

PLANNERS AND PLANNING FOR CLIMATE CHANGE.  
AN EXAMINATION OF SEA LEVEL RISE ISSUES FOR  
COASTAL SETTLEMENTS

by

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## ABSTRACT

This thesis focuses on the planning problems of anticipated increases in average global seas levels for coastal and island communities throughout the world. The combination of global warming repercussions, increasing population growth, and the evolution of megacities are discussed in the context of sustainable development in communities affected by rising sea levels. Inherent in these discussions are the related planning, political, and economic issues of equity and security of local, national, and international dimensions. Several country profiles are included from both the developed and less-developed nations to illustrate the similarities and differences among in their challenges and opportunities to deal effectively with global climate change.

It is argued that planners should act as "enablers", and that planning as a function of society has a specific responsibility to educate and prepare "the public" for global climate changes and sea level rise. The role of planning is discussed in the context of uncertainty in risk assessment, gaps in knowledge, constraints to planning, decision-making strategies, and coastal zone management in general. An overview of global, national, and local trends and preliminary actions taken to date are presented. It is argued that transitional measures and better decision-making strategies are required in planning, government policy development, future research, and education in order that all societies may move, more equitably, toward creating a sustainable future.

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## CHAPTER ONE

### GLOBAL CLIMATE CHANGE and SUSTAINABLE DEVELOPMENT

#### i) Introduction

To date, volumes have been written on global climate change. Problems such as the greenhouse effect, ozone depletion, and rising sea levels have been studied and debated with regard to their impact on all aspects of human life, as separate from associated ecological consequences in the natural environment. In reality current atmospheric change signals a "disequilibrium in human ecology" (Rees, 1990), which results from existing economic models of development which are based on growth, and which consider the natural environment as a static entity providing unlimited resources and a "sink" in which to dump human-produced wastes.<sup>1</sup>

Global climate change forms an integral part of any current environmental discussions as evidenced by the numerous publications, special committees, conferences, and institutions set up to specifically to address this phenomenon. At the heart of any discussion of climate change impacts, especially rising sea levels, is the more challenging issue of sustainable development. Together, the issues of global climate change and sustainable development represent the single biggest challenge (short of nuclear war), and window of opportunity -- economically and politically, of the twenty-first century. Thus, there is much

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<sup>1</sup> William E. Rees, (1990). "Atmospheric Change: Human Ecology in Disequilibrium", in The International Journal of Environmental Studies.

contentious debate over the causes, impacts, and appropriateness of action to be adopted.

The issues related to rising sea levels, indeed of global climate change in general, are plagued by attacks that many of the concerns, and the general level of anxiety surrounding them, are too broad, too vague at times, and too crisis oriented. However, contrary to the claims of these criticisms, the impacts of rising average sea levels upon coastal and island communities throughout the world are very specific in nature. They are more than just abstract impacts. Those affected have more than vague concerns, and both the land and its people affected are already and will continue to be experiencing serious to crisis-level repercussions on their economic, political, and cultural life.

Since atmospheric change is predominately a problem in human ecology (Rees, 1990), it is presented and argued in this paper that planners, and the role of planning, have a very specific responsibility to prepare their "publics" for the inevitable impacts of climate change wrought by the advancements of industrial development. As individuals, planners possess the skills and opportunities to educate both themselves and others, and therefore influence the planning process. In planning as a process of [or prelude to] action, opportunities exist for planners to be proactive in practice, as well as advocates and "big picture" thinkers utilizing existing knowledge and windows of opportunity to



effect a better, more secure future for all concerned.

This thesis, therefore, hopes to provide illumination of how economic, information, and cultural orders create "conditions of choice" that determines what options people see, and what choices they believe they are able to make (Boulding, 1983). Planning, as a function of society [human civilization], is therefore discussed as a vehicle by which climate change can and should be anticipated, addressed, and utilized in a positive way to create a truly sustainable future for all peoples everywhere. It is argued that better decision-making strategies are required to eliminate harmful economic and private activities, and that transitional measures are required on local planning and economic levels to help communities cope with changes in industry and lifestyles. By enacting transitional measures now eventually we will all be better off in the long run.

## **ii) The Problem**

### **a) Climate Change**

According to Rees (1990) in "Atmospheric Change: Human Ecology in Disequilibrium", there are two contrasting perspectives by which to examine the subject of atmospheric change in general; one, an ecological perspective which views "humankind as existing in a state of obligate dependency on the natural world", and two, an anthropogenic perspective which views nature or the physical

environment as merely a "static backdrop to human affairs".<sup>2</sup> The choice, and defence, of one perspective over another determines all current and future contexts for education, research, policy, planning, and action (or non-action). In short, it determines whether or not atmospheric change is perceived as a problem or crisis, or if it even exists, and whether or not something, fairly radical and very soon, should be done about it, or if and when anything can be done about it at all.

Over the past centuries former traditional cultures have continuously transformed themselves, their living environments, economies, and political systems from predominately rural-agrarian and small merchant economies to today's predominately western capitalist mode of industrial production based on growth. Much of this growth has occurred within coastal areas, wherein, it is currently estimated a full one third of the world's population currently lives within 60 kilometres of coasts.<sup>3</sup>

In this century, accelerating increases in greenhouse gases such as carbon dioxide (CO<sub>2</sub>), chlorofluorocarbons (CFCs), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O), have accumulated in the upper atmosphere resulting in gradual, but steadily rising global mean

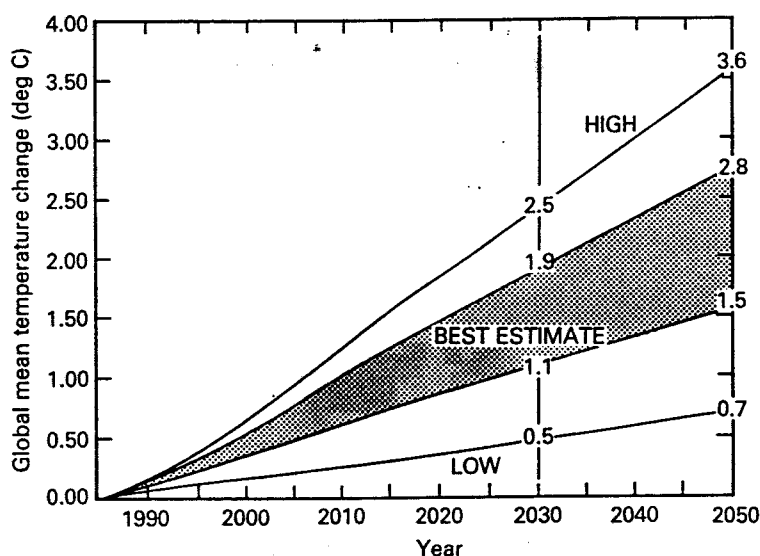
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<sup>2</sup> William E. Rees, (1990); Ibid.

<sup>3</sup> Al Gore, 1992. Earth in the Balance. Ecology and the Human Spirit; (Houghton Mifflin Company; New York, New York); page 104.

annual temperatures. Global atmospheric temperature has increased in the last 100 years by almost 1 degree Centigrade, and human activities threaten to further alter global average temperatures by up to 3-4 times that amount.<sup>4</sup> Human activities have driven up the concentration of carbon dioxide (CO<sub>2</sub>) levels from 300 ppm during the last ice age (17,000 years ago) to 335 ppm, with an anticipated rise to 600 ppm within the next forty years alone.<sup>5</sup>

**Figure 1 Model projections of global warming**



Source: Department of the Environment

Source: Department of the Environment (United States) in Martin Ince (1990). The Rising Seas. (Earthscan Publications Ltd.; London); page 27.

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<sup>4</sup> Al Gore, (1992), Ibid; pages 73 and 96.

<sup>5</sup> Al Gore, (1992), Ibid.; page 95; 130,000 years ago, at the end of the next to last ice age, CO<sub>2</sub> levels were less than 200 ppm.

This warming trend affects air current patterns, precipitation levels, movements of ocean currents, frequency and intensity of storms, and land-based glacial melting. This artificial warming<sup>6</sup> of the upper atmosphere is also leading to ozone depletion, reduced oxidation, and rising sea levels among other ecological problems.

#### **b) Global Warming and Sea Level Rise**

The cenozoic era in which we live began approximately 65 million years ago with the disappearance of the dinosaurs. At that time, the global mean annual temperatures were only 1-2 degrees Celsius warmer than those of today at 15 degrees Centigrade.<sup>7</sup> Anthropological evidence of human occupation along the existing coastal regions date back to approximately 1.2 million years ago.<sup>8</sup> For the past 6,000 years humankind has continuously adjusted its activities and settlements by the advances and recessions of the shorelines, with port construction and coastal settlements dating back to the 4th century. However, the most intense utilization of the coastal regions and resources has occurred within the last few centuries. Because these coastal regions serve diverse human needs

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<sup>6</sup> "Artificial" warming of the earth's atmosphere is defined in this paper as human-caused global warming, as opposed to the "natural" accumulation of greenhouse gases in the atmosphere as a byproduct of physical evolution.

<sup>7</sup> J. Lovelock (1988). "Man and Gaia" in The Earth Report. eds. E. Goldsmith and N. Hillyard; Mitchell Beazley; (Price Stern Sloan; London; Los Angeles.) in Gore (1992), Op. Cit.; page 95.

<sup>8</sup> S. Schneider (1983), "CO<sub>2</sub>, Climate and Society" in Robert S. Chen, et al. Editors Social Science Research and Climate Change. (D. Reidel Publishing Company; Dordrecht, Boston); page 9.

for food, energy, transport, recreation, urban development, industry, agriculture, forestry, fisheries, and trade, government policies have traditionally encouraged increasing population and industrial densities within these coastal zones.

Although sea levels have risen and fallen throughout the various geological periods, "never has the change been anywhere near as rapid as that now expected as a consequence of global warming" (Gore, 1992). At the end of the last ice age (approximately 20,000 years ago), global average sea levels were about 300 feet lower than they are today. Large areas of the continental shelf were exposed as dryland and shallow ocean straits, with the existing Bering Strait and the Gulf of Carpentaria acting as landbridges. These bridges provided migratory routes for the present-day aborigines into Australia, and the Asiatic nomads into North and South America. As the glaciers later retreated, sea levels rose once again (about 10,000 years ago) trapping the new migrants on their present-day continents. At the same time, as temperatures climbed, the global climate system settled into a pattern that it has roughly maintained ever since, up until this century.<sup>9</sup>

According to Dr. Irving Mintzer, Director of Policy Research at the Center for Global Change, University of Maryland, a small increase in temperature of 2 to 5 degrees Fahrenheit can be

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<sup>9</sup> Gore (1992), Op. Cit.; page 61.

expected early in the next century. He states, that "even a warming of just two degrees would take the planet outside the temperature range which has been experienced in the last 10,000 years".<sup>10</sup> Global warming raises sea levels in several ways: through higher average temperatures, through the discharge of ice into the ocean from land-based glacial melting in Antarctica and Greenland in particular, and through the thermal expansion of the volume of the sea as its waters gradually warm.<sup>11</sup> In terms of sea level rise, on a gentle slope (20:1, horizontal to vertical), ignoring subsidence and uplifting, a 1-meter rise would raise a tide landward by 20 meters (65.6 feet).<sup>12</sup>

Warmer temperatures accompanied by rises in sea level affect tidal flooding, oceanic currents and upwelling patterns, frequency and intensity of storms, changes in biological processes (especially for inundated coral reefs), landmass runoff and erosions patterns (already negatively affected by large dams such as the Aswan in Egypt), and increases in saltwater intrusion into estuaries, rivers, groundwater, and agricultural soils. Moreover,

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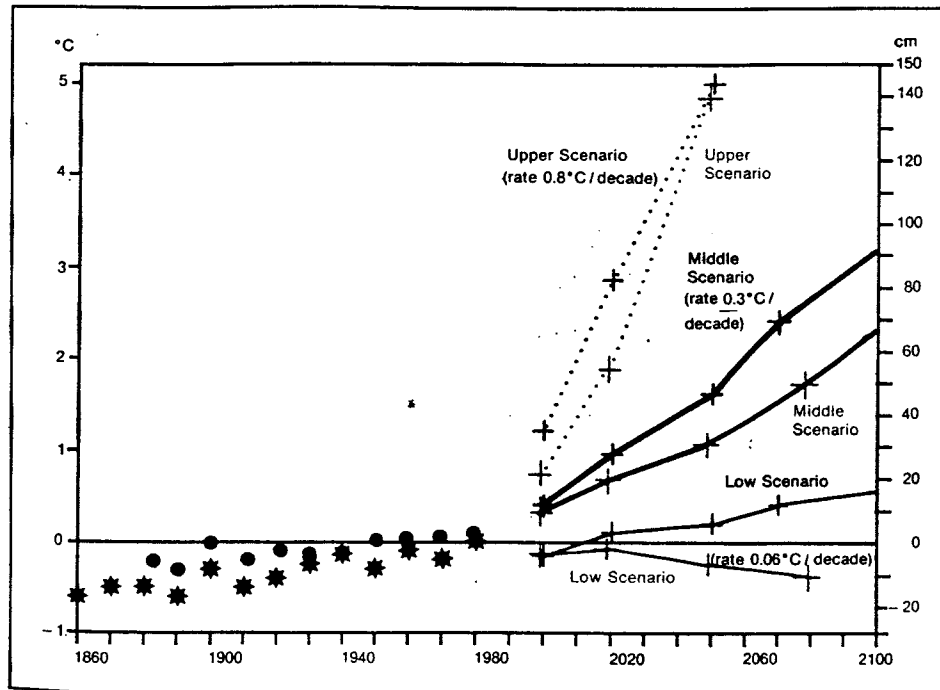
<sup>10</sup> Don Hinrichsen (1990), Our Common Seas. Coasts in Crisis. (Earthscan Publications Ltd.; London in association with United Nations Environment Programme; Nairobi); page 20.

<sup>11</sup> It is the "land-based" glacial melting, and not the melting of ice bergs in the ocean, which causes sea levels to rise. The large majority of the ice on earth is in the form of land-based glaciers.

<sup>12</sup> Lynne T. Edgerton (1991), The Rising Tide. Global Warming and World Sea Levels. (Natural Resources Defense Council/Island Press; Washington, D.C. and Covelo, California); page 24.

increased storm intensities and frequencies would cause serious property damage to coastal structures, human injury and death.

**Figure 2** Global Sea Level Change (cm)  
Global Temperature Change



*Global temperature and sea level change, historic and projected. To 1980, based on measurements. Upper scenario: with continued growth in energy use as at present. Middle scenario: stabilized emissions to the atmosphere. Lower scenario: with drastically reduced emission of greenhouse gases. (From J. Jaeger, *Developing Policies for Responding to Climatic Change*, World Meteorological Organization, April 1988.)*

Source: In Constance Mungall and Digby J. McLaren, Editors (1990). Planet Under Stress. For the Royal Society of Canada (Oxford University Press; New York, Toronto); page 65.

One of the most widely recognized impacts of global warming today is the rise of sea levels and the subsequent loss of low-lying coastal areas around the globe. Approximately 125,000 years ago during an interglacial warming period, sea levels rose

drastically by about twenty-three feet. Until 1991, scientists in general tended to discount the possibility of that catastrophe's reoccurrence for at least another 200-300 years. However, in 1991 Dr. Robert Bindschadler of NASA, one of the leading experts on West Antarctica, testified before a U.S. subcommittee that "new samplings from the bottom of the ice sheet now show dynamic and dangerous changes". As a result of these findings, Dr. Bindschadler has now shorten his earlier time frame for the anticipated breakup of the West Antarctica ice sheet as global temperatures continue to climb.

Similarly, early in 1992 two leading experts on glaciers, Lonnie and Ellen Thompson of the Bryd Polar Research Center at Ohio State University, reported that "all mid-and low-latitude mountain glaciers are now melting and retreating -- some of them quite rapidly -- and the ice record contained in these glaciers shows that the last fifty years have been much warmer than any other fifty year period in 12,000 years".<sup>13</sup> As a result, sea levels are steadily rising, almost one inch per decade to date, resulting in salt water intrusion into fresh water aquifers in coastal areas, the loss of coastal wetland areas, the loss of habitable residential and agricultural lands, and the loss of solid ground on which to carry on business as usual.

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<sup>13</sup> Al Gore (1992), Op. Cit.; page 105.



iii) Why is it important?

The critical point to understand here it is that only small, overall fluctuations in mean annual temperatures built up over time possess the potential to create completely new atmospheric environments, thus dramatically altering whatever the current "status quo" or equilibrium state of ecological existence. In "Atmospheric Change: Human Ecology in Disequilibrium", Rees explains that,

Living things evolve in dynamic relationship with each other and their physical environments. Over geological time, this unconscious mutualism has produced an ecosphere of intricate structure and relationship. The structural components of the ecosphere include everything from simple inorganic chemicals to entire ecosystems. These components **do not exist in static isolation** but are dynamically related through the continuous recycling of matter and a steady throughput of energy. The entire system is driven by an external source of energy, the sun.

From this perspective, **it is critical to recognize that the ecosphere shares a singularly important property with individual living organisms: at the whole system level, the ecosphere is continually self-organizing and self-producing.** The major components of the ecosphere are interdependently linked in a network of transformations and processes whose integrity is essential for the production and maintenance of the components themselves. **This type of self-perpetuating relationship is defined as autopoietic organization.**<sup>14</sup>

A most important implication of autopoietic organization should already be clear: **much of what we have been pleased to call "the environment" is actually the product of life itself.** Thus, the historic organization of the ecosphere is neither inconsequential nor indifferent to change. The removal of key components or the disruption of particular relationships could change the fundamental nature of the system. We have long known that a given species requires a particular set of environmental

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<sup>14</sup> Originally from, H. Maturana and F. Varela, (1988) The Tree of Knowledge (New Science Library; Boston); page 42.

conditions for survival, but [we] are unaccustomed to thinking that those environmental conditions are themselves dependent on the distribution, abundance, and interaction of species. [Emphasis added]

In contrast to these "natural" laws, Rees (1991), among others, reports that industrial society has always regarded "the environment" as a storehouse of resources and a sink for wastes".<sup>15</sup> In other words, "nature [as] a static backdrop to human affairs." Rees states that, "From this perspective, anthropogenic changes in atmospheric gases are perceived as isolated technical problems or as mere "externalities" resulting from market imperfections".<sup>16</sup> However, as a result of i) human activities, past and present, and ii) the normal course of ongoing evolutionary processes, albeit at a more rapid pace than in the past and certainly a more deleterious one at that, there now emerges the spectre of global climate change as the new ecological reality leading into the twenty-first century.

Inherent in this new reality are continuing trends of global warming, ozone depletion, and sea level rise among other, as equally as serious, consequences. According to Canada's Standing Committee on the Environment's 1988 Report, "The Changing Atmosphere: Implications for Global Security",

Humanity is conducting an unintended, uncontrolled, globally pervasive experiment whose ultimate consequences

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<sup>15</sup> William E. Rees (1990), Op. Cit.

<sup>16</sup> Rees (1990), Ibid.

could be second only to nuclear war.<sup>17</sup>

Similarly, now Vice-President of the United States, Al Gore writes in his book, Earth in the Balance,

... the artificial global warming we are causing threatens far more than a few degrees added to average temperatures; **it threatens to destroy the climate equilibrium we have known for the entire history of human civilization.** As the climate pattern begins to change, so too do the movements of the wind and rain, the floods and droughts, the grasslands and deserts, the insects and weeds, the feasts and famines, the seasons of peace and war.<sup>18</sup>

Gore reports Sir Crispin Tickell, a leading British diplomat and environmentalist, stated in a 1989 speech to the Royal Society of London that,

... a heavy concentration of people is at present in low-lying areas along the world's great river systems. Nearly one third of humanity lives within 60 kilometres of a coastline. A rise in mean sea level of only 25 cm. would have substantial effects ... a problem of an order of magnitude which no one has ever had to face ... in virtually all countries the growing numbers of refugees would cast a dark and lengthening shadow.<sup>19</sup>

Today, the developed nations throughout the world possess the ability and resources to insulate most people from the impacts of rising sea levels to some degree. However in the past, populations at risk merely relocated to other, more habitable grounds. In the still developing countries there are few, if any, resources,

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<sup>17</sup> Canada, Conference Statement in The Changing Atmosphere: Implications for Global Security; Toronto, Canada; 27-30 June, 1988. In Standing Committee on the Environment's Report of same title, published by Environment Canada, Ottawa (June, 1988); page 3.

<sup>18</sup> Gore (1992), Op. Cit.; page 98.

<sup>19</sup> Gore (1992), Ibid.; page 74.

capabilities, or other, more habitable grounds. While different regions around the world will be affected differently by climate change impacts, so too will the world's various populations, depending largely upon whether one is rich or poor. The poor nations, and island communities, will be hardest hit, with their substantial populations, meagre resources, and with few or no relocation possibilities.

So while social and physical scientists, political scientists and economists, and even planners struggle to grapple with the existing layers of cultural transitions which have already occurred, another layer of transformation is already engulfing them -- the role of climate change in the coming century. Thus, this is hardly the time for "business as usual". Planners in particular need pay special attention to the issue of global climate change. Every land use approval, via bylaw, zoning, municipal or rural plan of development is affected and dictated by the weather system and geographical underpinnings of their area. This is only common sense. However it is taken for granted by nearly all professionals in any given field that their physical environment is a "given" -- a static "fact" of little consequence in the overriding objective of feeding, housing, employing, and caring for people.

Over the past few decades Coastal Zone Management has evolved as a specialized field of planning in North America. In the Netherlands, coastal zone management has always been an ongoing

part of development. In Venice, foolish politicians and greedy developers have conveniently forgotten the care required to maintain their lovely, floating, city. Throughout the coastal states of North America, in the Carolinas, in Florida, Texas, and California the weather system has always ravaged the coasts. Emergency planning has also evolved as a specialized field of planning alongside coastal zone management to service these "special needs" places. Unfortunately, by its very nature, emergency planning is a reactive profession, based upon the presumption of a crisis that is short-term in nature, an out-of-the-normal occurrence of everyday life and planning in general. It sweeps in to save the day, hoping against hope that the crisis is never as bad as it could be, and that maybe some responsible parties had the good foresight to plan ahead.

**iv) What are the critical issues?**

**a) Uncertainty ...**

A working definition of uncertainty for planners could be as follows:

A condition to which a probability could not be attached. If such a probability could be attached, then uncertainty is transformed into a risk.<sup>20</sup>

With regard to climate change and rising sea levels there is uncertainty about the process, uncertainty about the range of

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<sup>20</sup> Janet L. Moore and Andrea LaCasse (1991), "Uncertainty and Complexity: Problems Endemic to Emergency Planning in Coastal Zone Management" (unpublished paper and presentation, School of Community & Regional Planning, University of British Columbia; Vancouver).

alternatives, and uncertainty about the public response to alternatives. There is also some uncertainty about the phenomenon itself.<sup>21</sup> In the real world there is no such thing as absolute certainty. It would be presumptive of mankind to argue otherwise. It would entail that humanity has not only found all the answers to all the world's problems, but incredulously, has thoroughly grasped the depth of the problems in the first place. Certainty belongs in a laboratory petri dish where all the variables are controlled, and infinitely controllable.

The world's leading atmospheric scientists are not in debate over the "facts" as they perceive them regarding global climate change. They are in debate over the "anticipated impacts" -- the when, where, and by how much questions. They are in full agreement that human activities in this century have profoundly impacted upon, and are changing, the chemical composition of the atmosphere. And, to a fairly good extent, they have managed to convince a number of world leaders that a) there is a problem, and b) that everybody should be doing something about it.

There are both tremendous opportunities as well as challenges inherent in changing climate patterns. Impacts of such include biophysical, social and cultural, economic, and insitutional and political aspects. Any of which can easily be perceived as a planner's nightmare, because frankly, people are substantially less

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<sup>21</sup> Moore and LaCasse (1991), Ibid.

receptive to change than the weather, for good or bad. According to Dr. Boutros Boutros-Ghali, United Nations Secretary General, "Despite uncertainty as to the rate of global warming, decisive precautionary measures are urgently needed."<sup>22</sup> And, they are urgently needed because of the inherent uncertainty of our ability to understand and adapt to, in time, changing evolutionary circumstances. Life itself is vulnerable, only of this are we certain.

**b) Sustainable Development ...**

As urban planners we need to ask ourselves "what if?" and "so what?" types of questions regarding current discussions of climate change impacts in general. What if climate change is occurring, as international scientific consensus suggests? So what if it does? What if carbon dioxide (CO<sub>2</sub>) doubles from current levels, and global warming increases? And, so what if it does? Finally, what if sea level rise is inevitable? And, so what if it is? These types of questions move us away from purely crisis-oriented thinking, and provides us with a starting point to remove the vagueness often surrounding environmental debates in general. It is human nature to perceive "change" as a crisis, as problematic.<sup>23</sup> The singularly

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<sup>22</sup> World Meteorological Organization (1992), Climate Change. Environment and Development. World Leaders' Viewpoints. (Secretariat of the World Meteorological Organization; Geneva, Switzerland); Forward, page xii.

<sup>23</sup> A unique interdisciplinary research project undertaken by the American Association for Atmospheric Sciences (1979-80), Environmental and Societal Consequences of a Possible CO<sub>2</sub>-Induced

most important point is that all coastal areas are vulnerable to the ravages of weather, and the seas. They are not inherently, nor indefinitely, sustainable geological entities. Whether or not the issues of climate change are perceived as a crisis depends largely upon whether one is rich or poor.

The impacts of climate change will affect poor nations differently than rich nations, rural areas different from urban areas, and geographical regions or entities, such as islands, different still. Most importantly, climate change will produce both opportunities and challenges to global society overall. However, this said, it cannot be over-stressed that the human-induced changes to the world's physical environment entails a very narrow window of opportunity, and many considerable challenges, with regard to current and future populations living within coastal urban centres, particularly in the still developing countries.

While "what the poor perceive in times of stress is rarely studied ... there is general agreement that they endure the biggest adaptation costs".<sup>24</sup> Thus, we have to stop looking at issues of urban planning as if they were totally separate, and distinct, from issues and activities related to the natural environment which

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Climate Change discussed in Robert S. Chen, E. Boulding, and S. Schneider, Editors (1983), Social Science Research and Climate Change (D. Reidel Publishing Company; Dordrecht, Boston).

<sup>24</sup> Jim MacNeill, John Cox, David Runnalls (1989), CIDA and Sustainable Development. (The Institute for Research on Public Policy; Halifax, Nova Scotia); pg. 43.



supports all human activities. Despite recent global initiatives to discuss, and act in accordance with, global climate change, we still have a fundamental flaw in our mindset, addressing concerns as merely technical and economic problems requiring quick-fix approaches and solutions.

The issue of sea level rise is particularly contentious because it affects all aspects of human society from a planning point of view. Wet rice and other forms of agriculture in low-lying coastal areas is not sustainable if water levels rise, and salt water intrudes. Residential communities are not sustainable for the same reasons. Tourism as an economic livelihood is not sustainable if beaches are washed away, and coral reefs inundated. Coastal developments of any kind located in regions subject to tsunamis, storm surges and hurricanes, are not sustainable if these natural hazards accelerate in their frequency and intensity.

These are just some of the impacts of atmospheric change. There are a multitude of other ecological repercussions including the spread of disease, pests, and loss of habitat and vulnerable species of flora and fauna. Throughout history, human civilization has continuously adapted their existence to the vicissitudes of the climate. And history has already shown us nature is neither infinitely sustainable in form, nor ultimately controllable in function. Therefore, that only leaves the dilemma of sustaining current human activities, in form and function. How we choose to

utilize existing resources shapes our future history -- socially and physically. If "the past is a foreign country", the future remains foreign territory, waiting to be sustained.<sup>25</sup>

#### **v) Presentation of Material**

This thesis focuses on the problems of sea level rise in the coastal cities throughout the world as a result of global climate change stemming from the "greenhouse effect". The combination of global warming, increasing population levels, and the increasing trend of urbanization are discussed in subsequent chapters as consequences of contemporary urban growth and change which has resulted from patterns of economic development to date. In Chapter Two, several country profiles are included which cover both the developed, and the still developing urban coastal cities and nations. Current circumstances and anticipated impacts are presented, along with some of the local planning and government responses to date. The range of planning responses required to address these coming changes is presented in Chapter Three, in the form of a working "list" as a preliminary starting point for action. The issue of "uncertainty" in planning is again addressed, taking a closer look at specific problems, the gaps in knowledge, and the constraints to proactive planning approaches. Chapter Four concludes with an analysis of the problems, proposed solutions, and initiatives on a global level to address climate change in general,

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<sup>25</sup> David Lowenthal (1985). The Past is a Foreign Country. (Cambridge University Press; Cambridge, Massachusetts).

and sea level rise in particular.

This paper is not about exploring, in minute detail, the physical mechanisms of the Greenhouse Effect. It is not about arguing whether a quantity of "x" will produce a "y" affect. This paper merely outlines the basic precepts behind global climate change because the voluminous scientific literature more adequately addresses the scientific details and analysis of the problem. Instead, this paper details the currently experienced problems, as well as those anticipated, with regard to sea level rise impacts. This information is presented in the context of examining the role of human activities in creating global climate change, and the role of planners in addressing it.

The problems and concerns over sea level rise in particular were chosen over other, equally as serious, environmental and human problems affecting planning because, I believe, rising sea levels provide a more "visual" example of arising planning dilemmas. The loss of land upon which to live, play, and work can be visually appreciated with greater ease than can, for instance, ozone depletion, or CO<sub>2</sub> build-up, or decreased oxidation -- all serious implications of global warming. If the land beneath your feet is vanishing, or if your drinking water is contaminated by intruding salt water, you know it -- immediately. There is no need to "wait and see" until all the "facts" are in. And, you can feel the immediate consequences of it -- economically and politically. Few

of us can walk on water.

Also, the problem of rising sea levels is currently the most widely recognized as one of the strategic threats arising from global warming as a result of human activities. As United States Vice-President Al Gore states,

In the course of **a single generation**, we are in danger of changing the makeup of the global atmosphere far more dramatically than any volcano in history, and **the effects may persist for centuries to come**. The global temperature changes for which we are responsible are **likely to be five times larger than the fluctuations that produced the Little Ice Age**, for example, or the global climate change that led to the Great Famine of 1314-17.<sup>26</sup>

According to Professor Obasi, "Climate and climate change will certainly have an effect on the future sustainable development of much of our planet's resources such as those relating to biodiversity, water, forests, land and oceans as well as in relation to various sectoral activities like agriculture and industry."<sup>27</sup> Therefore, it is argued that if the physical systems which govern these habitats cannot be incorporated into discussions of regional planning, and specifically urban planning, then societies have little hope to adequately respond to inevitable change. The result could be, (as we have already begun to see), a **series of crises compounded by the hopelessness of a future without "other options"**. What happens at a local level, in increasingly

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<sup>26</sup> Al Gore (1992), Op. cit.; page 74.

<sup>27</sup> Professor G.O.P. Obasi (1992), Climate Change. Environment and Development. World Leaders' Viewpoints. (World Meteorological Society; Geneva); Forward, page v.

urbanized centres, compounds into regional dynamics, and further escalates into global issues of equity and security.

The impacts of our fundamental flaw in our thinking (that until recently we did not consider the linkages of development to the physical environment which supports it), is not limited to worst-case scenarios for the urban poor in the still developing countries. On the contrary, it signals the decline of economic and political stability (not to mention environmental viability) of all cities, regions and nations around the world situated in coastal areas. With this foreshadowing of the future in mind, we now begin the journey toward the future, with a first look at where we are at, and where we might be headed.

## **CHAPTER TWO**

### **SEA LEVEL RISE IN COASTAL & ISLAND COMMUNITIES**

#### **i) Introduction**

##### **a) Current Conditions:**

The country, city, and island profiles which follow focus on discussions of pending sea level rise impacts, and some planning initiatives to date, in order to illustrate the pervasive problems involved. The profiles selected were chosen for three main reasons: First, both the developed and the developing countries share common environmental problems and risks as major coastal centres which support both economies and populations that are affected by global changes in sea level rise (with regional variations). For example, these urban centres possess extensive coastline areas, as well as areas of low-lying terrain, as part of their geographical make-up.

Second, the international development agencies continue to concentrate their development programmes within existing coastal centres already at risk, thus investments to date in infrastructure, as well as community development in general are at risk. For the developed and the newly-industrialized countries (NICs), this means substantial economic investment, as well as future hope, has already been invested. Furthermore, increasing urban development in coastal zones by local governments in the Third World have also concentrated the bulk of their economic

assets in zones at risk to rising sea levels (Ince, 1990).<sup>28</sup>

Third, massive food-producing areas in the developing countries, like the deltas of the Mekong, the Yangtze, and the Nile are especially vulnerable to impacts of sea level rise. Furthermore, many of these countries are heavily dependent upon their coastal resources to support burgeoning populations -- which are increasingly being concentrated in urban centres, for example, the cities of Calcutta, Lagos, Rio, Cairo, and Bangkok are all near sea level. Thus, the following profiles represent those geographical regions most vulnerable to rising sea levels, including Southeast Asia, Australia, the South Pacific Islands, the Hawaiian Islands, the United States, and the Mediterranean and Nile regions. The United Nations Environment Program report (1989) specifically cited Bangladesh, Thailand, Indonesia, The Maldives, Pakistan, Egypt, Mozambique, The Gambia, Senegal, Surinam (see also Table 1) as the ten developing countries most vulnerable to sea level rise.<sup>29</sup>

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<sup>28</sup> Martin Ince (1990), The Rising Seas (Earthscan Publications Inc.; London); page 58.

<sup>29</sup> Originally cited in UNEP Report, "Criteria for Assessing Vulnerability to Sea-Level Rise: A Global Inventory to High Risk Areas" (Delft, Netherlands: Delft Hydraulics Laboratory, 1989); referred to by Martin Ince (1990) The Rising Seas. (Earthscan Publications; London); page 58.

**Table 1 Ten Countries Most Vulnerable to Sea Level Rise**

Countries	Population	Per Capita Income
	(million)	(dollars)
Bangladesh	114.7	160
Egypt	54.8	710
The Gambia	0.8	220
Indonesia	184.6	450
Maldives	0.2	300
Mozambique	15.2	150
Pakistan	110.4	350
Senegal	5.2	510
Surinam	0.4	2,360
Thailand	55.6	840

Sources: United Nations Environment Programme, *Criteria for Assessing Vulnerability to Sea-Level Rise: A Global Inventory to High Risk Areas* (Delft, Netherlands: Delft Hydraulics Laboratory, 1989); income and population data from Population Reference Bureau, *1989 World Population Data Sheet*, Washington, D.C., 1989.

Source: in Martin Ince (1990). The Rising Seas. (Earthscan Publications Inc.; London); page 59.

According to recent studies (Yap (1989) and MacNeill (1989)), the processing and consumption of vast amounts of natural resources, both renewable and non-renewable, and the generation of waste and pollution are being increasing concentrated in, and driven by, the needs of ever-growing urban centres.<sup>30</sup> These urban centres have thus become the engines or perpetrators of climate change, leading to global warming through the greenhouse effect. For the coastal communities in the less developed countries a

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<sup>30</sup> Derived from a paper by Nonita Yap, Environmental Protection in Developing Countries and Canadian Development Assistance (Ottawa: Institute for Research on Public Policy, 1989), discussed by MacNeill, et al. (1989) in CIDA and Sustainable Development; (The Institute for Research on Public Policy; Halifax, Nova Scotia); page 49.



multitude of issues arise with regard to sea level rise, compounding existing problems of landlessness, poverty, inadequate shelter and services, and threats to national security. For coastal communities in the already developed countries, substantial economic and community losses are also a major factor. Therefore the examples which follow demonstrate the interaction of climate change with already existing problems for coastal urban centres at risk from sea level rise impacts, among other greenhouse factors.

**b) Projected Future Conditions:**

World population levels currently stand at 5.3 billion people according to the best United Nations estimates, with an increase to 6.3 billion expected by the year 2000. Approximately 45.2 percent of the world's population is currently based in urban centres. In the developing countries this represents about 1.3 billion people with a predicted increase to 2 billion by the year 2000, and a further increase to 3.8 billion by 2025. These figures represent an increase in urban populations overall to 51.1 percent by the year 2000, up from the current 45.2 percent.

The important point here is that we are living in an increasingly urbanizing world.<sup>31</sup> Furthermore, approximately 61% of the world's current population reside within coastal zones, more

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<sup>31</sup> Figures derived from two sources: A. Laquian, "The Urban Challenge: Urbanization Trends and Challenges in the 1990s" (Centre for Human Settlements, University of British Columbia; Canada); and J. MacNeill, et. al. (1989) CIDA and Sustainable Development. (The Institute for Research on Public Policy; Halifax, Nova Scotia).

specifically in major urban centres which are vulnerable to sea level rise (see Fig. 3). In 1985, an international conference sponsored by the World Meteorological Organization in Villach, Austria reported an expected rise in sea-level within the next 50 years between 20-140 cm caused by either land-based glacial melting and through the thermal expansion of oceans.<sup>32</sup> In terms of sea level rise, generally a 1 cm rise in sea-level will cause the shoreline to retreat 50-100 cm, therefore a rise of 20-30 cm in the next 50 years would probably cause a sandy beach shoreline to retreat shoreward by 10-30 meters.<sup>33</sup> According to Edgerton (1991), on a gentle slope (20:1, horizontal to vertical), ignoring subsidence and uplifting, a 1-meter rise would raise a tide landward by approximately 20 meters (65.6 feet).<sup>34</sup> Where will these populations relocate?

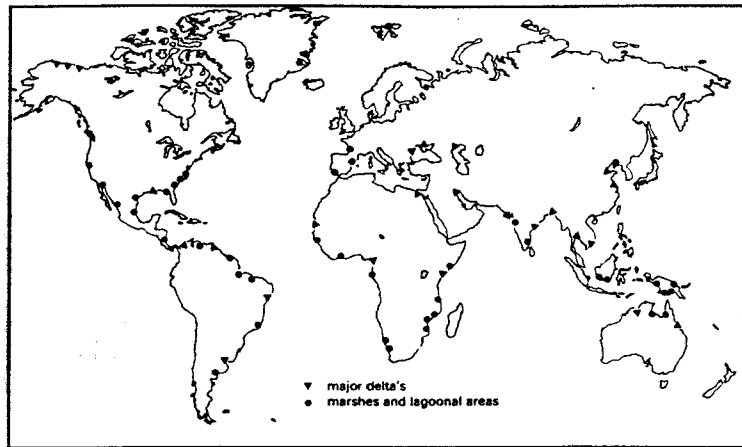
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<sup>32</sup> World Meteorological Organization (1986) Report of the International Conference on the Assessment of the Role of Carbon Dioxide and other Greenhouse Gases in Climate Variations and Associated Impacts, No. 661. (Villach, Austria).

<sup>33</sup> Edward Bryant (1991), "Sea Level and Greenhouse: Planning for change" in Australian Planner, March 1991; page 28. Bryant is a geographer at the University of Wollongong, Australia. He provides a detailed discussion of measurements, impacts and planning responses, especially with regard to Australia.

<sup>34</sup> Lynne T. Edgerton (1991). The Rising Tide. Global Warming and World Sea Levels. (Natural Resources Defense Council. Island Press; Washington, D.C. and Covelo, California); page 24.

**Figure 3 Areas Vulnerable to Rising Sea Level**



Source: Environmental Protection Agency

Source: in Martin Ince (1990). The Rising Seas.  
(Earthscan Publications Inc.; London); page 128.

In addition to increasing population levels, it is currently anticipated that more than 28 urban centres will become megacities by the year 2000 with populations of 25 million or more (as is currently the case in Mexico City); 22 of these cities will be in the developing countries. According to Aprodicio Laquian, Director of the Centre for Human Settlements, at the University of British Columbia, "while mega-cities of eight million or more are growing rapidly, agglomerations of five million or more are growing even faster". Thus, this "spreading urbanism as a way of life" will place accelerating pressures on the physical environment and resources for these areas. Furthermore, it is urban lifestyles and development which, to date, have promoted global warming through escalating production of, and accumulations in, greenhouse gases.

Professor Obasi, Secretary-General of the World Meteorological Organization states that, "... climate change is one of the central areas of concern which is part of the current world-wide attention on the theme of environment and development."<sup>35</sup> The uncertainty generated by climate change, increasing population levels, and the evolution of megacities adds considerably to the current debate of sustainable development, for present and future generations.

## ii) City and Country Profiles

The following profiles represent a collective glance at what is currently known, and anticipated, about the impacts of sea level rise upon these coastal communities. The profiles differ in the type of information they provide because each place possesses a unique environment, each with its own problems peculiar to their physical environment, and social, political and economic circumstances. Following the profiles is a discussion at greater length of the impacts for planning in general, and the global community at large, identifying key impacts for urban infrastructure and economic systems in particular.

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<sup>35</sup> G.O.P. Obasi (1992) in Foreword to Climate Change. Environment and Development. World Leaders' Viewpoints. (Secretariat of the World Meteorological Organization; Geneva, Switzerland); page v.

**a) The Developed Countries:**

**THE UNITED STATES**

The United States has a total of 25 coastal states which are subject to sea level rise impacts, (not including the Great Lakes states, Puerto Rico, Virgin Islands, Northern Marianas, American Samoa, and Guam). Although each coastal area possesses unique characteristics and responses, there are several common themes. First, the shape of coastlines will be altered resulting in the loss of coastal land and marshes, disruption of transportation, and eventually the loss of upland areas. Second, changes in tidal circulation will cause increased wave action, increased flooding, and impeded drainage. Finally, the chemical and mineral makeup of the water will change. In many areas, the rate of sedimentation will slow down. Increased salts and chlorides will harm irrigated crops and poison groundwater, thus destroying the drinking water supply for local populations.

In May 1986 the National Resource and Defence Council distributed a questionnaire to coastal managers in each of the coastal states requesting information concerning state and local planning efforts, including studies, plans, and legislation, that the states and local governments were undertaking to address problems ensuing from sea level rise. To date, sixteen coastal states have already initiated studies of sea level rise and its

effects on their coastal regions.<sup>36</sup> Although sea level rise was not taken into account in designing most coastal zone management programs, the Klarin and Hershman report (1990) concluded that "Despite the magnitude of potential problems, the challenges presented by a sea level rise are not unmanageable". They stated that a number of laws and policies already in place could be used to address the problems that must be faced. Maine, South Carolina and San Francisco Bay area have already adopted policies which respond to sea level rise.<sup>37</sup> However, despite the confidence of the Klarin/Hershman report, Edgerton reports that local studies have consistently proved that "effects [of sea level rise] will be devastating throughout the coastal U.S.", thus suggesting that perhaps the confidence expressed by Klarin and Hershman is both premature and too optimistic. More recent events in Florida in 1992 and California in 1993, among other southeastern states, appear to support the latter view.

#### CALIFORNIA

Currently, over 60% of California's population lives within coastal counties and this percentage is expected to increase. The California coastline is comprised of cliffs, beaches, and a variety of wetland types stretching over 1,100 miles. Approximately 86% of this coastline is presently eroding. Almost 10% of the eroding

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<sup>36</sup> P. Klarin and M. Hershman, "Response of Coastal Zone Management Programs to Sea Level Rise in the United States", Coastal Management 18(3), Summer 1990 in Edgerton (1991) Op. Cit.

<sup>37</sup> Edgerton (1991), Op. Cit.; page 49.

areas have hardened shoreline protective structures, and additional sections employ nonstructural protective methods.

California has a geologically active coastline as does Washington State, and British Columbia in Canada. Therefore in calculating relative sea level rise, local land subsidence and uplift must be taken into account. According to Edgerton in The Rising Tide, the areas of Santa Barbara and Ventura counties are currently undergoing uplift, while the areas of Humboldt and San Mateo counties are undergoing subsidence. Edgerton reports that even those areas undergoing rapid rates of coastal uplift will still experience beach erosion, bluff retreat, and submergence of lowland areas; with the greatest impact occurring in low-lying areas, which would be completely inundated. Moderately severe impacts will occur in areas with broad beaches or fragile coastal bluffs protected by loose rocky material. The least impact will occur in areas of resistant, steep coastal cliffs.<sup>38</sup>

Edgerton reports "Assuming that a low sea level rise by the year 2050 would be 0.1 meter, a moderate rise by 2050 would be 0.3 meter, and a high rise by 2050 would be 0.45 meter" a recent study has estimated the following impacts are likely to occur:<sup>39</sup>

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<sup>38</sup> Lynne T. Edgerton (1991), Ibid; page 50.

<sup>39</sup> Based on a study by the California Coastal Commission, Draft Report: Planning for an Accelerated Sea Level Rise Along the California Coast, prepared by Lesley C. Ewing, Jaime M. Michaels, and Richard J. McCarthy, June 26, 1989; prepared by the staff of the California Coastal Commission to investigate possible effects

- \* Sea level rise will exacerbate existing erosion problems and cause erosion and cliff retreat in **currently stable areas**.
- \* Coastal beaches will be reduced in size. Coastal beach retreat between 30 to 200 feet can be expected by the year 2050.
- \* In some areas, 35 to 100 percent of existing wetlands could be lost if development prevents upland migration.
- \* Higher water levels and wave forces will increase the uplifting forces on piers and erosion of foundation supports.
- \* Harbours may experience greater wave action, and higher water levels will adversely affect loading and unloading of cargo ships.
- \* Existing protective structures such as breakwaters, seawalls, and revetments will not be able to provide their current level of protection due to increased forces, erosion, and overtopping.<sup>40</sup>

Throughout the American coastal states similar impacts would result, in particular the San Francisco Bay area, the Delaware Estuary, Massachusetts, Hawaii (see island communities discussion), the surrounding Great Lakes districts, and Louisiana. These impacts would also apply, to varying degrees, up along the entire Pacific Northwest coastline extending into British Columbia, Canada. However, although the San Juan de Fuca is a geologically active area, the northern Pacific Coast has been relatively more stable in terms of coastal erosion impacts than its' Atlantic

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on the California coast from an accelerated sea level rise. The report had not been approved by the commission at the time of publication; Edgerton page 50.

<sup>40</sup> Case study excerpt from Edgerton (1991), Op. Cit.; pages 50-51.



counterpart due to a shoreline comprised of hardrock.<sup>41</sup>

## CANADA

The following Canadian profile is derived from two reports "Preliminary Study of the Possible Impacts of a One Metre Rise in Sea Level at Charlottetown, Prince Edward Island" (1988), and "Effects of a One Metre Rise in Mean Sea-Level at Saint John, New Brunswick and the Lower Reaches of the Saint John River" (1987), published by the Canadian Climate Centre. According to Ince (1990), the Canadian government has been one of the first governments to take global warming seriously, engaging its Federal Ministry of the Environment to undertake the above studies, among others. The two reports provide us with the benefit of detailing very specific impacts upon urban infrastructure, unlike so many other studies which provide only vaguely outlined anticipated impacts of both sea level rise and global climate change in general. For this reason, the summary of the two reports by Ince (1990), is quoted as follows:

... [a 1 meter] rise in sea level would have effects including the complete inundation of some land, erosion of land in what are now inland areas, saline attack on rivers, land and groundwater, and increased flooding. The size of such effects depends upon everything from the detailed geology of aquifers to the profiles of river channels. Both the Charlottetown and the Saint John studies used sophisticated models to determine the possible effects, on the basis of detailed mapping and decades of tide data. The work concerned is probably a better guide to the full scale of the problem than many countries, especially in the Third World, have found it possible to produce.

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<sup>41</sup> Edgerton (1991); Ibid; page 78.

The first study finds that in the City of Charlottetown itself, an array of expensive new waterfront developments would become uninhabitable, including a new convention centre and a courthouse. Several streets downtown would be below high-water mark or subject to flooding, and a total of 225 buildings would be vulnerable to floods. The sewage and storm drain systems would collapse during storms, and at high tide -- and so would the swimming pool. Outside town, flood problems would affect road causeways and other structures. It may be that these flooding problems could be eased by building new protective works, and by altering planning practices to shift development away from vulnerable areas. Harder to solve would be the sea attack on sewage pipes and flood control systems.

The coastal area around Saint John could well be even more radically affected by sea level rise, since the town lies on the Bay of Fundy, which has some of the most spectacular tides in the world. The tidal range there is already 8.8m. A 1m rise in sea level would be accompanied by an increase in tidal ranges to perhaps 8.95m.

Higher tides and sea level would mean that two of Saint John's major residential suburbs would be inundated completely or subject to severe flooding. At the same time, the city's road and rail links would be seriously affected. There is a risk that links to the east of the city could be cut altogether. Further economic damage could be caused by the loss of key centres of employment, including the shipyard and sugar refinery. And as at Charlottetown, there is the severe risk that sewage and drainage system built on the assumption of today's sea levels would be unable to cope. At Saint John there is a risk that the lagoons used to hold the city's sewage and industrial waste would be inundated. This would mean an immediate release of large amounts of pollution, and would also cripple the waste systems for some time. Other parts of Saint John which could be seriously affected by rising sea levels include the power station, which would be vulnerable to flooding, the city's fresh water supply, and the wharf area, which would be completely inundated.

These problems will probably be expensive to solve, and in the Canadians' view will call for changes throughout the planning process. However, potential problems within a single modest-sized city are at least geographically confined. The authors of the Canadian report note that there will also be severe effects along the whole of the Fundy coast. The effects on the Saint John river itself might be less sweeping because its size and shape are determined essentially by the fresh water

coming down it, but even here, increased penetration of salt water might devastate local fish stocks. There would also be flood risks to prime agricultural land which would call for investment in protection and perhaps the adoption of new agricultural practices. Increased flooding could also cut the country's biggest arterial road, the Trans-Canada Highway, with severe effects on the whole road link between Central and Atlantic Canada.<sup>42</sup>

## AUSTRALIA

Australia is called the "island continent" -- a substantial landmass nearly the size of the United States and completely surrounded by ocean. The country's urban development has concentrated around this coastal periphery, since its vast inland territories are mostly desert. The sheer size of the continent's coastal range implies a variety of region-specific impacts will arise due to climate change interactions with the surrounding oceans. In the literature on sea level rise in Australia, considerable discussion is given over to the impacts upon the Great Barrier Reef. This is, unfortunately, due I believe, to the current trend of geographers, marine scientists, and environmentalists focusing selectively on the more publicly popular threats to non-human habitats (like coral reefs). Yet human settlements are at equal risk since they too are entirely dependent upon their natural environment to physically support and sustain them. One current estimate suggests that a rise in sea level of 20-30 cm in the next 50 years along Australia's sandy beach area

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<sup>42</sup> The Reports were published by the Canadian Climate Centre in Downsview, Ontario, and the summary of these two reports appears in Martin Ince (1990), The Rising Seas. (Earthscan Publications Ltd; London); pages 145-146.

would cause coastlines to retreat shoreward by 10-30 metres, "placing development at crucial sites along the Australian coastline that much closer to the influence of storm surges and waves".<sup>43</sup>

In his article "Environmental Priorities and the Greenhouse. Planning at the Local Government Level" (1991), Robert Zehner reviewed a 1983 nation wide survey distributed to determine which environmental issues were most important, at that time, to Local Government Area (LGAs) councils, as well as assess the extent to which planning for greenhouse effects had appeared on their agendas.<sup>44</sup> The survey was mailed to the attention of the Chief Town Planner in 883 LGAs, receiving a 76% response rate with the completion of 671 surveys. Zehner reports that, despite the plentiful commentary on climate change in Australia in the local media at that time, half of the respondents stated there was "no real interest" on their council in planning for long-term climate change, and that only 10% of the councils had actually progressed to the state of preparing papers for discussion. The study also revealed greenhouse effects were expected in roughly half of the LGAs, but only 3% of the LGAs had implemented planning-related

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<sup>43</sup> Edward Bryant (1991). "Sea Level and Greenhouse: Planning for Change", Australian Planner, Vol. 1 (March, 1991); page 28.

<sup>44</sup> Note: This survey is 11 years old and at that time Australia was already dealing with impacts of ozone depletion with national health campaigns informing the public of risks sun overexposure.

changes in policy at the time of the survey.<sup>45</sup>

Furthermore, the survey revealed most professionals and government representatives depended upon informal sources of information (television, newspapers, radio, friends and colleagues) upon which they based their knowledge of the subject. Only 215 LGAs were aware of any work being done by their own state government departments in this area, with knowledge of federal government work being even lower.<sup>46</sup> However by 1989, Zehner reports, "it would probably have been possible to attend a "greenhouse" or "global warming" or "climate change" conference, seminar, or workshop somewhere in Australia virtually every week of the year with articles in newspapers and journals appearing almost as frequently.<sup>47</sup> Zehner claims this "benchmark" survey demonstrates that, "with or without greenhouse effects, most of Australia's LGAs are already concerned about a variety of issues directly related to the environment, from drainage to flooding to erosion".<sup>48</sup> However to date, Zehner concludes, many LGA councils remain relatively unaware of federal initiatives to address these issues.

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<sup>45</sup> Robert Zehner (1991). "Environmental Priorities and the Greenhouse: Planning at the Local Government Level", in Australian Planner, Vol. 1 (March, 1991); pages 35-37.

<sup>46</sup> Zehner (1991), Ibid; page 36.

<sup>47</sup> Zehner, Ibid., page 37.

<sup>48</sup> Zehner, Ibid.; page 38.

**b) The Still Developing Countries:**

**SOUTHEAST ASIA**

**BANGLADESH**

In her book, The Rising Tide. Global Warming and Sea Level Rise (1991), Lynne Edgerton summarizes the current situation in Bangladesh. Surrounded by India on the Bay of Bengal, Bangladesh and hosts one of the most densely populated countries in the world. An estimated 93 million people occupy 143,000 square kilometres, giving a density of 650 people per square kilometre. Dhaka is the largest city with 4 million people, followed by Chittagong and Khulna which have populations of 1.5 million and 800,000 respectively. "The remaining 86 million people are evenly distributed throughout the country, barely surviving on subsistence agriculture", as determined in a 1983 study which estimated "85 percent of the population received less than the 2,122 calories per day necessary for minimal subsistence".<sup>49</sup> In summary the population "is poor, overcrowded, often hungry, and growing - at the rate of 2.5 to 3.0 percent a year".<sup>50</sup>

"Nearly 80 percent of the land is made up of the complex Bengal delta system, fed by the Ganges, Brahmaputra, and Meghna

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<sup>49</sup> Derived originally from G. Jansen, Rural Bangladesh: Competition for Scarce Resources, (Bergen, Norway: Michelsen Institute, 1983), in Edgerton (1991), Op. Cit.; page 73.

<sup>50</sup> Derived originally from Broadus et al., "Rising Sea Level and Damming of Rivers: Possible Effects in Egypt and Bangladesh", in Effects of Changes in Stratospheric Ozone and Climate Change, Vol. 4, 1986. (UNEP/EPA, New York); in Edgerton (1991); Ibid. page 171.

rivers. Agricultural production on these lands makes up about 55 percent of the country's GDP" (Gross Domestic Product). Approximately 85 percent of the people are dependent upon agriculture for their livelihood. The heavily utilized lands are currently protected by dense forest and mangrove systems that line many of the waterways. These forests provide the vulnerable low-lying arable land with protection from storm surges.<sup>51</sup>

Edgerton's report estimates that "a 1-meter sea level rise will affect approximately 9 percent of Bangladesh's people, destroy about 11 percent of the nation's crops, thus affecting nearly 6 percent of the GDP. A 3-meter rise would be much more devastating, affecting 27 percent of the nation's people, 27 percent of the crops, and about 15 percent of the GDP. These numbers do not include the indirect effects of saltwater intrusion into the nation's fresh groundwater sources; intrusion could extend as far as 480 kilometres inland, thereby prohibiting irrigation of crops in those regions" as well.<sup>52</sup>

Compounding the adverse impacts of sea level rise on agriculture, the nation's fishing industry could lose as well. The 1.5 million people who depend on fishing for their livelihood currently provide the nation with 80 percent of the consumed animal protein. Roughly 40 percent of the nation's fishing capacity is centred in areas likely to be inundated by a 3-meter rise. While some fishing may be relocated, the significant fraction

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<sup>51</sup> Edgerton (1991), Ibid; page 73.

<sup>52</sup> Edgerton (1991), Ibid. page 74; from Broadus et al., Ibid; pages 177-179.

that depends on freshwater fishing may be lost entirely.<sup>53</sup>

Storm surges pose another major threat to human life in Bangladesh. Historically vulnerable to major cyclonic activity, the country was hit in November 1970 by a devastating storm that killed upward of 250,000 people [and reached 150 km inland].<sup>54</sup> A 1985 storm killed 5,000. The combined effects of increased storm surges from sea level rise, the death of protective mangrove buffer zones due to inundation, and projected increases in storm power due to the greenhouse effect might spell further disaster for the low-lying areas.<sup>55</sup>

As to be expected, Edgerton reports that "the nation of Bangladesh is neither financially nor socially prepared to cope with the predicted rise in sea level. Such a rise will increase the number of starving people in the country and further weaken its financial position in the world. The consequences of inaction in this nation will be catastrophic. Both a climate convention and a protocol concerning cooperation and assistance in responding to the effects of sea level rise and global warming are vital to Bangladesh's future."<sup>56</sup>

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<sup>53</sup> Edgerton (1991), Ibid.; page 74; from Broadus et al., Ibid.; page 179.

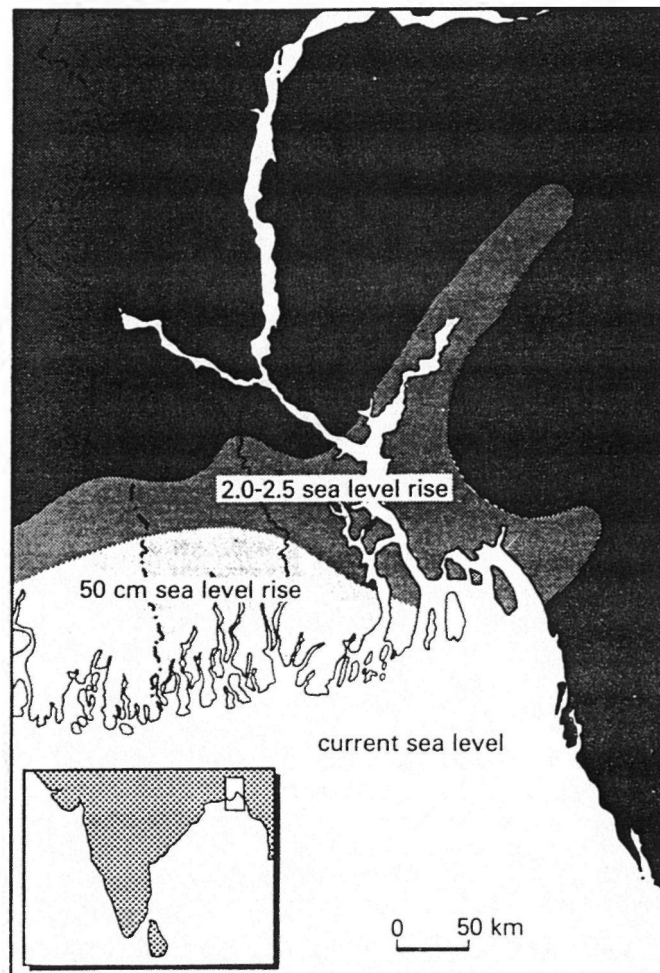
<sup>54</sup> Don Hinrichsen (1990). Our Common Seas. Coasts in Crisis. (Earthscan Publications Ltd.; London); page 21. NB: Hinrichsen quotes 300,000 (rather than 250,000) killed in the 1970 storm surges.

<sup>55</sup> Edgerton (1991), Ibid; page 74.

<sup>56</sup> Edgerton (1991), Ibid; page 74.



**Figure 4 Bangladesh Under Threat**



Source: UNEP

Even a 50 cm sea level rise would inundate large areas of Bangladesh. A 2.0-2.5 metre rise would reach nearly to the country's capital city.

Source: in Martin Ince (1990); Op. Cit.; page 69.

## BANGKOK, THAILAND

With a population of over 5 million, the City of Bangkok is situated on the floodplain of the Chao Phraya River, approximately 25 km north of the Gulf of Thailand. "The majority of the metropolitan area (about 470 km<sup>2</sup>) extends across a low backswamp at an elevation ranging from 0.5 to 1.5 metres above mean sea level. The area receives considerable rainfall during monsoon season, a time when the Chao Phraya River also rises. Until now, the city has depended on a series of canals for drainage into the Chao Phraya River, constructed over the last 200 years."<sup>57</sup> In his book, Ecology and Development in the Third World, Gupta (1988) states that "like other developing cities in the Third World, Bangkok suffers from problems of water contamination, air pollution, and flooding during the rainy season. One of the greatest hazards facing the city is the effect of subsidence -- Bangkok is sinking."

Gupta reports that "since the 1950s the city has grown rapidly, and with it the demand for water, which to date has been met to a large extent by the tapping of groundwater resources. The water originates in several sand and silt aquifers located within the soft marine sediments including highly compressible clay beds that underlie Bangkok." This water is used for both domestic and industrial purposes because industries find it cheaper than the water supplied by the city. The proliferation of unchecked pumping

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<sup>57</sup> A. Gupta (1988). Ecology and Development in the Third World. (Routledge; London, New York); page 62.

of underground water has led to a rapid lowering of the water table, with resulting salt water intrusion to varying degrees.

A major problem is ground subsidence which has more recently been carefully monitored, and found to range up to 14 cm per year in south-eastern Bangkok. Both structural damage and increased flooding has resulted. Structural damage commonly occurs at the junction between street pavements and buildings. Large buildings were built on piles thereby settling at lower rates than the streets. Permanent cracks along the pavements and buildings have now become a characteristic feature of Bangkok's urban landscape. As a result the larger buildings now require the addition of an extra step to be installed below the original ones, sidewalks develop cracks and scarps, well casings protrude above the ground surface, and walls open into cracks larger than a person's arm.<sup>58</sup>

Gupta reports that while some of Bangkok's problems are fairly extreme, many other cities of the Third World are similarly located on comparable substratum including Mexico City, Calcutta, Ho-Chi-Minh City, and Jakarta. He states that Bangkok has now imposed a Groundwater Act in an attempt to plan and control the rate of water extraction from beneath the city.<sup>59</sup> However it remains to be seen how effectively it can be implemented, as well as accommodate future rises in sea level, and associated global warming impacts.

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<sup>58</sup> Gupta (1988). Ibid.

<sup>59</sup> Gupta (1988), Ibid.; page 65.

## MANILA, & NEGROS, THE PHILIPPINES

In his book, Our Common Seas, (1990), Don Hinrichsen reports that "Manila Bay has been rising at the constant rate of two centimetres a year for the past 15 years. Scientists are not certain if this is due to subsidence or the fact that huge portions of the Bay have been filled in for land reclamation projects. Whatever the cause, it has city managers worried because the city of Manila, like Bangkok, is sinking".<sup>60</sup>

North of Manila, along the coast, fish farms and rice fields are currently suffering from salt water intrusion into their shallow groundwater supplies. According to Richardo Bina, of the International Centre for Living Aquatic Resources Management (ICLARM) in Manila, that while lessons have been drawn from Australia's Great Barrier Reef Authority over this problem, the coastal problems afflicting most Third World countries are far more complicated than those confronting the Great Barrier Reef. Bina believes it's possible the "entire coastal environment of this region could be permanently altered to a more salty one. ... We don't know the consequences of this process. It could be catastrophic".<sup>61</sup>

Hinrichsen reports that this issue is now being taken up by

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<sup>60</sup> Don Hinrichsen (1990). Our Common Seas. Coasts in Crisis. (Earthscan Publications Ltd.; London); page 117.

<sup>61</sup> Hinrichsen (1990), Ibid; page 117.

ICLARM in conjunction with other Non-Governmental Organizations (NGOs) to motivate local people to accept management plans, which is seen as fundamental to the success of any coastal management strategy. Similarly, on the island of Negros, Hinrichsen reports that "local communities are taking measures into their own hands without government or other outside help, to conserve and manage their coastal resources"<sup>62</sup>.

#### **THE MEDITERRANEAN REGION**

The practical effects of rising sea levels on poor people are well illustrated by reference to the varied countries around the shores of the Mediterranean, which touches some rich countries of southern Europe as well as poorer nations of North Africa and West Asia. Work carried out for the United Nations Environment Programme on sea level rise in the Mediterranean indicates that the effects of the rising sea are likely to be multiplied by the impact of increased precipitation in the area, (with the exception of North Africa which continues to suffer from increased drought), with dramatic effects for the region.

The Mediterranean area has a long history of human habitation and an almost equally lengthy history of being examined by archaeologists and other scientists interested in tracing its human and physical development. As a result, detailed records of its sea level through time are available. These records reveal that rises

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<sup>62</sup> Hinrichsen (1990), Ibid; page 19.

in sea level caused by the greenhouse effect, combined with changes due to geological movements, could result in sea level rises of 3-20mm a year for the next fifty years. Continuing changes in sea levels in the future "will be felt on shorelines which are already suffering severely from erosion and from flooding during high storm" including the Nile and Italy.

A variety of human activities has hastened the erosion of land around the Mediterranean. For instance, the pumping of water for agricultural and industrial use increases the rate at which the land subsides because, once pumped, will run off to the sea instead of being returned underground. According to Hinrichsen (1990), in some areas this factor alone is lowering land levels by centimetres a year, and dams built on major rivers trap sediment which would normally make its way to the coast, thereby wrecking the dams as well as increasing erosion downstream. Hinrichsen believes that in the case of the Nile, even 20-30cm of sea level rise would be comparatively easy to deal with by comparison with these changes, which are exacerbated by the increasing use of coastal land for food production, housing, and work; a half a metre of sea level rise would cause serious difficulties.<sup>63</sup>

#### **THE NILE, EGYPT**

Although Egypt occupies a million square kilometers of land, it is only the 35,000 square kilometers (3.5%) landbase along the

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<sup>63</sup> Hinrichsen (1990), Ibid.; pages 26-39.

Nile that harbors the bulk of the population. For every square kilometer along its banks, approximately 1,400 people live, relying predominately upon agricultural activities in the delta to support themselves and Egypt's economy. The large port cities of Alexandria, to the west, and Port Said, to the east at the Mediterranean entrance to the Suez Canal (with populations of 3 million and 800,000 respectively), straddle either side of the Nile's massive delta. The Nile has supported Egypt's people for thousands of years, sustaining their crops and carrying boat traffic. However in the last twenty years it has been realized how critical a role the Nile River has played in sustaining the shorelines of the delta from rising sea levels over the centuries.

When the high dam at Aswan was closed in 1964, about 900 kilometres up the river, sediment supply to the delta was cut off. The combined effects of local tectonic subsidence and global sea level rise caused a pronounced relative rise in sea level that submerged many coastal areas. Edgerton (1991) reports that "While the subsidence and global sea rise has been occurring for the past 7,500 years, a constant supply of sediment carried down the giant river had built up the delta at a comparable rate, effectively nullifying the adverse effects". The construction of the dam suddenly ended this process, and today many coastal residents are beginning to feel the full impact of the dam.<sup>64</sup>

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<sup>64</sup> Derived originally from Quarterly Economic Review of Egypt (London: Economist Publications, 1985), Annual Supplement. In Edgerton (1991), Op. Cit.; page 72.

Edgerton reports that if "the current trend of relative sea level rise continue in Egypt, 8 to 10 million may be displaced as flooding waters submerge their land. With a 1-meter rise in sea level, approximately 15 percent of the country's gross domestic product (GDP) will be affected in some way, and 12 to 15 percent of the nation's arable land will be submerged", and that with "a 3-meter rise in sea level, approximately 20 percent of the GDP will be affected and 20 percent of the arable land ... submerged". Already, considerable erosion has occurred along the deltaic coast, and is expected to intensify considerably.<sup>65</sup>

Edgerton states that, "Clearly such changes would be catastrophic for Egypt, destroying much of the country's farming capabilities, causing widespread hunger, and sparking mass migration away from the flooded lands."<sup>66</sup> Much depends upon the ultimate rate of sea level rise, but we should assume a 0.7-meter global rise by the year 2050".<sup>67</sup> Egypt, like many other countries, is largely unprepared for this rise.

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<sup>65</sup> Derived originally from J. Broadus et al., "Rising Sea Level and Damming of Rivers: Possible Effects in Egypt and Bangladesh", in Effects of Changes in Stratospheric Ozone and Global Climate, vol. 4 (New York: UNEP/EPA, 1986), pp. 165-190) in Edgerton (1991), Ibid.; page 72.

<sup>66</sup> David Suzuki, "The Changing Climate", The Nature of Things (Television program, March, 1992) also discussed Egypt's problems in this regard. Suzuki interviewed farmers who stated that climate changes in the last few years have significantly altered their historical calendar by which they have always planted their crops. Now, year after year, they face poor crop harvests.

<sup>67</sup> Edgerton (1991), Op. Cit.; page 72.



**c) Island Communities:**

**THE SOUTH PACIFIC ISLANDS**

There are three distinct parts to the South Pacific -- Micronesia, Melanesia, and Polynesia covering an ocean area of about 41 million square kilometres taking in twenty-five countries. Disregarding Australia and New Zealand, only 2 percent of the area is land, with only seven of the islands over 1000 square kilometres in size.<sup>68</sup> Dr. John Pernetta, Associate Professor of Vertebrate Biology at the University of Papua New Guinea, reports that

... the picture postcard image of the South Pacific is, in many places, false. Behind the facade of palm trees waving gently in the breeze is the stark reality of grinding poverty set against a backdrop of some really basic environmental problems. For many Pacific Island societies, which had evolved practical and sustainable ways to realize their resources, Western style development proved their downfall.<sup>69</sup>

In his book, Our Common Seas. Coasts in Crisis Hinrichsen (1990), reports that in the struggle to modernize their economies resource issues are, incredibly, often neglected. The island nations depend predominately upon fishing, rather than agriculture or industry, to sustain themselves. Any agriculture that is carried on, as in Fiji, is done at low altitude above sea level, especially in river delta areas. However, these areas are also affected by rising sea levels due to sedimentation and increased

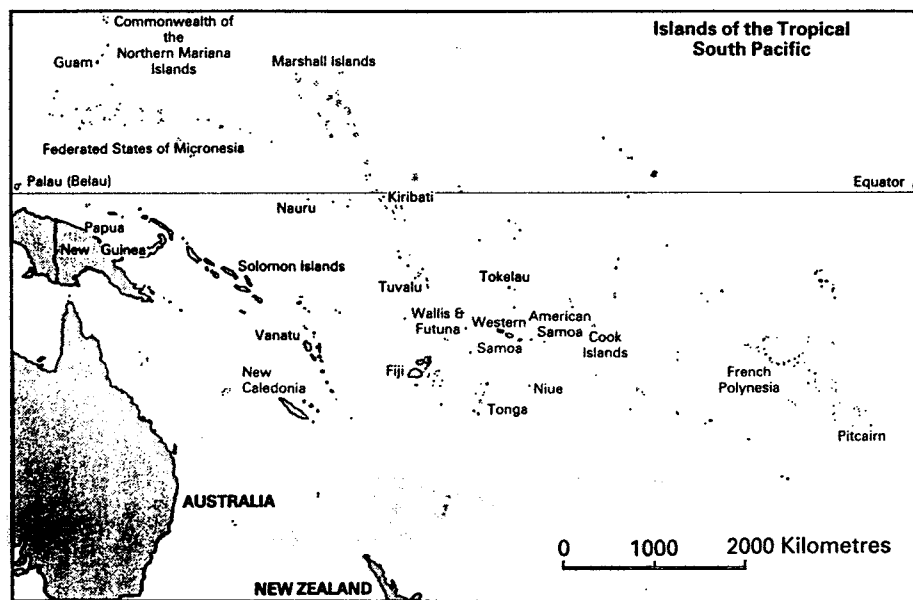
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<sup>68</sup> Martin Ince (1990), Op. Cit. page 105, original source, the Association of South Pacific Environmental Institute; Port Moresby, Papua New Guinea.

<sup>69</sup> Hinrichsen (1990), Op. cit.; page 63.

river flooding.<sup>70</sup> According to a recent article in Ecodecision, Leatherman states that problems of salt water intrusion into the ground water supply is already occurring in the Marshall Islands, and that in some small atolls, "the lens of freshwater lying above the salt water is now [in 1994] only two centimeters deep".<sup>71</sup>

**Figure 5 Islands of the Tropical South Pacific**



Source: Ministry of Foreign Affairs, Wellington, NZ

Source: In Martin Ince (1990), Op. Cit.; page 104.

In terms of both sea level rise and other associated global warming effects, the impacts and problems are as diverse as the islands themselves. Most of the South Pacific's 5 million people

<sup>70</sup> Hinrichsen (1990), Ibid; page 64.

<sup>71</sup> Stephen P. Leatherman "Rising Sea Levels and Small Island States" in Ecodecision, Vol. 11 January, 1994; page 54.

are coastal residents. Many of the islands are really coral atolls, including Kiribati, Tokelau and Tuvalu -- areas most vulnerable to sea level rise. In larger islands, like Papua New Guinea, the urban and coastal populations are growing more rapidly than those in the forested uplands. Urbanization is a trend the Pacific Islands share with virtually every region of the world. However, these small islands, with limited space and resources, can least afford the damaging effects of crowded coasts and rising sea levels. Overcrowding has already resulted in out-migration to other Pacific Rim nations, predominately to Australia and New Zealand.

A 1-2 meter rise in sea level would result in Tuvalu, Kiribati and the Marshall Islands being swamped or under water, their populations forced to move to higher, dryer islands or to the mainland countries. Rising seas would flood over a quarter of Papua New Guinea's 17,000km coastline, inundating flood plains and river deltas. A 1-meter rise would lead to saltwater intrusions into water tables, as well as the waterlogging of soils, and massive coastal erosion. In sum, all principal towns and centres of government would be inundated, forcing relocation of all industry, commerce, and government activities. In areas which survive rising sea levels, remaining communities would be hit by exacerbated weather effects associated with global warming, in particular the incidence of severe storms becoming even more frequent as the Earth's atmosphere becomes warmer and more humid.<sup>72</sup> According to

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Martin Ince (1990), Op. cit.; page 105.

Ince, the "most probable overall effect is an increase in cyclonic weather near the Solomon Islands, Papua New Guinea and even New Zealand itself". Up the bright side, those areas which currently suffer from this type of weather, like Fiji and Tonga, may benefit significantly from the new weather patterns as storm patterns shift elsewhere.<sup>73</sup>

#### **THE MALDIVES, EAST INDIAN OCEAN**

The Republic of the Maldives lies south-west of India in the Indian Ocean, and is comprised of approximately 1,300 islands, with about 275 inhabited and almost all of which are used economically for forestry or other purposes. Its population of about 180,000 (1985) is concentrated on twenty-five of these islands, including 46,000 on the main island of Male.<sup>74</sup>

According to Ince (1990), the Republic of the Maldives has "an obsessive interest" in rising sea level, since its highest point is little more than three metres above present-day sea level. A recent study undertaken for the Commonwealth Secretariat revealed that virtually the whole of the country's population, infrastructure and economy lies between 80cm and 2m above sea level.<sup>75</sup> Speaking at a Commonwealth meeting in Kuala Lumpur, Malaysia (1989) the President

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<sup>73</sup> Ince (1990), Ibid.; page 106.

<sup>74</sup> Ince (1990), Ibid.; page 32.

<sup>75</sup> Alasdair Edwards, of the University of Newcastle upon Tyne in the UK, completed the study for the Commonwealth Secretariat. In Martin Ince, (1990) The Rising Seas; page 32.

of the Maldives, Mr. Maumoon Abdul Gayoom, stated that if the sea level rose as predicted by one meter by 2050, many countries in the Commonwealth would "simply disappear". With most of his nation's islands no more than two meters above sea level, the Maldives is, in Gayoom's words, "an endangered country". Thus, the governments of the South Pacific nations have taken a leading role in promoting world concern about sea level rise, especially those within the Commonwealth.<sup>76</sup>

#### THE HAWAIIAN ISLANDS

Like many of the South Pacific Islands, Hawaii is built upon volcanic rock, with limited fresh water resources, and restricted developable land. The island populations are concentrated predominately around the volcanic perimeters of the islands. Tourism -- both luxury coastal resorts and eco-tourism, forms the mainstay of the economy, followed by plantation style agriculture. There is no industry whatsoever on the islands. In Edgerton's book, The Rising Tide. Global Warming and World Sea Levels, (1991) she reports the following anticipated impacts of sea level rise for Hawaii's main city, Honolulu, over the next 100 years.<sup>77</sup>

\* A 0.6-meter sea level rise would have the following effects: major flooding threats during storm conditions; **loss of Waikiki Beach**; increased losses of property to storm waves; increased cost of shoreline protection; and

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<sup>76</sup> Ince (1990), Op. Cit; pages 33-34; and Hinrichsen (1990), Op. Cit; page 20.

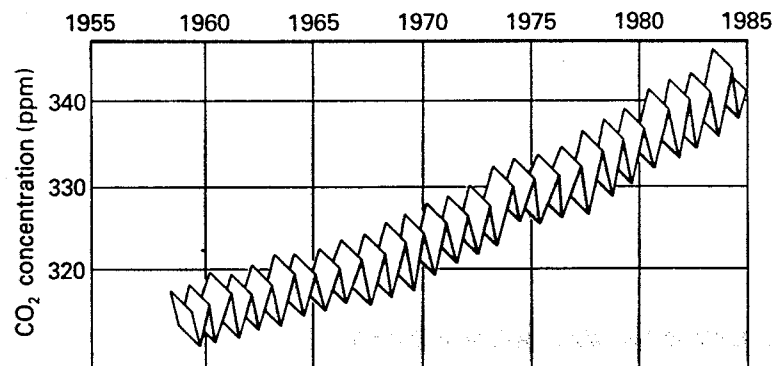
<sup>77</sup> This section is based on the following study: Effects on Hawaii of a Worldwide Rise in Sea Level Induced by the "Greenhouse Effect" (Honolulu: Hawaii Coastal Zone Management Program, 1985).

temporary disruptions of transportation at Honolulu Harbour, international airport, and three major surface thoroughfares.

\* A 1.5-meter rise would lead to the following results: coastal hazards threatening shorefront areas, as well as **properties up to a mile inland**; at a minimum the enormous, if not prohibitive, **cost of stabilising the entire Honolulu waterfront**; loss of valuable urban land; **geographic isolation of Waikiki**; and prolonged disruption of surface, air, and maritime transportation systems. Moreover, much of the present urban district may become uninhabitable.

Edgerton further reports Hawaii's groundwater would also be affected by saltwater intrusion into groundwater aquifers, resulting in a smaller supply of usable groundwater.<sup>78</sup>

**Figure 6 Measurements of Carbon Dioxide Concentrations In the Air From Mauna Loa, Hawaii**



Source: UNEP

Source: Ince (1990); Op. Cit.; page 9.

### iii) Repercussions

As these profiles have illustrated, in conjunction with aforementioned increases in expected levels of both population and urbanization trends -- particularly in vulnerable coastal areas, action needs to be started now to avoid worst-case scenarios. As

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<sup>78</sup> Edgerton (1991), Op. Cit.; page 43.

Edgerton points out, many of the countries currently without plans to combat sea level rise "will experience severe effects from even a moderate rise [in sea levels]", especially Egypt and Bangladesh.<sup>79</sup> Impacts from sea level rise are already being felt in the Nile, the Mediterranean, and the South American and South Pacific regions. Temporary climate changes experienced in 1982-3 along the western coast of South America resulted in a relative sea level rise along the western coast of South America, creating an El Nino effect wiping out annual anchovy harvests.<sup>80</sup> According to Ince (1990), impacts will vary among different regions as a result of "the sum [total] of effects of global sea level rise combined with vertical land motions due to tectonics, glacial loading, or fluid withdrawal (gas, oil, water)".<sup>81</sup> Impacts of relative sea level changes are therefore local in nature, influenced by transient climate phenomena, continental uplift, and subsidence factors, among other phenomena.

For regions like the Caribbean and the South Pacific island nations, who have a shorter and less intensive period of industrial development, impacts will differ from mainland coastal centres. However the impacts will be equally dramatic, some with some island communities vanishing altogether. According to Ince (1990), the

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<sup>79</sup> Edgerton (1991), Ibid; page 72.

<sup>80</sup> P.W. Glynn, "Widespread Coral Mortality and the 1982-83 El Nino Warming Event", Environmental Conservation 11(2) (1988): 133-146 in Ince (1990), Op. Cit.; page 18.

<sup>81</sup> Ince (1990), Ibid.; page 18.

remaining island nations will emerge as areas much like other Third World places --

full of economic potential which will be hard to achieve for any number of reasons, and made critically more difficult by the rising sea. The picture of disadvantaged nations and people being harmed further by sea level rises caused by the developed world's air pollution habits presents policy makers with the starkest possible moral issues -- or should.<sup>82</sup>

As stated earlier in Chapter One, the point of this paper has not been to discuss the various arguments (and degrees thereof) over when, or by how much, climate change will occur. It is taken as a fact that climate change is indeed occurring, and that a significant percentage of the world's population, its urban centres, and resources are at risk. It is almost irrelevant to discuss "when" or "by how much" these habitats are at risk. Does it matter? In light of many of their present economic and political realities, many communities are already suffering from a lack of adequate shelter, urban services, employment, access to suitable land, and various human rights violations. Therefore, delay in the discussion, decision-making, or planning to accommodate further environmental degradation may lead to political anarchy and future social unrest.

While the case studies have already established the fact that the effect of rising sea levels on Third World cities will differ in detail from case to case, Ince further argues that "the

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<sup>82</sup> Ince (1990), Ibid.; page 67.



extensive literature on quick and slow disasters in the Third World suggests strongly that the effects will mainly involve impoverishing and endangering the people least able to cope".<sup>83</sup> In 1979, an interdisciplinary research team organized by the American Association of Atmospheric Sciences stressed the need to understand, in advance, the possible range of impacts of CO<sub>2</sub> induced changes on human activities and welfare, as well as the ability of society to deal with such impacts (Chen, 1983).<sup>84</sup> Despite the ability of many of the developed countries to respond to atmospheric change, there also remains the more overriding concern of "willingness", in other words, political will. The 1979 study also revealed, among a multitude of more recent ones, the "long-term, slowly developing and irreversible aspects" of atmospheric change, and "underscored the importance of viewing the problem in the general context of other societal problems and rapid societal change".<sup>85</sup> In his book, The Rising Seas (1990), Martin Ince points out that the problem for governments and planners, among others,

... is the immense range of the expected rise [in sea level]. At the lower figure, cheap measures will allow

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<sup>83</sup> Ince (1990), Op. Cit.; page 63.

<sup>84</sup> AAAS Panel Report, DOE document and Workshop on Environmental and Societal Consequences of a Possible CO<sub>2</sub>-Induced Climate Change (1980) in Robert S. Chen, et al. (1983), Social Science Research and Climate Change. (Reidel Publishing Company; Dordrecht, Boston); Preface.

<sup>85</sup> Robert S. Chen (1983), Social Science Research and Climate Change, Robert S. Chen, Elise Boulding, and Stephen H. Schneider, Editors (D. Reidel Publishing Company; Dordrecht, Boston); Preface.

extensive areas to be protected. At the upper limit, areas of land which have held human populations for millennia are all but certain to vanish. ... The message applies equally in other parts of the Third World subject to rapid geological change, especially around the Pacific, in the West Indies and in countries like Indonesia.<sup>86</sup>

The principal effects then, of sea level rise and climate change to urban human settlements are discussed below as they impact a) urban infrastructure, and b) economic systems, as follows:

**a) Urban Infrastructure -**

Highways, bridges, waterways, ports, airports, mass transit systems, facilities for water supply and hazardous waste storage, and associated maintenance systems.

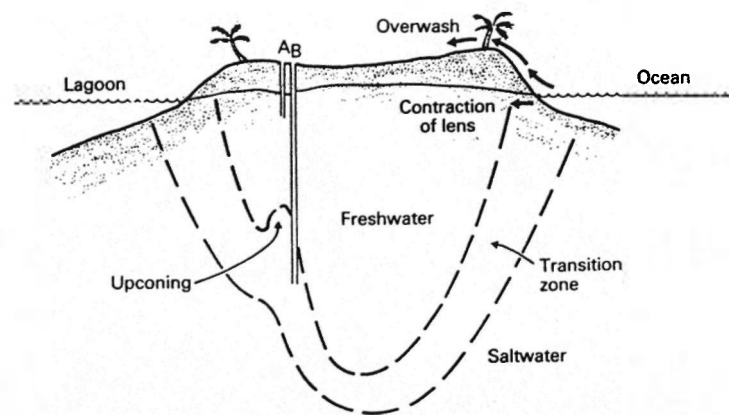
According to Edgerton (1991), a rise of 0.7 meters, coupled with other effects of climate changes, will place urban infrastructure under tremendous strain. In the developing countries much of the current funding to build this infrastructure comes from various foreign aid programmes, while local governments are, for the most part, unable to collect the required revenues needed to pay for maintenance of them. Therefore, from a planning and financing perspective, the impact of environmental damages to urban infrastructure is overwhelming. Damage from sea level rise will result in significant infrastructure damage, and huge financial burdens to repair and/or replace.

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<sup>86</sup> Ince (1990), Op. Cit.; page 65.

Increased salinity and higher water tables in general will also generate a wide range of problems for city infrastructure. Saltwater intrusion into domestic and industrial water supplies will render the groundwater unsuitable, and it will corrode underground cables and pipework at a faster rate than that of freshwater. Higher water tables will affect building foundations, lead to subsidence and cause further shifting of foundations, resulting in significant cracking throughout the buildings. Businesses and government buildings will continually face disruption and increased maintenance and/or relocation costs.

**Figure 7 Three Ways In Which Salt Water Can Intrude Into A Freshwater Lens**



Source: Commonwealth Secretariat

Source: Ince (1990) The Rising Seas (Earthscan Publications Ltd.; London); page 53.

In Bangkok, subsidence from the blocking of underground canal channels has already led to subsidence, damage to buildings, and

water intrusion into buildings from regular flooding. Some businesses there have installed physical barriers to block out water seepage.<sup>87</sup> In addition reduced use-ability of land in some city areas will drive up the price of alternative properties, provided there exists other land options in the first place.

**b) Economic Systems -**

Loss of national and local revenues from reduction or destruction of traditional livelihoods in fisheries, farming, and tourism; loss of other natural resources (i.e. forests); increased operation and maintenance costs; reduced competitive abilities in global market place; interference in the multiplier effects normally generated from local economies; increased land prices; rebuilding and/or relocation costs; etc.

Obviously, an attack on the local economies of the less developed countries represents an attack on their national and local economies, as well as affecting other economies around the world. Sources of revenue which support consumer markets and social services are affected by both climate change and sea level rise. According to Schneider (1983), between

5000 to 8000 years ago, evidence suggests that mean global temperatures were perhaps 1-2 degrees Celsius warmer than today ... [therefore the] **important message is that seemingly small changes in global temperature can be reflected by large, regional changes in temperature and precipitation patterns.** ... While such alterations are not necessarily bad, depending upon the nature of economic activities in each region when the climate changes, the important point is that we will have to

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<sup>87</sup> Avijit Gupta (1988) Ecology and Development in the Third World. (Routledge; London, New York); page 63.

learn to adapt - or migrate.<sup>88</sup> [Emphasis added]

Ince (1990) has suggested "it may be possible over a period of decades to solve these problems by a well-designed programme in which key activities like government are shifted to new locations away from sea level rise problems".<sup>89</sup> Ince believes such a programme would serve to encourage other major employers to follow suit, thereby protecting economies and services at risk by "the spreading of employment and wealth more widely" from the few existing core economic centres. However, this seems highly unlikely since these centres have agglomerated and emerged as economic multipliers for reasons specific to their locale based on existing resources, skilled labour, and various other institutional support systems; otherwise, wealth and employment would already be more widely dispersed.<sup>90</sup>

Further exacerbating these main urban impacts would be further impacts upon urban shelter and services as rural farmers abandon farming areas affected by salinization and flooding, relocating to the already sea-threatened cities, placing greater demands on urban

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<sup>88</sup> Stephen H. Schneider "CO<sub>2</sub>, Climate and Society" in Robert S. Chen, et. al. Editors (1983) Social Science Research and Climate Change. (D. Reidel Publishing Company; Dordrecht, Boston); page 9.

<sup>89</sup> Ince (1990), Op. Cit.; page 64.

<sup>90</sup> For a excellent discussion of how and why some cities generate wealth while others fail, see Jane Jacobs (1985), Cities and the Wealth Nations. (Vintage Books, Random House; New York).

resources and employment opportunities, thereby heightening political issues of landlessness, unemployment and equity. According to Ince, these

Abandoned lands will become "flood ghettos", and "involve a confrontation with the Third World's problems of landlessness and the unequal distribution of land. Even more than developed world cities, those in the Third World tend to grow in a sprawling and ill-planned manner. For their poorest inhabitants the main criterion is the availability of land, however unsuitable, and losing part of a city to rising sea levels will simply mean pushing such inhabitants into even less suitable places. The problem here is inequality, not rising sea levels, but it is exacerbated by the sea level rise issue."<sup>91</sup>

If this analysis is correct, at the extreme end of things national security becomes an issue, threatening to disrupt tenuous holds on political control and civil obedience.<sup>92</sup> Furthermore, should Ince's theory of "flood ghettos" become a reality, all the progress to date in areas of health and welfare would be lost or severely taxed, and population control would take on a whole new, and ugly, dimension. As stated earlier, whether one perceives climate change and the impact of sea level rise as a "crisis" or not depends wholly upon whether one is rich or poor.

The problems which rich countries with major capital investments and wealthy cities in coastal areas face from sea level rise are quite different from those of poor countries whose land is mostly used for subsistence agriculture, or for cities where a substantial part of the population lives in poverty. For the rich, sea level rise means the risk of economic loss and disruption, but

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<sup>91</sup> Ince (1990), Op. Cit.; pages 63-64.

<sup>92</sup> The 1979 AAAS study also recognized the potential link of climate change impacts and nuclear war and national security. In Chen, Boulding, et al. (1983), op. cit.

in the Third World the risk to many people is of death rather than bankruptcy.<sup>93</sup>

Thus, the impact of climate change, in particular sea level rise, must be considered in development strategies in the provision of shelter and services as a fundamental component of sustainable development.

The following represents a partial compilation of potential impacts as a result of atmospheric change, and sea level rise; many are already underway, other impacts may still be unknown.

**c) Summary of Known Impacts of Sea Level Rise Due to Climate Change**

**Physical Environmental Impacts:**

- \* Flooding of coastal and low-lying terrain;
- \* Subsidence (sinking of coastal urban centres);
- \* Loss of softrock shoreline areas and beaches.
- \* Loss of land, and inundated urban and rural areas by encroaching water;
- \* Groundwater contamination by saltwater intrusion;
- \* Destruction of natural protective shoreline ecosystems, i.e. mangroves;
- \* Diminishment and/or destruction of marine fisheries;
- \* Reduction of biodiversity and natural resources;
- \* Warmer temperatures;
- \* Major shifts in precipitation belts;

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<sup>93</sup> Ince (1990), Ibid.; page 58.

- \* Increased incidence of pests, disease in agricultural areas;
- \* Salinization of agricultural soils;
- \* Increasing pressure on diminishing freshwater resources.

**Social, Economic, and Political Impacts:**

- \* Increased landlessness;
- \* Increased poverty;
- \* Increased health risks, disease;
- \* Loss of livelihood in fisheries, farming, tourism;
- \* Loss of natural resources;
- \* Threatened national security;
- \* Issues of equity;
- \* Damage to infrastructure (roads, bridges, buildings, ports, airports, underground cables and pipes);
- \* Altered growing seasons in agriculture;
- \* Contamination of water for domestic and industrial use.



## CHAPTER THREE

### PLANNING IN ACTION

#### i) What is Planning? What do Planners do?

Coastal zones, and their resident populations, are on a "collision course" with destiny -- from increasing and cumulative impacts of increasing greenhouse gases, higher earth temperatures, rising sea levels, beach erosion, wetland loss, increasing coastal populations and urban development, coastal engineering and coastal upland loss. Therefore, issues of global climate change and the result of anticipated increases in sea level rise due to global warming trends have to be addressed now -- by communities, politicians, businesses, planners, and policy makers alike. All coastal communities around the world are impacted by the advent of rises in sea levels, some areas being only slightly affected but many others to the point of extinction. The challenge of coastal zone management with regard to climate change issues is not limited to regulating sector-specific activities, nor merely land-use planning. In this context, coastal zone management falls under the much more pervasive umbrella of "sustainable development". Therefore, planners and their respective governments urgently need to get a grip on the facts, trends, and history of their region, reviewing both the short and the long-term implications of current and proposed plans and policies pertaining to their coastal areas.

The objective of current planning is to promote and provide a system which sustains human activity, preserving and protecting

resources while regulating human behaviour in order to continuously support society in all its functions, needs and desires. The advent of unanticipated climate change, as a result of industrial and technological developments over the past century, has exposed a weak link in the field of planning -- that planning itself, in its attempts to perpetuate the status quo of its society's values, relies upon a relatively static natural environment, one in which little change occurs in the physical phenomenon which sustains society. Rarely have significant changes in natural phenomena been taken into account, conspicuous by the general absence of long-term plans by either government or businesses, particularly in North American society. Planning by nature is a short-term exercise, often in the form of reactive measures to previously unanticipated disasters resulting from previous activity. The longer term view lies seemingly beyond the control or concern of planners or government, falling instead into the nether realm of "futuurologists".

Theoretically, planning as an activity implies having both control over a situation, and specific objectives to be achieved. In short, a plan outlines specific action for a specific condition designed to primarily serve immediate and near-future interests of its society. However, nature has already proven to be neither infinitely sustainable in form, nor ultimately controllable in function. Thus, the challenge of planning remains the dilemma of trying to sustain current human activities in both form and

function while simultaneously coping with significant environmental changes. We have now arrived at a state in our natural environment that is turbulent in nature, and one that is unlikely to stabilize any time soon. According to David Morley (1986) "by turbulence we refer to conditions that exhibit variations outside the range of expected disturbances that affect our economic and social systems".<sup>94</sup> By Morley's definition, "turbulence" exists if individual or collective experience reflects it, in any of the following:

- \* accelerating rates of change;
- \* increasing scale of perturbations or shifts in conditions;
- \* increasing unpredictability of events;
- \* a continuing sense of crisis;
- \* frequent confrontation with problems that are of a level of complexity that makes them inaccessible to normal intervention strategies; and
- \* a tendency for increasing amounts of time to be spent on responding to the unintended effects of previous actions.<sup>95</sup>

The current issues and debates about global climate change, and pending sea level rise, meet all of the above criteria, therefore we must conclude that a) we are indeed living with a turbulent environmental situation, and b) moving out of the previous comfort

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<sup>94</sup> David Morley "Approaches to Planning in Turbulent Environments", in Planning in Turbulence (1986), Edited by David Morley and Arie Shachar (The Magnes Press, The Hebrew University, Jerusalem, Israel); page 5

<sup>95</sup> Morley (1986), Ibid.; page 5.

zone of planning based on "rational analysis" and "objective observation" alone, and into one of "transitional adjustment".<sup>96</sup> This means planners are now faced with the challenge of trying to "respond under circumstances in which belief in the ability of the existing means used by them to carry out such tasks has been significantly undermined by the widely recognized tendency for the unintended outcomes of a planning strategy to outweigh the planned outcomes".<sup>97</sup>

Planning is essentially an exercise in problem solving. However, now it seems we are to soon join forces with those much maligned futurologists in our attempts to stabilize existing trends of change looming on the near horizon. How shall planners determine the costs and the benefits of such an exercise when no one variable can be controlled? The current situation reflects to a considerable degree, the challenges always faced by the emergency planning field. It is perhaps this type of planning exercise that planners and policy makers can best turn to in their attempts to develop a proactive planning methodology in anticipation of change, if not outright crisis. According to Warrick and Riebsame, since it is never the long-term trend that people adapt to, but rather "the extreme of the short-term fluctuations within a trend", planners can draw upon behaviour occurring in "drought, floods, and other extreme weather conditions which we label crises" since these

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<sup>96</sup> Morley (1986), Ibid.; page 4.

<sup>97</sup> Morley (1986), Ibid.; page 5.

are the "raw materials from which we can draw conclusions about what kinds of adaptive behaviour could be mobilized to deal with long-run change".<sup>98</sup>

In response to the new global thinking regarding efforts to achieve "sustainable development", the Canadian International Development Agency (CIDA) revised its policies guiding its development objectives for developing countries as specified in its document "Policy for Environmental Sustainability" (January, 1992). According to this document, all future development initiatives are to reflect the following objectives in its planning process:

1. **The ecological basis for development**, to recognize the productive potential and ecosystem limits to development in a given area;
2. **The economic value of the environment** and means for recognizing environmental values in economic decision-making;
3. **The relationships among poverty, population dynamics, natural resource consumption and environmental degradation.**<sup>99</sup> [Emphasis added]

These points represent an excellent first step in recognizing the degree and depth of the problem. However, what methodology will be used to determine the answers to these concerns? Will short-term considerations, such as economic gain for a few, still predominate over long-term issues of environmental sustainability? What value

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<sup>98</sup> Robert S. Chen, Elise Boulding and Sephen H. Schneider, Editors (1983), Social Science Research and Climate Change. (D. Reidel Publishing Company; Dordrecht, Boston); page 6.

<sup>99</sup> Canadian International Development Agency (CIDA). (1982) Policy for Environmental Sustainability (Government of Canada; Ottawa).

will our society or others place on human life in the future, especially as populations continue to expand and natural systems destabilize? As Boulding (1983) points out "local short-term adaptation and long-term societal planning are ... very different orders of phenomena".<sup>100</sup>

**ii) Uncertainty in Planning -- Gaps in Knowledge and Other Constraints to Planning**

Along with Chen, Boulding, and Schneider (1983) the authors of the American Association for Atmospheric Sciences study also recognized the difficulty of communicating long-term trend changes to planners (and policymakers) accustomed to dealing with i) assumptions of system stability, and ii) short-term plans based on current political and economic agendas.<sup>101</sup> Throwing in the juggernaut of uncertainty regarding specific impacts of global climate changes, such as sea level rise among others, places further constraints on the planning process to sustain development. According to Yehezkel Dror (1996), planning as an activity is not suppose to include elements of risk -- that in essence it is expected to produce a "risk-less" plan.<sup>102</sup> At the present time,

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<sup>100</sup> Elise Boulding (1983), "Setting New Research Agendas: A Social Scientist's View" in Robert S. Chen, E. Boulding, and S. Schneider, Editors. Social Science Research and Climate Change (D. Riedel Publishing Company; Dordrecht, Boston); page 6.

<sup>101</sup> Robert S. Chen, Elise Boulding, and Steven Schneider, Editors (1983), Social Science Research and Climate Change (D. Riedel Publishing Company; Dordrecht, Boston).

<sup>102</sup> Yehezkel Dror (1986) "Planning as Fuzzy Gambling: A Radical Perspective on Coping with Uncertainty" in Planning in Turbulence (1986) David Morley and Arie Shachar, Editors (Magnes Press, The

subtle changes in sea level rise or climate change in general occurring over a long period time may not appear, at first glance, to warrant all the attention and expense demanded by many groups, including researchers, environmental advocates, and most recently, the small island nations. However it is the insidious cumulative and compounding aspects of these changes that really create planning and policy headaches.

Planners are now dealing with a degree and kind of uncertainty that differs from past experiences -- the magnitude being global and all pervasive. According to Morley (1986), this new kind of uncertainty "places greater demands for the services of experts" while at the same time the phenomena of such impacts are severely testing their technological capacities to provide concrete answers.<sup>103</sup> However Wildavsky (1991) warns that to assume "no risk is the highest risk of all".<sup>104</sup>

In his book, The Rising Seas, Martin Ince states that "consensus [exists] among scientists that global sea levels have been steadily rising for the past 100 years and that global warming is likely to accelerate the rate of this rise over the next century", and that,

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Hebrew University; Jerusalem); page 33.

<sup>103</sup> Morley (1986), Op. Cit.; page 3.

<sup>104</sup> Aaron Wildavsky "No Risk is the Highest Risk of All" in Readings in Risk (1991), Theodore S. Glickman, Michael Gough, Editors. (Resources For the Future; Washington, D.C.); page 120.

Virtually all of the principal scientists working in the field believe that the time has come for coastal planning with regard to accelerated sea level rise. Scientists believe that a significantly accelerated global sea level rise is probable during our lifetimes.<sup>105</sup>

He goes on to state that the "planner's task, then is to work out - as a policy matter - a reasonable and prudent general planning assumption for how much the sea will rise and by when"! This seems like a reasonable request, however finding out this information alone, not that we can to any great degree of predictability, is not enough. In doing so would merely provide endless debates as to whether or not sufficient evidence exists to warrant the time and resources required to change current activities within coastal zones.

The following summarizes the various constraints to planning for, implementing, and achieving sustainable development strategies which would aid planners in the task of addressing sea level rise among other global climate change issues:

- \* Sustainability factors (demands on the physical limits of resources) of increasing population trends and demographic characteristics of these increases since it is estimated that in excess of one third of the current population resides within coastal areas;
- \* Both domestic and foreign politics, especially the general unwillingness to sacrifice present profits for long-term sustainability; the environment as an issue related to economic development has only recently, in 1993, made it on to the agenda of international economic summits;
- \* Depressed global economic stability and production levels of the developed countries while simultaneously facing challenges

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<sup>105</sup> Martin Ince (1990), The Rising Seas. (Earthscan Publications Ltd.; London); page 17.



from rising third world economies;

- \* Economic models of development which fail to include the natural environment and issues of equity in the benefit/cost analysis of development;
- \* Hiring traditionally-trained economists to develop cost-accounting mechanisms for environmental damage (the attitude of the environment as a commodity to be auctioned off), while still resisting the need for interdisciplinary "experts" and team approaches to problem solving;
- \* Government policy that is developed in consultation with private business interests, motivated by profit and short-term gains at the expense of issues of equity and long-term system stability;
- \* A lack of co-ordinated national and local level policy objectives developed within an integrated or holistic framework;
- \* Private business interests which continue to overwhelm public interests in land use and other development proposals;
- \* Competition among various donor agencies for overseas contracts in the developing countries which complicate the negotiating process regarding sustainable development policy objectives;
- \* In the developing countries, tied-aid objectives of foreign aid programmes that run contrary to policies to incorporate environmental sustainability into planning activities;
- \* Financing and regulations in lending agreements to less developed countries are not linked to environmental sustainability policies, nor to issues of human rights issues or equity; Alternative financing arrangements for developing countries should be devised to allow for opportunities to address environmental issues with regard to foreign aid debt;
- \* Underdeveloped public education in awareness of, and commitment to, issues linking long-term economic stability with environmental sustainability;
- \* Published research and recommendations of special committees are not fully utilized in the development of new policies or programs by governments or the business community, while simultaneously calling for more research to provide "hard evidence" and "easy solutions".

The call for further research is both a positive and a negative in

the planning process. From a negative viewpoint it can, and has been, used as both an argument against, and delay tactic, to taking present action to change the way planning and policy making is developed. On a positive note, it does convert lost jobs from traditional sectors of the economy, such as resource extraction, into environmental gains as new roles are found for people in the context of environmental monitoring and management. Furthermore, gaps in existing knowledge have been legitimately identified as a hinderance to really effective planning strategies. The following constitutes a partial list of such gaps:

- \* Lack of accumulated historical data (i.e. climate, hydrometeorology & hydrology data available is often incomplete, except in Mediterranean area where extensive historical records have been kept);
- \* Problems with accurateness of collected data (the world is not a controlled laboratory experiment); debates over methodologies and analysis of collected statistics a problem;
- \* Risk Assessment - Time line, predictability of forecasting trends wherein the degree of "uncertainty" increases as time lines lengthen. (Further complicated by the fact that the "when" and "by how much" cannot be estimated accurately, however the current guideline is to allow for 0.7 meter rise in sea level by 2050)<sup>106</sup>;
- \* Whole arena of risk/uncertainty in decision-making process; should be dealt with directly in Environmental Impact Assessments; some of the uncertainty can be removed, and certain risks alleviated by increasing monitoring, surveillance and supervision programs.

The general public looks to its government and policymakers for guidance and reassurance, much the same as children look to their parents for decisiveness and certainty. It is very difficult to

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<sup>106</sup> Ince (1990), Ibid; page 17.

develop a process of making decisions when operating in an intellectual void and general atmosphere of environmental chaos. Given the concept of "change" as the only constant, how can effective plans and decisions be made?

**iii) Decision-making in Planning: The Role of Coastal Zone Management in Planning for Climate Change**

Compounding the problem of persistent, but seemingly imperceptible change, is the need to implement steps now but whose results and benefits may not be realized for many decades into the future. In other words, societies are being called upon to sacrifice short-term and immediate interests (e.g. preferred courses of action and profits) in order to preserve and protect the sustainability of future ecological systems for future generations. In their paper, "Surprise & Opportunity: In Evolution, in Ecosystems, in Society" C.S. Holling and Stephen Bocking (1991) state the need to "acknowledge the inevitability of change [of our ecosystems] in [the] context of sustainable development".<sup>107</sup> Holling and Bocking state that people will have to become their own "architects of sustainable development". In sum, all aspects of human endeavour to sustain daily life will require that all government policies and their respective institutions incorporate issues of global climate change in order to produce a cohesive and

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<sup>107</sup> C.S. Holling and Stephen Bocking, "Surprise and Opportunity: in Evolution, in Ecosystems, in Society" in Planet Under Stress. The Challenge of Global Change. (1991) Edited by Constance Mungall and Digby J. McLaren (The Royal Society of Canada, Oxford University Press; Toronto); page 236.

collective system of management whereby the intended policy objectives of sustainable development filter down to each and each aspect of human activity. Furthermore, thinking and planning will have to be recast to encompass a long-term, integrated approach to coastal zone management wherein economic progress and environmental issues are not only everybody's business, but every person's responsibility.

As for planners, there is a need to ask, "what does my discipline already do?", "what should it do?", and "how could interdisciplinary work be designed?" to address the problems arising from global climate change impacts. To reiterate Boulding's wisdom, "local short-term adaptation and long-term societal planning are ... very different orders of phenomena".<sup>108</sup> What is really needed is the creation of a "Living Policy or Plan" -- getting it off the paper, beyond rhetoric as a living component of the context in which decision-making is done. We don't want it to be a ritual checklist item, not an afterthought, nor one those abstract "policy guidelines" that no one in the field or in the administration can get a handle on it, thus paying it lip service only without a constructive mechanism for actually implementing it.

Knowing what we don't want in planning responses is a positive first step. Ideally we want a proactive planning and follow-up strategy utilizing a team approach. To bring it "alive" requires

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<sup>108</sup> Boulding (1983), Op. Cit.; page 6.

that benefits and windows of opportunities be sought for improvements, to examine economic and political systems for obsolescence, and to train people now to look at information within a context of change, not the norm or status quo, not "business as usual". Planners are all those individuals, institutions, and organizations (public and private) who have an agenda -- in sum, society at large working together to achieve a common mandate. Therefore, critical to initiating action is getting the issue of climate change on everyone's agenda. If we are not actively thinking about it, we are not doing anything about it. It's the old adage of "out of sight, out of mind". Until new thinking paradigms can evolve to the level of second nature, the problems demand all policies and plans keep the objectives clearly printed in black and white.

In their article, "A Multinational Assessment of Coastal Zone Management in OECD Countries" (1994), authors Christopher Chung and Lawrence Hildebrand, cite three types of management deficiencies and failures which characterize the current coastal zone management efforts of the OECD member countries: i) policy deficiencies, ii) intervention failure, and iii) market failure.<sup>109</sup> While these inadequacies are cited as the underlying problems of coastal zone management, they are particularly relevant to the decision-making process in planning attempts to address global climate change and

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<sup>109</sup> OECD - Organization for Economic Co-operation and Development

its impacts, particularly that of sea level rise. A review of these problems illustrates the case in point.

**a) Policy Deficiencies**

First, successful, integrated coastal zone management is "few and far between" among OECD member countries due to an absence of policies, or else poorly developed ones exist resulting in poor integration, coverage, implementation, and enforcement. These policies are also characterized by inappropriate institutional and administrative arrangements, ambiguity or contradiction between policies administered by different sectoral agencies (resulting in "territorial" type conflicts and confusion), and a lack of effective consultation procedures and conflict resolution processes.<sup>110</sup>

Chung and Hildebrand also state that the development of "good" policies, i.e. those that possess clear goals, and policy which integrates legislation, administrative arrangements and sectoral activities, is not enough to ensure adequate coastal zone management. There is a further requirement that these policies be backed up "by political will and support" to translate them into action. They cite the case of the Fraser River Estuary in British Columbia, Canada as suffering from weak political commitment to the planning and management programs developed, demonstrated by a lack

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<sup>110</sup> Christopher Chung and Lawrence P. Hildebrand "A Multinational Assessment of Coastal Zone Management in OECD Countries" in Ecodecision, Vol. 11 (January, 1994); page 46.

of sufficient funding and support staff at the implementation stage.

Second, "legislation relating to the coastal zone is often contradictory and insufficiently comprehensive to respond adequately to the complex relationships that exist". This was illustrated in the OECD study by the existence of "poorly defined or overlapping jurisdictional boundaries, a plethora of administering agencies at several levels of government, duplication of responsibilities or consent procedures, variable public consultation required, limited consideration of the cumulative impacts of decisions and development, and poor enforcement". An example cited is the case of Australia wherein "30 local government councils along the coast interact with some of the 19 state agencies with coastal responsibilities, and, at times, with Commonwealth (federal government) agencies".<sup>111</sup>

On a more positive note, the Coastal Zone Management Act (CZMA) developed in the United States has been recommended as a good reference point for critical policy analysis because of its recognition of the primary roles of state and local government, which the Australian Parliament has subsequently recommended, *inter alia*, that the Commonwealth Government enact a Coastal Zone Management Act upon similar lines. In 1991 New Zealand adopted a new Resource Management Act which relates all "responsibility for

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<sup>111</sup> Chung and Hildebrand (1994), *Ibid.*; page 46.

developing a national coastal policy to one central government department, with the roles and powers of all other agencies involved on the coast clearly specified". To date, procedures have been established that require all levels of government to coordinate and implement policy in an integrated manner as follows:

- \* **At the national level:** responsibility for broad policy formulation and decision making on matters of major significance for the coast or the nation as a whole. Integration at a policy level with other economic sectors (for example, fishing, transportation, and agriculture) is required;
- \* **At the regional level:** responsibility for detailed planning for coastal and inland waters and broad policy guidance for the management of coastal land. Integration at a planning level with other economic sectors is required;
- \* **At the local level:** responsibility for detailed coastal land-use planning.<sup>112</sup>

Chung and Hildebrand comment that it remains to be seen if this type of single agency approach can be adapted to other countries with different political circumstances, and further, if the long-term performance of such a strategy will yield the desired outcome. For example, although the CZMA in the United States represents a well-accepted program, there still remain many policy conflicts despite long-standing interdepartmental and interstate cooperation, in particular subsidized flood insurance programs which encourage risky coastal development and redevelopment; the potential for federal tax policies to conflict with environmental preservation policies; and policies that promote resource development conflict with wetlands preservation policy.

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<sup>112</sup> Chung and Hildebrand (1994), Ibid.; page 46.



**b) Intervention failure:**

In their efforts to maximize the outputs of their coastal zones, many OECD member governments utilize direct intervention strategies, which more often than not, fail. The OECD report cited five primary reasons for this failure including the absence or inadequacy of information, inadequate co-ordination among relevant agencies, the poor demarcation of responsibilities between agencies within and outside government, the limited range of policy instruments used for implementation, and lastly, unsatisfactory policy implementation and monitoring/evaluation phases.

The absence or inadequacy of information results from either missing or deficient types of information, which is often compounded by the shortage of skilled technical personnel to undertake the research and critically review development proposals. Chung and Hildebrand state this is most notable at the local government level, i.e. at the planning level, where detailed coastal land use and management decisions are commonly made. It is the familiar problem of having complex assessments of benefit and cost exercises being relegated to local planners and their respective local councils while at the same time both are hampered time constraints, small and/or inadequate staffing, and insufficient guidance from national and regional coastal policies.

Other problems with regard to the inadequacy of information include the range of information gathered, for instance physical

and biological information should be supplemented by analyses of the economic costs and benefits and environmental impacts of alternative plans, programs and developments. Also, limited opportunities exist for public participation and public input in coastal zone management. In British Columbia, at the local level only one act makes it compulsory to invite public comment, however this input is almost made irrelevant by the absence of public involvement at the planning and decision making levels.

Inadequate co-ordination among relevant agencies result in confusion, environmental damage, and lost or reduced economic or social opportunities, often causing backtracking later at additional expense to fix botched up planning efforts, as in the case of the lagoon of the Aveiro estuary in Portugal. A more positive example of agency co-ordination is the case of the eastern Scheldt estuary in the Netherlands which was based on a lengthy period of planning studies and a high national commitment to the success of the project. Chung and Hildebrand state that "the resulting management plan provides for economic objectives associated with flood protection measures to complement the protection of ecological, fisheries and recreational opportunities.

Poor demarcation of responsibilities between agencies within and outside government impede success of any coastal zone management plan unless clearly specified and co-ordinated roles are laid out. At present, Chung and Hildebrand state that institutional

responses generally fall into two camps: a "within the system" rearrangement in which the overall planning and management system is maintained but constituent elements, procedures and responsibilities are reshuffled; or a complete overhaul of the system is undertaken wherein new "rules of the game" are specified, the New Zealand Resource Management Act being an example of this approach.<sup>113</sup>

The OECD study revealed a strong emphasis on regulatory type instruments among OECD countries including regulations for water quality, targets, zoning, and permitted discharge limits, etc., and economic incentives including polluter-pays principle, taxes, charges, tradeable permits, and fines, etc., and lastly, voluntary agreements including negotiation, education, and suasion. Chung and Hildebrand, among others, argue against such excessive reliance upon economic approaches alone since there exists the tendency to undervalue certain environmental resources, and therefore recommend a combination with a mix of economic instruments and regulation to create a more integrated policy approach.

Problems of reactive policy development and implementation, coupled with a lack of political will to support implementation, a lack of systematic monitoring arrangements, and poor enforcement mechanisms also lead to failures in coastal zone management efforts.

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<sup>113</sup> Chung and Hildebrand (1994), Ibid.; page 47.

**c) Market failure:**

Improvement in the way economic markets operate is only one aspect of attempts to produce effective coastal zone management programs. Chung and Hildebrand argue, "Imperfect valuation or non-valuation of coastal resources lead to inefficient allocation and temporary or permanent environmental damage." "If market prices fail to reflect a resource's full value, demand will be excessive; there is no economic incentive to alter behaviours, and secondary environmental problems may be triggered". Fines and penalties which are too low undermine any and all efforts to control and/or alter behaviour as in the case of the Fraser River in British Columbia, where the authors state the "Fines for violations of habitat protection and pollution control regulations were small and prosecutions intermittent". Furthermore, efforts to incorporate externalities into full resource costs are a difficult task, requiring improved information on the dynamics of interactions and impacts that affect the coastal zone.<sup>114</sup>

As can be gleaned from the OECD report and the comments of Chung and Hildebrand in their assessment of the state of coastal zone management today, new positions need to be taken toward the act of planning, incorporating both past and present data into a more broadly based, integrated format into order to achieve a more proactive approach, rather than "reactive responses involving denial and maintenance" as suggested by Morley (1986) that are

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<sup>114</sup> Chung and Hildebrand (1994), Ibid.; page 48.

commonly found in situations of uncertainty. In summary, it is expected that planning will provide, in the decision-making process,

... a significant role in monitoring the changing nature of the positions held by the interests involved, providing for consideration a range of alternative courses of action, advising on the selection of those actions that will maximize the return to the body it is reporting to, and assisting in the implementation of the chosen route.<sup>115</sup>

In our efforts to respond to global climate change, we must assume the future state of the physical environment to be turbulent -- one which "exhibit[s] variations outside the range of expected disturbances that affect our economic and social systems".<sup>116</sup> In the decision-making process, planners and policy makers will be increasingly required to incorporate, and refine, both the qualitative and quantitative aspects of their information into their planning strategies. It is in this effort that planners enter the realm of "fuzzy gambling" as Dror (1986) calls it because we cannot be absolutely certain, of the outcomes, intended or otherwise, of our efforts to manage present and future situations.<sup>117</sup>

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<sup>115</sup> Morley (1986), Op. Cit.; page 4.

<sup>116</sup> Morely (1986), Ibid.; page 5.

<sup>117</sup> Dror (1986), Ibid.; page 24.

## CHAPTER FOUR

### INTEGRATING CLIMATE CHANGE IN PLANNING

In 1896, Swedish physical chemist Svante Arrhenius published the first analysis on potential climate change caused by industrial emissions of radiatively active gases. Since that time the theory of the greenhouse effect has evolved from conception, to hypothesis, to the current consensus view that it is both real and the probable driving force for global climate change today (Jaeger, et. al., 1988).<sup>118</sup> Although uncertainties abound over both the magnitude and timing of potential climate warming, more ambivalence surrounds the prospects for co-operatively resolving its global implications through a combination of international, national, and local initiatives.

In this review of global climate change and its impacts, such as sea level rise, we have considered the physical phenomenon, investigated its impacts for coastal and island communities, and examined the role of the planning and of planners. The discussion included the complexities involved, uncertainty in planning, constraints to planning, and the challenge of current ambitions to achieve sustainable development through a more integrated approach of coastal zone management. In this concluding chapter we take an overview of past, current, and proposed initiatives to incorporate

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<sup>118</sup> Erik Arrhenius and Thomas W. Waltz (1990), World Bank Discussion Paper "The Greenhouse Effect. Implications for Economic Development". (The World Bank; Washington, D.C.).

new information regarding the environment and development, and more specifically that of climate change impacts in the context of sustainable development goals.

However, it is here amongst the current efforts, that the traditional role of planning and planners, and the objective of sustainable development, are subjected to scrutiny and challenged. What does the challenge of sustainable development really say about the current state of human values and what does this really mean for planning? Traditional planning and the goal of sustainable development are scrutinized for their validity when examined against Dror's contention that "denial and maintenance" are the common responses to issues of uncertainty and that planning has essentially been a reactive exercise, for example in its role of "problem solver". It is further argued here that the role of planning as an activity, and the role of the individual planner, should be one of "enabler", an agent of change who enables its society to be "proactive" through the exercise of planning for the future rather than one of reacting against unintended outcomes of past policies and values.

**i) Current Planning Initiatives and Proposals to Address Climate Change, and Rising Sea Levels**

**a) The International Community**

**The 1970s - Stockholm. The Environment.**

In 1972 the Stockholm Conference marked the beginning of a significant change in the public's awareness of the inter-

relatedness between the physical environment and economic development. It brought to the fore the dangers of indiscriminate development to the natural environment, and recognized the limited capacity of the earth to sustain current patterns of development and indefinitely provide essential resources in the face of blind progress. The environmental issues which emerged were seen, by the end of the Conference, as more than just a question of pollution and isolated cases of degradation. The Stockholm Conference initiated a new, evolutionary stage in humankind's attitude toward the physical environment and its' impact upon it.

By the early the 1970s the failures of "development", particularly in the Third World countries, were becoming rapidly apparent. These countries were caught in a downward spiral exacerbated daily by increasing human demands upon the physical environment. The Green Revolution had failed to fulfil its promise of a technological solution to a people-generated problem. It had also become clear that the Third World nations could not afford the "react and cure" policies adopted by the developed countries. In the poorest countries, environmental issues were directly related to the basic preoccupations of people to find food, fuel, and shelter.

#### **The 1980s - The Emergence of Climate Issues.**

Seven years after the Stockholm Conference, in 1979, the First World Climate Conference was convened in Geneva by the World



Meteorological Organization (WMO), in collaboration with other United Nation organizations and the International Council of Scientific Unions (ICSU). Later that same year, the World Climate Programme was established by the WMO. At that time the new World Climate Programme members declared, "... **there is an immediate need** for nations to utilize existing knowledge of climate and climate variations in the planning of social and economic development".<sup>119</sup> Since 1972 the volume of scientific publications, social debates, and economic arguments have been as endless as the problems of development themselves.

In 1988 the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP) jointly created the Intergovernmental Panel on Climate Change (IPCC). Its mandate was to assess the scientific understanding of climate change, determine the environmental and socio-economic consequences, and formulate possible response strategies to limit or reduce the impacts.<sup>120</sup> At present approximately fifty nations participated in the IPCC Bureau, their efforts divided into three working groups. In August 1990, the IPCC published its first report which plainly stated, "**we cannot continue with business as usual**", and urged the international community to take action. The IPCC also recommended

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<sup>119</sup> Professor G.O.P. Obasi (1992). Climate Change. Environment and Development. World leaders' viewpoints. (World Meteorological Organization; Geneva); Foreword, pg. vii.

<sup>120</sup> Environment Canada "Towards an International Accord on Climate Change" in the Green Plan (August, 1991); (prepared by Atmospheric Environment Service, Downsview, Ontario).

that an international accord be developed on climate change. The proposed Climate Change Convention "would be similar to the existing international agreement to protect the ozone layer" as set out in the 1985 Vienna Convention, "and would set down, as a minimum, a framework of general principles and obligations".<sup>121</sup> Thus, the Framework Convention for Climate Change was tabled at the 1992 United Nations Conference on Environment and Development (UNCED), Earth Summit, in Rio de Janeiro, Brazil.

#### **The 1990s - United Nations' Earth Summit.**

In the 1990s the issue of ecological disequilibrium is no longer restricted to discussions of just economic development activities but extend to include issues of equity, security, and ecological sustainability, most especially so for the small island developing states (SIDS). On a positive note, the issue of global climate change has, at the very least, succeeded in harnessing greater public awareness of the interrelatedness of physical environment and human affairs. The capability of global climate change to undermine both current and future economic and social prosperity has perhaps succeeded in awakening the "sleeping giant" -- the uncertainty surrounding the sustainability of human activities on the planet.

Echoing the sentiments first espoused at the Stockholm

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<sup>121</sup> Environment Canada (1991), "Towards an International Accord on Climate Change"; Ibid.

Conference, and later in the Brundtland Report, Our Common Future, the United Nations' Earth Summit attempted once again to garner world-wide support and consensus on the pervasive ecological problems facing all societies as a result of human activities. In June 1992, as countries convened at the United Nations' First Earth Summit in Rio de Janeiro, the hope was held out that this would be "the" international event of the century, finally putting in place the groundwork for sustainable development and the protection of the global environment through a series of internationally sanctioned conventions to protect and control the use of the earth's diminishing natural resources.

The 1992 UNCED Framework Convention on Climate Change was signed at the Earth Summit committing many of the world's nations to protect the world climate system through a series of specific measures. For the developed nations the convention's prescribed measures included reducing emissions, helping developing nations manage their emissions while continuing to develop, protecting carbon sinks (including forests, oceans and anything else that removes carbon from the atmosphere), and a long list of requirements for inventories, monitoring and reporting.<sup>122</sup>

In recognition of very special circumstances of the small island developing states (SIDS) in meeting the challenges of

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<sup>122</sup> Glenn Rollans, "UNCED Convention Change in the Weather, Changes in the Wind", in Environment Views (Alberta Environment; Edmonton). Vol. 15, No. 3; Winter 1992; page 15.

sustainable development in the face of ecological and economic fragility and vulnerability, Agenda 21 negotiated at the Rio Summit recommended that a global conference be convened to attempt to address the concerns. In April, 1994 SIDS will convene in Barbados for the Global Conference on the Sustainable Development of Small Island Developing States. Its' objective is to "define a number of specific actions and policies relating to environment and development planning to be undertaken by [SIDS], with the assistance of the international community, to facilitate [their] sustainable development".<sup>123</sup> This conference follows earlier work undertaken throughout 1993 in the Preparatory Committee sessions, one in Port Vila, Vanuata for SIDS of the Pacific and Indian Oceans, and the other in Port-of-Spain, Trinidad and Tobago, for SIDS in the Caribbean, Mediterranean and Atlantic oceans. "Each RTM developed [in 1993] a number of plans, policies, programs and bases for action for sustainable development at the national, regional and international levels."<sup>124</sup>

With a mandate to "examine strategies for national and international action with a view to arriving at specific agreements and commitments by Governments and by intergovernmental organizations for defined activities to promote sustained and

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<sup>123</sup> John W. Ashe and Mark D. Griffith in "The Barbados Conference for the Sustainable Development of Small Island Developing States (SIDS): Possible Outcomes" in Ecodecision Vol. 11 (January 1994); page 55.

<sup>124</sup> Ashe and Griffith; Ibid.; page 55.

environmentally sound development" of SIDS at the Barbados Conference, it is hoped that at long last these nations will gain the much needed political and economic clout in the international community.<sup>125</sup> Furthermore, Ashe and Griffith report that an important shift in focus from short-term and interim goals to a long-term planning strategy will be required since much of the environmental decision-making occurring in SIDS are done on an ad-hoc basis. Also on a positive note, progress in the right direction has been the formation of a "53-member Commission on Sustainable Development (CSD), a subsidiary body of the Economic and Social Council (ECOSOC), which has been charged with the task of ensuring effective follow-up to the United Nations Conference on Environment and Development (UNCED) by monitoring the implementation of Agenda 21 at all levels".<sup>126</sup>

**b) National Planning Strategies**

On a national level, efforts to address global climate change and its associated impacts such as sea level rise, has been restricted primarily to planning in the form of policy development -- its analysis, and implementation in its programs. For instance, the Canadian Federal Government has undertaken a series of planned policies to address the impacts of expected global warming, as outlined in the 1991 A State of Environment Report, Understanding Atmospheric Change, along with the Federal Ministry of

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<sup>125</sup> Ashe and Griffith (1994), Ibid.; page 56.

<sup>126</sup> Ashe and Griffith (1994), Ibid; page 56.

Environment's more recent initiative, the Green Plan. These documents provide the basis of information and policies by which the Canadian government intends to implement controls, and mitigate the most negative consequences of atmospheric change. Canada's Green Plan already goes beyond reductions in emissions set out in Earth Summit Climate Convention, aiming for stabilization of greenhouse-gas emissions at 1990 levels by the year 2000 and, by the end of October 1992 a CASA secretariat was assigned to tackle "about a dozen priority issues, including evaluating impediments to energy efficiency, reviewing the building code, and reviewing the use of fossil fuels for the generation of electricity".<sup>127</sup>

In conjunction with the Green Plan, the Canadian International Development Agency (CIDA) also released its updated policy mandate, Policy for Environmental Sustainability in January 1992 to incorporate the growing complexity of environmental concerns into its overseas programs and projects. Existing CIDA policies have already made efforts to incorporate the concept of sustainable development in principle, usually through the requirement of environmental impact assessments (since 1986) into its programs and projects.

In general the developed nations have placed a heavy emphasis

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<sup>127</sup> Ian Burn of Albert Energy quoted in Glen Rollans "UNCED Convention. Change in the weather, changes in the wind" in Environment News, Vol. 15, No. 3, Winter 1992. (Alberta Environment; Canada); page 15.

on research, research reporting, and special committee work, much of which has been seen as delay tactics by critics who advocate a more proactive and immediate response. While similar types of initiatives are being developed and implemented around the world, there are significant differences between the efforts of developed nations versus those of the still developing nations. These two very different economic, social, and cultural groups share common environmental concerns on a global scale, such as global warming trends, however, as stated earlier in Chapter 2, the impacts of such and the ability to respond and/or plan for such changes differ substantially. For example, the OECD member countries have predominately chosen among a variety of economic and market approaches to curb unwanted behaviour, in addition to implementing coastal zone management plans (replete with the necessary technology and expert staff). For these countries it is predominately a matter of material restraint and foresight, since disasters are not yet regularly appearing upon their doorstep. However, if recent events in the coastal zone regions of the United States is any indication of what is coming, perhaps many of the developed nations will heed the wake-up call.

By contrast, in the still developing countries the response is generally an extreme of "our turn to develop as we see fit" or one of crisis because their land base and fresh water resources are rapidly eroding and ecological disasters are routinely visited upon them in the form of floods, hurricanes, tsunamis, etc. This is

why, the small island nations are joining forces to fight for their rights at an international level. Ashe and Griffith report that "To implement sustainable development policies and practices, SIDS will now have to develop, adopt and implement medium- and long-term plans that not only integrate the multiple uses of limited resources, but identify the types of development compatible with their limited endowments".<sup>128</sup>

The small island developing states (SIDS) have identified several priority areas which include integrated coastal zone management, waste management, conservation of freshwater resources, trade, financial mechanisms, information, technology, human resources development, legal instruments and relevant international mechanisms.<sup>129</sup> Ashe and Griffith report six main activities designed to address these issues include: a Small Island Developing Information Network (SIDSNET); Regional Sustainable Development Centres; a Small Island Developing States Technical Assistance Programme (SIDS/TAP); a national Disaster Emergency Fund; negotiation for more equitable terms of trade; and the acquisition of new financial resources from bilateral and multilateral donors.

#### **c) Local Planning Responses**

As discussed in the OECD report in Chapter 3, many, but not all, of the OECD member countries have adopted coastal zone

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<sup>128</sup> Ashe and Griffith (1994), Op. Cit; page 55.

<sup>129</sup> Ashe and Griffith (1994), Ibid.;page 55.



management programs, some integrating national policies and objectives with local concerns and priorities. While the Netherlands has experienced great success with its sea walls to corral the sea, this is not a viable option for many coastal communities. Ince (1990) states that while,

... it may be possible to reduce the cost by concentrating efforts on cheaper options than massive sea defences, including the revival of old technologies for building and food production ... [t]hese are often designed to cope with flooding instead of shutting it out. In the same way, it may be possible to channel flooding to encourage large areas of land near sea level to silt up rather than try to shut out the sea.<sup>130</sup>

As Ince points out, actions and plans like these "depend crucially upon Third World countries having enough time and information to develop coherent plans for dealing with rising sea levels". He states that at present estimates of the greenhouse effect, the Third World countries have up to fifty years to prepare for the worst effects. Pier Vellinga of Delft Hydraulics, Netherlands, "warns against common human measures, such as building sea walls, river embankments and other defences against the rising water", stating that once begun, they will likely become hard to deal with, requiring further building, restoration, higher dikes, and while technically feasible in most cases, also requiring economic, social and administrative conditions that probably cannot be met in many cases.<sup>131</sup>

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<sup>130</sup> Ince (1990), Op.Cit.; pages 60-61.

<sup>131</sup> Ince (1990), Ibid.; pages 58-60.

In his article, "UNCED Convention. Changes in the weather, changes in the wind" Glen Rollans (1992) reports that "In the absence of an international system of economic instruments, jurisdictions that set tough emission-reduction targets may [quickly] find themselves on the moral high ground at the cost of a competitive marketplace".<sup>132</sup> In Ontario, for example, Dr. Giacomo Capobianco, president and CEO of the Coal Association of Canada states "they have set ... a 20 per cent reduction by 2000... [but] they haven't come to grips with the fact that a 20 per cent reduction is bloody painful. By contrast, the Clear Air Strategy says, 'Until we know how much it's going to cost, we're not going to commit to anything'".<sup>133</sup> Glen Rollans further reports that the negotiators of the climate convention "left out specific targets for reducing emissions of greenhouse gases, on the insistence of the United States" and to many observers, this remains "its fatal flaw".<sup>134</sup>

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<sup>132</sup> Glen Rollans (1994), Ibid; quoting Doug Bruchet of the Canadian Petroleum Industry who sat on the advisory committees to both the Clean Air Strategy for Alberta (CASA) and the Canadian Delegation to the climate change convention negotiations; page 16.

<sup>133</sup> Glen Rollans (1992), Op. Cit.; page 17.

<sup>134</sup> Glen Rollans (1992), Ibid; page 15.

Table 2

Convention on Climate Change: CO <sub>2</sub> Emissions Reduction Schedule	
Country	Target
Australia	Interim goal: stabilization at 1988 levels by year 2000, and 20% reduction by year 2005.
Austria	20% reduction by year 2005.
Canada	Stabilize emissions at 1990 levels by year 2000.
France	Stabilize CO <sub>2</sub> emissions at 1990 levels by year 2005.
Germany	30% reduction in CO <sub>2</sub> emissions by year 2005.
Japan	Stabilize at 1990 "per capita levels" by 1995.
Netherlands	Stabilization target of 1989-90 levels by 1995, with 3 to 5% reduction by year 2000.
New Zealand	Reduction of 20% from 1990 levels by year 2000.
Norway	Stabilization during the 1990s.
Sweden	Annual reduction of 5 to 10 million tonnes CO <sub>2</sub> .
United Kingdom	Stabilize CO <sub>2</sub> emissions at 1990 levels by year 2005.
United States	No commitment on CO <sub>2</sub> .

Source: Glen Rollans (1992), "UNCED Convention. Changes in the weather, changes in the wind" in Environment News. (Alberta Environment; Canada); page 15.

In his book, Our Common Seas, Coasts in Crisis, Hinrichsen (1990), believes that the attention currently being generated by discussions on climate change and rising sea levels is a positive one, and

If this obsession with the likely impacts of sea level rise - especially for low-lying islands and coral atolls - generates better management of coastal areas, so much the better. It is the only coastal issue, for the moment, which is capable of arousing a truly international response.

One of the best results that could emerge from all the

concern over climate change and swollen seas would be the development of workable coastal management plans for all developing countries with a coastline. Proper, well-conceived and executed coastal zone management strategies would permit billions of people to utilize their resources better and give them time to prepare for rising seas. Such plans would also allow coastal populations to build for a sustainable future. Perhaps more importantly, they might help give millions of the poorest people, those constantly living on the edge of survival, a sustainable present! [Emphasis added].<sup>135</sup>

Thus, to incorporate climate change information into our daily practices, business and personal, requires no less than a fundamental revamping of how we currently view, and operate in our world. It requires a restructuring of our social institutions, both public and private to enable us to incorporate data in a different context, and design more realistic solutions to global environmental issues. Environmentalist Mia Benjamin-Robinson states, "I would like to be able to say, "Here are five things. Every community do them and you've got no problem." But it really does call for a much deeper mindset change than just simply having a composter."<sup>136</sup> Calgary's Margaret Durnin, of the Development Education Co-ordinating Council of Alberta, concurs:

A sustainability model asks people to say, "Okay, what is the greater good -- greater than just me? What's my role in the community?" And if people only have the energy to start on the individual level of change, of changing lifestyles and habits, and maybe going into the workplace and influencing that, that's great. But I think we have

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<sup>135</sup> Don Hinrichsen (1990), Our Common Seas. Coasts in Crisis (Earthscan Publications Ltd.; London in association with the United Nations Environment Programme, Nairobi); pages 19 and 21.

<sup>136</sup> Scott Rollans (1992), "Alberta at UNCED. Bringing Rio Home" in Environment News, Vol. 15, No. 3 (Alberta Environment; Canada); page 20.

to learn to focus a lot more on working together to produce change.

You can have an entire country recycling, and never see a real change in how forestry policy works ... If you're not willing to get out there and be the activist, then you can support the people who are. Make some donations, give it a priority so that you're supporting some people who are doing policy-oriented work, because it's the hardest thing to fund raise for and it's super important.<sup>137</sup>

Environment and development workers believe "it's important to see yourself as part of a grassroots movement, and not just as a radical working in isolation".<sup>138</sup>

## ii) Planning as if today mattered

In his article, "Myths and Realities of Global Climate Change" James Bruce (1991) states that,

The problem of global warming is real and recognized by a strong scientific consensus. It has been called the most serious global environmental threat of this or any other generation. In spite of this reality, there are significant institutional barriers and other difficulties, in both developed and developing countries, to put ... a program in place. As a Vermont, USA mayor has said, "It is easier to think globally than to act locally".<sup>139</sup>

During an international workshop on energy and climate held in the Federal Republic of Germany (1980), the Preface to its findings concluded that,

... in the decades ahead, **decisions have to be made to**

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<sup>137</sup> Margaret Durnin quoted in Scott Rollans (1992), Ibid; pages 20-21.

<sup>138</sup> Scott Rollans (1992); Ibid.; page 21.

<sup>139</sup> James P. Bruce (1991), "Myths and Realities of Global Climate Change", in Ecodecision, Vol. 1 (1991); page 92.

reduce or avert the impacts of climatic change **before all the answers have been obtained**. Although a climate impact assessment program is faced with many uncertainties, it nevertheless **has to be started now, because society cannot afford to wait until all variables are quantified to the satisfaction of all parties involved**.<sup>140</sup> [Emphasis added]

Schneider further states that "if such studies are not made, then society will merely "perform the experiment" of unprepared, "post-crisis" adaptation with little lead time to minimize preventable damage or maximize available advantage"<sup>141</sup> As Boulding so aptly expressed in her work,

People don't just adapt to change, they create new realities" ... "When interests conflict in the face of environmental and resource changes, whether between households or nations, what determines the development of skills of conflict resolution rather than a resort to violence? What is the relationship between societal vulnerability and societal creativity?".<sup>142</sup>

This brings us back to our earlier discussion on global security issues in relation to climate change impacts. According to Dr. Martin Holdgate, head of IUCN, who chairs the Commonwealth Group of Experts on Climate Change and Sea Level Rise, "the size of this threat to Third World countries points to a basic imbalance in the way the world will deal with the global warming problem. He told the 1989 Commonwealth Small States Conference on Sea-level Rise

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<sup>140</sup> In Chen, Boulding, and Schneider, Editors (1983), Social Science Research and Climate Change, citing Bach, W., Pankrath, J. and Williams, J. (eds) 1980, Interactions of Energy and Climate, (D. Reidel Publi. Co., Dordrecht, Holland; page VIII); page 13.

<sup>141</sup> Schneider (1983), Ibid; page 14.

<sup>142</sup> Elise Boulding (1983), "Setting New Research Agendas: A Social Scientist's View" in Robert S. Chen, Elise Boulding and Stephen Schneider, Editors. Social Science Research and Climate Change (D. Reidel Publishing Company; Dordrecht, Boston); page 8.

that the transitional costs of slowing or halting the emissions which cause global warming will fall mainly on the developed world".<sup>143</sup> Regardless of whether this belief is accurate or not, it implies the generation of further tensions in international relations regarding discussions of development and equity issues. Interviews with world leaders included in the World Meteorological Organization's publication, Climate Change. Environment and Development. World leaders' viewpoints, (1992) covered a wide range of topics including the implications of climate change, ozone layer depletion, air pollution and other related issues, socio-economic development programmes, and activities undertaken to date or proposed to mitigate the potential adverse effects. In the Foreword, Professor Obasi's states that despite the diversity of backgrounds of the interviewees, "their words convey a common thread of hope, of aspirations, as well as a call for action and international cooperation."<sup>144</sup> The important point here is, how can society collectively respond in a constructive and effective manner to pending climate change issues, especially on the local level?

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<sup>143</sup> Ince (1990), Op. Cit.; pages 60-61.

<sup>144</sup> World Meteorological Organization (1992), Climate Change. Environment and Development. World leader's viewpoints. (WMO-No. 772, Secretariat of the World Meteorological Organization; Geneva, Switzerland); pg. viii.

### iii) Recommendations for Action

It is the contention of this author that it is not the role of planning, or planners, to maintain the status quo as is often the case, but rather to enable it to change. We do not live in a static environment but rather in an ever-evolving one so why do we continue to support and encourage those activities which are the causes of rapid climate change such as global warming? Planners include policy makers, government bureaucrats, elected political representatives, business leaders, city and regional planners, and academics. To date most of their efforts and resources have been concentrated upon the accumulation of data, elaborate discussions, and revamping of policies to minimize negative impacts, with most of this activity occurring on the global and national levels. Revisions of coastal zone management strategies, and the regulation of some local economic activities are essentially reactive measures to prevent the worst-case impacts of development in environmentally sensitive zones.

What is not being targeted for change are the primary causes of climate change. We should be working to change and replace those activities which cause CO<sub>2</sub> in the first place. We maintain the status quo by continuing to support private vehicle usage over public transit, by delaying and discouraging the development and implementation of alternative forms of energy use, and by failing to get tough with technologies and industries which contribute to global warming. **What is most critically needed are transitional**



measures to accomodate needed changes in economic and private activities which cause global warming; Attack the cause of problems to permanently re-invent "how" we "do business" and live on a daily basis.

**a) Implementing Transitional Actions on National & Local Levels**

Where, on the international level, the objective is to seek common ground and negotiate consensus for acceptable economic behaviour, national governments should seek to review policies, practices, and financial investments by asking how behaviour at home contributes to the global and regional impacts of atmospheric change as a result of its chosen methods of development and other activities. For instance, a national government should ask,

1. How does this new "layer" of information on atmospheric change affect existing economic, social, and resource policies, including those pertaining to preservation and conservation?
2. Are there specific policy guidelines already in place with regard to linking environmental impacts and development strategies, and do they address the issue of sustainable development? If not, is preparatory work underway to do so? and, What guidelines and criteria should be considered?<sup>145</sup>

If the guidelines are already in place, how adequate are the guidelines and criteria? and, What specific objectives do they meet?

3. Is there a conflict of interest between types of economic activities engaged in and the new concerns and objectives over climate change? How would the new policies affect

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<sup>145</sup> "Guidelines" refer to generalities of practice which should be considered, while "criteria" refers to more specific rules or regulations which must be met. These terms have also been referred to throughout policy literature as "principles" and "obligations".

existing institutions and the delivery of existing programs?, and would the new policies affect existing economic activities?

4. How might existing institutions and local planners better utilize this new knowledge to enable itself to restructure in order to eliminate conflicts and obsolescence within the system, keeping its eye firmly on future scenarios?
5. What transitional activity can be adopted to phase out damaging economic activity until more ecologically sound technologies are developed and implemented?

On the local level, planners should act as enablers, aiding their national counterparts to bring into implementation a cohesive agenda which compliments, instead of competing with, national policies. By performing the role of "enabler" planners, including those who serve as policymakers and elected officials, protect the integrity of the systems which they are serving. By enabling existing institutions to survive via the integration of new information, new circumstances, and new methodologies planners can preserve the means by which its society can survive. Planners serve as enablers when they teach those who are less informed than themselves to stretch beyond existing limitations to achieve more progressive, and hopefully, altruistic goals. Planners enable others by:

- \* being receptive to new ideas and information;
- \* providing current information obtained through networking;
- \* providing a forum for discussion, review, and integration of new information;
- \* providing opportunity to design new and more appropriate methodologies;

- \* providing support and nurturance of new ideas and strategies;
- \* subjecting what we do and why we do it to regular and rigorous self-examination;
- \* keeping abreast of current research in their area of responsibility;
- \* being positive and patient about initial efforts to incorporate new ideas and methods;
- \* possessing integrity;
- \* by blending the best of scientific methodologies in its search for truth with the best aspects of spirituality, respecting the integratedness of all life.
- \* and, most importantly, by lobbying against the use of additional financial resources in projects, infrastructure, and economic activities which support the old status quo of development.

**b) Implementing Transitional Actions in Coastal Zone Management**

Giving special consideration to role of planning in the developing countries, it is here more than anywhere, that the planner must act as an enabler, working to incorporate the following type of information into its coastal zone management plans:

**Foreign Aid Programmes, Action Required By Country, and By Project:**

- \* Identify physical zones of risk, rank on a scale (i.e. coastal zones, floodplains);
- \* Identify any past and current macro-changes in land uses which have impacted upon area, significantly changing physical environment [i.e. flow of water, ground water table, significant reduction in natural, indigenous vegetation and/or crops, changes in soil quality, changes in rainfall, precipitation patterns, temperatures, especially where seasons have been adjusted which affect planting of crops, seed

germination and pollination, (e.g. the Nile in Egypt, no longer possesses a reliable growing timetable; flooding and subsidence in Bangkok where ground tables have been altered; deforestation in China; impacts of previous bombing in Vietnam; and in Africa the affects of salinization of soils, drought, desertification);

- \* Identify population trends within region, types of growth, demographic factors (age, gender, ethic composition);
- \* Identify local and international Non-Governmental Organizations (NGOs) with expertise and contacts within region and area of concern;
- \* Conduct and further update data assessment of coastal zone areas [i.e. rise or lowering of sea level, further invasion of brackish water into fresh water tables];
- \* Note any changes in transition zones of region re vegetation, animals in both rural and urban areas;
- \* Note cloud cover and precipitation levels; pollution; urban heat islands (in megacities especially);
- \* Evaluate projects in terms of sustainability of existing resources for various time frames (including multiple scenarios);
- \* Evaluate expected additional land pressures due to population increases, rural and urban migration patterns, the evolution or presence of megacities, and natural attrition rates;
- \* Hire staff, project managers and consultants for field work which have a sound knowledge of environmental sustainability issues and knowledge of the physical environment. Require the development of a multidisciplinary team incorporating both physical and social scientists, as well as engineers and economists who are specially trained to think in an interdisciplinary manner.

In addition to the above recommendations, the following should also be addressed:

- \* Perception of stress and risk by the poor;
- \* Role of gender since women are the primary managers, adapters, and buffers in times of shortages and economic hardship;
- \* Review existing recommendations from various reports;

- \* Role of local NGOs, local citizen participation to collect data, give input (a less expensive and more reliable approach to improving existing data bank and provides built-in constituency to support future programs, and in addition, aids in local awareness and education); Incorporation of local expertise of indigenous populations who possess special knowledge, insight into their regions, and survival skills in areas of risk;
- \* Education at home and abroad, for the general public and for business especially ("business as usual" is no longer acceptable);
- \* Governments spend time re-defining its' terms of "development" and "sustainability" before undertaking any future projects;
- \* Wider consultation which includes NGOs, local representatives, world environmental bodies, not just business interests. Expand role of community participation and role of women in development;
- \* Liaison with associated projects, locally and internationally with regard to policy development;
- \* Co-ordination of environmental policies and mandates with economic agendas.

These activities should be led by a multidisciplinary team which combines the expertise of both physical and social scientists, and especially those individuals from government, NGOs, and the private sector who have experience in the area of natural disasters. It is this group of people who possess "hands-on" expertise and skills, and therefore can red flag theories or assumptions on the part of other team members.

Leatherman (1994) reports that "there have been few detailed studies of coastal vulnerability of small island states (Roy and Connell, 1991; Pernetta, 1992).<sup>146</sup> In addition to the above

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<sup>146</sup> Stephen P. Leatherman (1994), "Rising Sea Levels and Small Island States", Ecodecision, Vol. 11 (Winter 1994); page 54.

recommendations, Patrick Holmes of Imperial College, London, states that "Sea level information is only one of the types of knowledge which need to be obtained by Third World countries wanting to cope with rising seas", and therefore makes the following additional recommendations:

[that] There ... be a set of "coastal management objectives" setting out just what the country in question wants to achieve in a war against rising sea levels. Since one of the policy options, as always, is to do nothing, it is worth thinking about areas of land which it might be easier to sacrifice than to try saving. In most cases, however, the production of a detailed register of the assets of coastal areas will reveal an overwhelming number of important items, from the national airport to the main suburbs, where such an option is probably not a realistic one.

In this case, the next essential is a detailed database on the coastal environment and the processes which go on there, looking at patterns of erosion and deposition and other issues. This allows a list of options and costs to be drawn up, and eventually leads to a programme of protective works and other tactics. The real point may be to ensure that as much as possible of the work of adapting to higher sea levels takes place within the context of the decisions which people and organizations take all the time, even in normal circumstances.<sup>147</sup>

In looking at climate change impacts in general the early interdisciplinary study (1979) done for the American Association of Atmospheric Studies (AAAS) reported findings similar to that of Holmes,

... what is important for economic and social impact studies is the regional response. Unfortunately, to predict regional responses of temperature, rainfall and so forth requires climatic models of greater complexity - and expense - than is needed to make globally averaged predictions. Nevertheless, those few models which have been applied to this problem tend to suggest certain

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<sup>147</sup> Patrick Holmes quotes in Ince (1990), Op. Cit.; page 62.

coherent features. These include generally wetter subtropical and monsoonal rainbelts, longer growing seasons in the high latitudes, wetter springtimes in high and mid-latitudes, and -- most problematically for future agriculture in developed countries -- drier midsummer conditions in mid- and some higher latitudes (Manabe, Wetherald, Stouffer; 1981).<sup>148</sup>

Boulding aptly summarizes the experience of the planning process in the interdisciplinary AAAS project. She states every social scientist involved with the project had a,

... mind-stretching experience in considering even at the simplest descriptive level the climate-determining interactions of lithosphere, geosphere, hydrosphere, cryosphere, biosphere, sociosphere, lower atmosphere and stratosphere. [Finding that] the hard-soft dichotomy between the physical and the social sciences melt[ed] away in the face of the prediction-resistant complexities of planetary climate processes.

Predictability belongs in the laboratory, or when one is dealing with large-scale processes taking place under familiar and well-defined conditions. ... The economist, sociologist and the psychologist can predict as well as the physicist when the variables are under control. In the study of these macrolevel interactive processes on which our survival as a species may depend, **we are all learners**, from whatever discipline, including the discipline of the humanities. **We all need each other.**<sup>149</sup>

#### iv) Future Thoughts

One of the most interesting points raised regarding the issue of "uncertainty" in planning was the earlier comment by Dror (1986) in "Planning as Fuzzy Gambling: A Radical Perspective on Coping with Uncertainty", of the tendency for "denial and maintenance" to occur in situations of uncertainty. Is the current new philosophy

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<sup>148</sup> Robert S. Chen, Elise Boulding, and S. Schneider (1983), Op. Cit.; page 11.

<sup>149</sup> Elise Boulding (1983), Op. Cit.; page 4.

and policy objective of "sustainable development" really a form of denial -- of another uglier truth, that perhaps situations are worse than those being revealed to the public, and furthermore, is it plausible that the environmental systems won't remain in tack despite our best efforts to promote "sustainable development"? Is the trend to finally address environmental knowledge of systems management merely a clever delay tactic, an attempt to "maintain" the existing status quo without really making a serious effort to develop a new paradigm of thinking -- new ways of living and surviving in a rapidly changing world?

When confronted by new and radically different information than anticipated, it is common for people, organizations, and their governments to fall into a psychological mind-trap which considerably hinders and delays any real progress to averting serious crises. In an effort to grasp and ultimately respond to, new information and rapidly changing circumstances we stumble through a series of behavioural stages characterized as follows. The first stage occurs as something is slowly being recognized as going wrong, usually after massive investment has been made, emotionally, physically, and financially. The tendency in this first stage is to deny the little "signs", justify the "anomalies", and otherwise convince oneself of "coincidence" or one-time phenomena but nonetheless continue to deny the trend.

The second stage admits suggestions that things might be going



astray to surface, but again either denying and/or reserving opinion on some or all aspects of the perceived problem(s). The third stage is to openly admit there are indeed some true "bugs" in the system and order further investigations (usually done only after a minor crisis of sorts has occurred), meanwhile carrying on business as usual for the most part, but now perhaps looking over one's shoulder occasionally to avoid being totally blindsided by further unexpected contingencies.

The fourth stage is the limiting and/or rejecting of certain types of information to be included in the impact analysis reviews; and later fighting tooth and nail any and all proposals which suggest a radical departure from the organizational and operational status quo. This is followed by the final, fifth stage which is when "the future" arrives. Reality collapses all previously held myths; massive, often painful restructuring occurs to the extent that all obsolete systems are defunct and replaced by new systems which better incorporate the new realities -- a paradigm in thinking occurs which in turn now creates a new status quo. At some time in the future the cycle will repeat itself as life progresses along its own course of evolution.

In reality the world is straddling all stages simultaneously because of the very diverse circumstances occurring not only environmentally, but politically, economically, socially, and culturally throughout the world at any given time. The cultural

component is especially important and not to be lightly dismissed -  
- each culture is immersed in its own vision or interpretation of reality based upon its past history, physical environment, and the religious and spiritual philosophies that have evolved in order to cope with such realities. The institutional responses to these realities have evolved directly out of that culture's particular worldview. Some cultures rely heavily upon maintaining the status quo while others regard the future as more important; some have a long history, some have relatively young histories. Each culture places different "values" upon their physical environments, their resources, and most importantly their very humanity -- the value of human life, often further complicated by issues of gender and equity.

The environmental and social impacts that have arisen as a result of our economic behaviour assumes both past and current activities. However, many of the impacts in the future will be largely out of our control to stop because of our past economic behaviour, especially if we "continue business as usual". Human activities have unleashed a chain reaction of a magnitude which we are powerless to stop, and we have become prey to our own criticisms of being merely reactive politicians and planners responding to pending crises, rather than proactive agents in control of our own destiny. The local, national, and international pleas for action and assistance via slogans such as "Think Globally, Act Locally", and "Reduce, Reuse, and Recycle" can only

hope to soften the inevitable blow to the current state of the environment. What is needed is better decision-making strategies which acknowledge the need to eliminate harmful economic and private activities, and replace them with environmental-friendly livelihoods and lifestyles.

It is not prudent to assume that a single approach to global climate change and its related impacts will be sufficient. Each geographic and cultural entity will respond according to its own physical and human problems, and within the context of its own capabilities. After two decades of debate on the environment, it has brought us to the brink of a philosophical global battlefield controlled by a few players, of various extremes and stripes, and suffered by all. It would seem then, that we are currently confronted by what Boulding (1983) refers to as the "Global Problematique", comprised of international economic, information, cultural, and environmental orders.<sup>150</sup> Perhaps we have reached the stage wherein human society can no longer afford to preserve its own "cultures" if global climate change is to so significantly alter the current environment. On a more positive note, to be individually successful will require an openness to outside help and ideas, as well as outside effort to help individuals progress. Transitional measures are required on a local level to help communities cope with changes to industry and lifestyles. There will be no one "right way", but instead a myriad of "better ways",

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<sup>150</sup> Elise Boulding (1983), Op. Cit.; page 3.

some of which have been discussed in this paper. By enacting transitional measures now eventually we will all be better off in the long run.

The challenge then for planning and all planners of every genre is, to change, to be more informed, to be more open to new ideas, values, and approaches to managing daily life, and to be committed to changing our ways of doing business. It is in only planning for the future that we are capable of successfully managing present resources. The farther into the future one looks, the more likely one can be guaranteed a lifetime of which one is proud to claim. This is true, because the value system by which we measure our true worth as individuals will form the overriding principle by which we make our plans, base our decisions, and revert back to in times of crisis. Firmly entrenched values which support and sustain life protect us from backsliding and aid us in successfully resisting temptations which will always present themselves. One successfully lived day added to another leads to a series of many successful days, weeks, months and years. In short a more successful future.

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