects will have to await regionalized predictions of temperature and related changes. Exploitation of non-living coastal resources which follows is not likely to be affected by a sea level rise, but recreation will suffer through land loss while aquaculture may be favored in some and disfavored in others of its modes. Estuaries and atolls can be severely impacted by a sea level rise both by loss of valuable, if not essential, land; they are also more vulnerable to salt water incursion, storm surges, and typhoons. Tropical river mouth, especially in Asia and arctic regions, are treated. Anticipatory actions toward mitigation of effects of a sea level rise are essentially those of coastal zone planning with the caveat that technical fixes eventually to be employed have to be adjusted to the highly site-specific characteristics of the land water interface.

Introduction

It is plausible to expect a man-caused climate change to be manifest some time in the next century (Carbon Dioxide Review, 1982); coastal regions will be particularly affected because they are densely settled and because they will experience both the various effects of a warmer climate and a loss of land and damage to structures thereon by dint of a rising sea. It would be fair to say that nearly two-thirds of mankind live in coastal regions in the broad sense of the term (Pirazzoli, 1985), and these also tend to gain in population faster than those inland (Marx, 1975). For instance, 14 among the world's 25 largest growing conurbations are port cities, most at the mouth of a river (Table I). Aside from industry and agriculture at and near many shores, most uses of ocean resources depend on geologic, hydrographic, biotic and other attributes of the shore zone and its near-shore waters. Though of finite areal extent, coastal zones are difficult to define because great variability exists along and across them. The variability comes from characteristics associated both with land and sea which all have a bearing on the nature, distribution and variety of resources on the coast. The marine extent of the coast goes from the water's edge to the base of the steep continental slope (0–200 cm) (Menard and Smith, 1966), but towards the land its width may be more variable depending on...
TABLE I: World’s 25 largest cities in the year 2000

<table>
<thead>
<tr>
<th>Rank</th>
<th>City/country</th>
<th>Population (mill.)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mexico City, Mexico</td>
<td>26.3</td>
<td>Inland</td>
</tr>
<tr>
<td>2</td>
<td>Sao Paulo, Brazil</td>
<td>24.0</td>
<td>Inland</td>
</tr>
<tr>
<td>3</td>
<td>Tokyo/Yokohama, Japan</td>
<td>17.1</td>
<td>Coastal (P)</td>
</tr>
<tr>
<td>4</td>
<td>Calcutta, India</td>
<td>16.6*</td>
<td>Coastal (P)</td>
</tr>
<tr>
<td>5</td>
<td>Greater Bombay, India</td>
<td>16.0*</td>
<td>Coastal (P)</td>
</tr>
<tr>
<td>6</td>
<td>New York/New Jersey, U.S.A.</td>
<td>15.5</td>
<td>Coastal (P)</td>
</tr>
<tr>
<td>7</td>
<td>Seoul, Republic of Korea</td>
<td>13.5</td>
<td>Inland</td>
</tr>
<tr>
<td>8</td>
<td>Shanghai, People’s Republic of China</td>
<td>13.5</td>
<td>River Mouth (P)</td>
</tr>
<tr>
<td>9</td>
<td>Rio de Janeiro, Brazil</td>
<td>13.3*</td>
<td>Coastal (P)</td>
</tr>
<tr>
<td>10</td>
<td>Delhi, India</td>
<td>13.3</td>
<td>Inland</td>
</tr>
<tr>
<td>11</td>
<td>Greater Buenos Aires, Argentina</td>
<td>13.2*</td>
<td>Coastal (P)</td>
</tr>
<tr>
<td>12</td>
<td>Cairo/Giza/Imbaba, Egypt</td>
<td>13.2*</td>
<td>On River</td>
</tr>
<tr>
<td>13</td>
<td>Jakarta, Indonesia</td>
<td>12.8*</td>
<td>Coastal (P)</td>
</tr>
<tr>
<td>14</td>
<td>Bagdad, Iraq</td>
<td>12.8</td>
<td>Inland</td>
</tr>
<tr>
<td>15</td>
<td>Teheran, Iran</td>
<td>12.7</td>
<td>Inland</td>
</tr>
<tr>
<td>16</td>
<td>Karachi, Pakistan</td>
<td>12.2*</td>
<td>Coastal (P)</td>
</tr>
<tr>
<td>17</td>
<td>Istanbul, Turkey</td>
<td>11.9*</td>
<td>Coastal (P)</td>
</tr>
<tr>
<td>18</td>
<td>Los Angeles, California, U.S.A.</td>
<td>11.2</td>
<td>Coastal (P)</td>
</tr>
<tr>
<td>19</td>
<td>Dacca, Bangladesh</td>
<td>11.2*</td>
<td>On River</td>
</tr>
<tr>
<td>20</td>
<td>Manila, Philippines</td>
<td>11.1*</td>
<td>Coastal (P)</td>
</tr>
<tr>
<td>21</td>
<td>Beijing, People's Republic of China</td>
<td>10.8</td>
<td>Inland</td>
</tr>
<tr>
<td>22</td>
<td>Moscow, U.S.S.R.</td>
<td>10.1</td>
<td>Inland</td>
</tr>
<tr>
<td>23</td>
<td>Bangkok/Thonburi, Thailand</td>
<td>9.5*</td>
<td>Coastal (P)</td>
</tr>
<tr>
<td>24</td>
<td>Tianjin, People’s Republic of China</td>
<td>9.2</td>
<td>Coastal (P)</td>
</tr>
<tr>
<td>25</td>
<td>Paris, France</td>
<td>9.2</td>
<td>Inland</td>
</tr>
</tbody>
</table>

Note. – * = Annual population increase more than 2% yr⁻¹. (P) = Port Functions.


the nature of the shore and the land beyond. There are, in fact, definitions that encompass only a narrow strip of land like that of Chinese geographers who have considered 10 km landward and 15 m depth seaward from the water’s edge at mean tidal level as the coastal zone proper of their country (Mei-e-Ren, pers. com., 1988). Coastal zone formations, activities and resources treated here will be broader, noting that tidal influences may be felt well inland, especially in large rivers, tongues of which may also reach into the sea for 100 km or more.

Numerous efforts at global climate modelling have given us a gamut of very broad and general scenarios. In all of them there is stress on lack of data, on uncertainties in assumptions that had to be made, on the obvious complexity of the systems affected and above all on the difficulty of predicting their interactions. Desirability of regional or even sub-regional disaggregation is also generally acknowledged and a few constructions of regional scenarios have been attempted; Titus et al., 1985; Broadus et al., 1987; and MacCracken et al., 1987 are some examples.