



Risk Management and Burden Sharing in Climate Change Adaptation and Natural Disaster Mitigation

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Abstract

The connections between natural disasters and climate change are being increasingly recognised. However, the two communities – the “disaster community” and the “climate community” – have yet to work closely at the scientific/technical level or in the policy and negotiation process.

This paper addresses the possibility of developing a global system of insurance as one possible way in which the common interests of the climate and disaster community might find some useful synergy.

Climate Change and Natural Disasters

Throughout the last decade of the 20th century, both climate change and natural disasters received more attention than ever before in international meetings at the UN, in the media, by governments and civil society, and in the private sector. The International Decade for Natural Disaster Reduction (IDNDR) helped to focus attention on the need for greater efforts to reduce the impact of extreme events in nature on human life and livelihood. The Decade culminated in a forum at which many useful lessons were presented and encapsulated in a declaration. Provision for the continuation of its work was made by the establishment of the International

Strategy for Disaster Reduction, led by an inter-agency Task Force and secretariat based in Geneva.

During the same decade the UN Framework Convention on Climate Change went from negotiations, to signature, and ratification in rapid succession. The Kyoto Protocol to the Convention has also been agreed, and signed, and is close to ratification.

These two important initiatives are both directed towards improved management of the relationship between human beings and their environment, and as such can both be seen as part of the sustainable development agenda described in the Brundtland Report (Our Common Future) and formulated in more detail in Agenda 21.

There are some important connections between natural disasters and climate change. When viewed from the perspective of the “disaster community”, climate change is an additional threat that will cause increased variability and more extreme events. Climate change adds to the problem of natural disasters. From the perspective of the “climate community” an increased frequency of extremes is an indicator of climate change, and helps to dramatise what might otherwise be thought of as a slow incremental process not requiring immediate action.

Despite this obvious commonality of interests, the two communities have not worked as closely together as they might have done, either at the scientific/technical level or in the policy and negotiation process.

One reason for this is probably that both communities have been preoccupied with other aspects of their domains or areas of concern. For the climate change community the preponderance of attention and efforts has been directed at “mitigation” by which is meant the reduction of greenhouse gas emissions and the sequestration of carbon in biomass, with the aim of eventually stabilising the concentration of greenhouse gases in the atmosphere and thus reducing the threat. The disaster community has long focussed its attention on emergency preparedness and disaster relief and rehabilitation. Seen in this light the two communities have much less in common.

The situation has now been dramatically changed by a shift in priorities in both communities. One of the major conclusions of the IDNDR was that more attention should be given to actions that can reduce the vulnerability of people and places to extreme events in nature. In some circles this is referred to as disaster mitigation, and includes longer run measures such as land use planning, building design, and insurance as well as short-term disaster planning. This broadening of the strategy for dealing with disasters has in fact been happening for some time, but the IDNDR confirmed and reinforced this direction.

Change has come more slowly in the climate community and the idea of adaptation encountered strong resistance for some time. In the past two years the prevailing views have changed dramatically and now adaptation is receiving a lot of attention. Three new sources of money or “windows” are being created to help meet the costs of adaptation in the most vulnerable countries and regions, and the 46 Least Developed Countries are being assisted to prepare NAPAs or National Adaptation Plans of Action.

This shift in priorities is in fact a new convergence of interests. There is now a clear opportunity for the



disaster and climate communities to work more closely together.

Attribution, Risk and Burden Sharing

In order to make best use of this new opportunity it is appropriate to ask how we might best draw upon the relative strengths of the two communities. I have one suggestion to make in this direction, and perhaps there are many others.

Climate change is seen as a global environmental problem in a way that disasters are not, at least not so far. Climate change has been brought into the funding mechanisms of the Global Environment Facility (GEF) precisely because it is seen as an issue involving the common property of the global atmosphere. All nations are at risk (although by no means equally) from climate change. Moreover the reason why this is so can be attributed in large part to the historical emissions of carbon dioxide from the more developed or industrialised countries. In the case of climate change the fault or attribution of blame has been placed on the shoulders of the developed countries and in the United Nations Framework Convention on Climate Change (UNFCCC) the developed countries accept this interpretation in principle. How much blame they share, and how this will change in future as the developing countries continue to increase their own emissions are now being vigorously debated and negotiated. In the case of natural disasters no such attribution of blame has been accepted and few even suggest it. Natural disasters are still largely perceived as just that – natural – and hence the attribution of blame is rarely proposed at the international level. At the national and local levels there often is a search for the perpetrators. Governments, private sector entrepreneurs, and God are often indicted. Now climate change is being added to the list of usual suspects.

Because there is an obvious source of blame in the case of climate change attention has focused on the idea of compensation. The developing countries have determined that the industrialised nations are to blame and therefore that they should provide compensation. Since there is no obvious attribution of blame in the case of natural disasters (although some are now beginning to challenge this), the attention has focused much more on risk and risk assessment, risk management and risk reduction.

Insurance to the Rescue?

One way in which the common interests of the climate and disaster communities might find some useful synergy is in the area of insurance. If a way could be found at the international/global level to create a system of insurance against the perils of natural disasters and the impacts of climate change a number of objectives might be simultaneously addressed, and a way out may be found from the present impasse over compensation and liability.

Since the impacts of natural disasters caused by natural forces and natural disasters exacerbated by climate change cannot be distinguished in practice, a global system of insurance could be created which would draw upon the risk assessment models and skills used in disaster work, and the concern for appropriate compensation which so troubles the climate community.

A fundamentally moral case can be made for such action. Since the days of Jean-Jacques Rousseau and his

work on the social contract it has been understood that an essential part of the glue that holds societies together is the idea that “we are all in this together” and that there is a responsibility on the part of the better off and more fortunate members of a community to share their wealth with other less fortunate than themselves. This does not mean that a utopian equality should prevail, but rather that the distribution of wealth, safety, and risk in a society should be “reasonable”. What is reasonable in any given circumstances is open to debate, but the principle is widely accepted.

At the global level such a sense of the social contract does not yet exist, although there are many signs that it is struggling to be born. The rapid progress of globalisation in matters of economy, finance, and trade is making the need for comparable advances in the social and environmental sphere daily more evident. The creation of some sort of global insurance scheme to provide protection against the worst impacts of natural disasters and climate change is a daunting but not impossible ambition. There are many obstacles that need to be carefully considered, not the least of which is the problem of moral hazard. By trying to do good one can in fact encourage and promote actions that make things worse. In addition there is the obvious fact that for most of the world insurance is a private industry that would strenuously oppose more “government interference”. My suggestion therefore is only to take a modest first step. Let there be established at a global level a commission or a task force or some similar body, that could make a careful study of all the options and report back to the UN.

I think that UNDP is in a good position to initiate such a study in association with others such as the World Bank. It would carry even more weight if it could be conducted under the authority of the United Nations and if some governments also actively supported the idea. The specification of the terms of reference and modus operandi of such a commission or task force requires some careful thought and probably negotiations. In the meantime however there are a number of things that might be done to facilitate the work of a commission once established. For example it would be helpful to have a survey of the present availability and status of insurance. Where and in what ways has recent experience been positive, and where and what are the deficiencies? UNDP is in a good position to begin gathering data of this kind and making an assessment of the present situation.

Among the questions that need to be formulated are the appropriate roles of public and private insurance, and also the extent and types of risk to be examined. The idea of insurance is very broad concept and might be designed to include anything from small-scale farmers, up to the nation state itself. At one end of the scale the concern is with the viability of very small enterprises and the flow of resources in small communities. At the other end of the scale the financial viability of nations is at stake.

In view of the growing threats of natural disasters and climate change it is time to examine the idea of collective security and our common future in a globalising world.



8

S E M I N A R P A P E R

Ethical Bases of Risk Management

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Abstract

The human being can be considered “the masterpiece” of the known Universe, taking into account that each one of the more than six billion human beings inhabiting this planet have in our brains an amount of approximately 100 billion neurons (the same number of stars in our galaxy and the same number of galaxies in the Universe), that as recognised by science, form the most complex structure existing, at least in this known Universe. Each human body is the result of the interaction of trillions of cells; each one specialised in fulfilling a specific function. During the process of pregnancy, the human body repeats in “fast motion” (generally in nine months) the process of the emergence and evolution of life on Earth, four billion years ago, until the time in which the first human beings started to walk on the surface of our planet. After birth, we human beings begin to cover, also in “fast motion”, the history of culture (the set of different expressions of the impact of our species on the cosmos, including the knowledge we have on this same cosmos and on ourselves). We human beings are, on the other hand, the creators of the structure that may get to be more complicated than the human brain: the “noosphere”, mentioned by Teilhard de Chardin, formed by the interconnected human brains in true time and of which the first “version” we know today is the world wide web.

But while each one of us, the men and women that inhabit this planet, are an expression of this prodigy of the

cosmos, we must recognise that in the four billion years in which there has been life on Earth, our species has become the worst plague that has ever hit this planet.

Some of the reasons on which we base this statement are the following:

- *Our species has eliminated almost all its “natural enemies”, considering as such, the species that through homeostasis or self-regulation mechanisms control the size and behaviour of a population. Our few, still existing “natural enemies” are found in viruses (HIV, Hepatitis B, etc), but our species is taking firm steps towards their elimination or control.*
- *There is no ecosystem where the human species cannot thrive: we human beings live within the inter-tropical strip, the temperate region, the poles, on the coasts, in cities, at great heights above sea levels, etc. We do not live permanently in the bottom of the seas or in outer space, but the impact of our species is ever growing in each one.*
- *We have been able to avoid the action of natural selection on the individuals of our species (including the author of these lines) that would have surely not reached an adult age without the aid of “cultural measures”. Science and technology have allowed the survival of individuals that would have otherwise not endured, and has increasingly prolonged the lifespan of human beings.*
- *No other species has had the ability of the human species to impact the biosphere, up to the point that today, the human being is able to manipulate the essential software of life through genetic engineering, with medium- and short-term consequences that we are not completely able to foresee. At the same time, we have tried, although without success, to manipulate the software of the climate that, after being achieved, can bring about disastrous consequences.*
- *Today more than six billion human beings inhabit this planet “and if the duplication remains constant, within 40 years (towards 2040) there will be 12 billion; within 80 years 24 billion; within 120 years, 48 billion... However, few people believe that there may be room on Earth for so many persons”. Of course, not all the inhabitants of the Earth exert the same impact on the planet: those calling themselves “developed countries” produce a much greater impact than the countries belonging to the so-called Third World, while at the same time, the strata of the population having the greatest consumption capacity within each country exerts a much greater impact than those with lower incomes. In other words, it is not only the number of persons inhabiting this planet that determines the fact that we are a plague, but the way in which we interrelate with ourselves and our surroundings.*
- *Culture, that in the so-called “primitive communities” was a mechanism for “ecological regulation” that successfully substituted the natural mechanisms that controlled the other species in the different ecosystems, has today become one of the main reasons for our condition as a plague. Just to give an example, we may say that according to the predominant culture in the world, for an animal or plant species to have the right to exist, it must demonstrate its usefulness to the human being, especially in relation to its contribution to competitiveness in the market. This is extended in practice to human cultures and communities and to men and women as individuals: those not “competing” in the market, or not being successful in this competition,*



SEMINAR PAPER

lose their right to exist.

Phenomena such as global heating and its effects on natural phenomena such as hurricanes or the El-Niño and La Niña phenomena, that seem to have become much more destructive than before (and having always in mind the fact that vulnerability is increasing in an even larger and poorer population) can be interpreted in two ways:

This is given by the results of the impact of human activity on the self-regulation mechanisms of the biosphere, and specifically, as effects of the deterioration of these self-regulation mechanisms through the action of man. In more simple words, we may say that the human beings are “ruining” the self-regulation ability of the biosphere.

But, on the other hand, we may consider that far from having been deteriorated, the self-regulation mechanisms, acting like the immune system of the biosphere, are found in a perfect state of health and, through phenomena such as global heating and its impact on the natural phenomena described, they are working to rid themselves of the plague (a thesis that I personally endorse at this moment).

Our work as (theoretical and operative) actors in risk management, is to prevent the natural, social-natural and anthropical phenomena from becoming a threat to humankind. And, as a consequence, we prevent them from producing risks and disasters. Will we then be preventing the self-regulation mechanisms – the immune system – of the biosphere, from fulfilling its objective? Will we then be favouring the plague?

I personally consider that the only acceptable ethic is that of having human happiness as its ultimate goal. Our challenge then is to work for the benefit of human happiness: human safety in the face of the dynamics of Earth and before our own dynamics. But also, we must guarantee that our species will not become a hazard for our ecosystems.

For this we must start from an ethical position that, among other things, will demand the need to acknowledge the right of nature to participate in the decisions affecting it. The wrongly called “natural disasters” are expressions of the voice of nature complaining harshly, since it was not kindly heard or attended when human decisions were made.

Introduction

This text was written in Colombia, and is therefore marked throughout by the painful reality of the war the country is now living through, and that, in the words of the French researcher Daniel Pecault, more than a *civil war*, it is a *war against the civil society*.

The violence in Colombia produces 40 thousand homicides each year, of which nearly 30 thousand are attributed to common delinquents. The others are due to confrontations between legal and out-of-law armed actors (military and police forces, guerilla groups and paramilitary groups), affecting the unarmed civil population that, as in Bojayá (Chocó) a few days ago, tends to be caught between two fires; and the massacres that the guerilla and paramilitary groups carry out indiscriminately against the communities that are suspected to be

collaborators or sympathisers of the other troop, or whose territory is of strategic interest to any of these groups, motivating their forced displacement. The number of internally displaced persons in Colombia at the moment (June, 2002) is nearly three million people.

But also while this paper is being written, a high percentage of Colombian territory and of the communities inhabiting its cities and rural areas are found literally under water due to the strong rainfalls recorded during the months of May and June of this year and the consequent growth of rivers and other water reservoirs in the country, with densely populated banks. It would not be surprising – since this has occurred many times – that, within a few months, many of these same communities will be affected by drought, water and energy rationing due to the depletion of the reservoirs and to forest fires.

The Colombian population, as well as other communities in the world, is losing its ability to adapt itself to changes in its surroundings, that, although being considered apparently *natural*, are increasingly harsh and, as we will see later on, is interpreted by the author as an expression of the desire of the biosphere to recover from the aggressions of the human species, of which it has been the victim.

If the ecosystems have the ability of *resilience*, allowing them to “heal” or recover from the crisis affecting them, the biosphere, formed by all the ecosystems in the planet and by the strong interrelations and interdependence between each other, also has the global ability of *resilience* (an expression of the ability of self-regulation or homeostasis of living creatures), that is expressed at a planetary level or through local processes. We are dealing with an immune system characteristic of living creatures that is also shown by the Earth, and that, as in the immune system in the human body, it produces *fever* when an attack of a certain virus is recorded. In this case, the viruses are possibly ourselves, human beings, and the immune system of the planet is trying to rid itself of us. Paradoxically, from this viewpoint, our function as *promoters of risk management* may be then interpreted as trying to prevent the success of the immune system of the planet in its purpose to rid itself of the *plague*. This is so unless, as part of the risk management, we may find a way to keep working to benefit the human species, but without holding – and much less increasing – our condition as a *plague*. Ethics constitute a prime tool for this purpose.

We Colombians are starting to understand that simultaneously at the local and Earth levels, and both in our condition as Colombians as well as of members of the human species, ethics are for us, at this moment, a requisite for survival. The starting point to constructively solve the crises affecting us is the acknowledgement of the *sacred condition of all forms of life* (including, of course, that of humankind), the acknowledgement of the *unity of the vital phenomenon* (that is expressed as the interdependence between all living creatures forming the biosphere and between the ecosystems of which we are a part) and the acknowledgement of our *responsibility, as human beings, in the face of life on Earth*.

The following pages are the result of many years of work with vulnerable communities both to natural and anthropical threats, the latter being the most severe, with violence in all its expressions (and that in itself as a threat, it is also vulnerability and disaster).

In other words, these are theoretical considerations emerging from our daily practical work, and that through



SEMINAR PAPER

workshops, lectures, field days, pedagogical materials and other means, are returned to the communities as new working tools.

We are a Masterpiece of Universal Transformation

“When I think of the relation between the Universe and the human brain, one of the images that comes to my mind is that of a tree, but not only of its splendid treetop, formed by branches and leaves, but also of the equally extensive rooting system that may get to be as deep under the earth as the branches toward the sky. For me, the branches symbolise the observed Universe, while the roots symbolise the brain. Both systems are constantly growing and evolving and they depend on each other”.

Timothy Ferris

“El Firmamento de la Mente” (The Firmament of the Mind)

Our sun, the star from which all the energy used on Earth is derived, is found at the edge of a galaxy – the Milky Way – which is formed, according to the most sensible calculations, by another 100 billion stars (100,000,000,000). Astronomers state that in space there are some 100 billion (100,000,000,000) other galaxies, some having two, three or four times more stars than our Milky Way.

Supposing that all galaxies had an average of some 100 billion stars, there would then be, in the Universe, the square of 100 billion stars (100,000,000,000 x 100,000,000,000), that is, 100 billion trillion stars (10,000³000,000²000,000¹000,000), a one followed by 22 zeros, a number that is impossible for us to conceive.

Not all these stars have planets revolving around them (in fact, it is believed that, for example in the Milky Way, only 5 per cent of the stars have planets), nor are there the conditions for the emergence of life in all planets, at least in a form similar to that we know on Earth, in which it is essential to have water in a liquid state.

Astronomers take into account other factors to calculate the probability that life may exist somewhere else in the universe, and especially some form of life that is aware of its own existence and of the existence of the cosmos, such as we the human beings: that is, what we proudly call “intelligent life”, or at least “conscious life”.

Among these factors is the probability that, in fact, this may not emerge even in a planet with conditions for life. There is also the probability that in that planet, life would have evolved into an “intelligent” form of civilisation and that it may have been able to survive through its own technological development without falling into a self-destructive phenomenon such as a nuclear catastrophe.

The truth is that no matter how low these probabilities may be, considering any number, in one out of every 10 billion stars in a universe of 100 million trillion stars, there would be one trillion (1000 billion) stars having at least one planet revolving around it that would be inhabited by a civilisation.

In other words, from the viewpoint of probabilities, it is not only possible, but most probable that somewhere

else in the Universe there are living creatures, and even other beings like us that are aware of their own existence.

Our existence on this planet is due to the conjunction of multiple factors, some as strange as that of the presence of the gigantic Jupiter in its orbit around the sun, with an enormous gravitational influence that determines that collisions as that of 65 billion years ago when a comet hit the Earth, are not observed more frequently (which would have not allowed life to evolve to this point).

But even in this case, as we said, no matter how complex the confluence of factors needed for the emergence and persistence of life on a planet, and no matter how small the probability may be that all these factors may appear, it is unconceivable that in such a gigantic universe (10^{33} cubic light years of space, according to Timothy Ferris), this consciousness would have only been developed in a small planet that revolves around a non-significant star located at the external edge of a medium-size galaxy.

Furthermore, where forms of life and forms of consciousness may exist, they may not necessarily be linked to biological processes that are similar to those on Earth, but materialised in other forms of energy or in other types of processes that we are not even able to suspect.

Hence, there has to be life – and also a conscious type of life – somewhere else in the universe, of which we have no doubt, at least from the viewpoint of probabilities, even under the most conservative calculations.

Nonetheless, in this universe of 100 billion trillion stars, we are only absolutely sure of the true existence of life in only one planet: Earth.

And we are only completely sure of the true existence of one sole form of life that is aware of its own existence and aware of the existence of the cosmos: the human species, our own species.

I should anticipate in saying that I share the criticisms formulated to my last statement in regard to the possibility that other forms of life such as animals, and even plants (or mountains and clouds), may also be conscious – in their own way – of their own existence. It is also possible that some animal species (perhaps elephants, whales, dolphins?) may be aware – also in their own way – of the existence of the cosmos.

Furthermore, I would dare to say that I believe that they truly are (the mere act of being what one is, that *“dignity without words of the wild animals”* stated by Timothy Ferris could be understood and realised as another form of cosmic consciousness). But we are entering the field of subjectiveness, in which (although I do not reject its validity), the view of the cosmos of each person and his or her personal values play an important role.

Yet, it seems objectively confirmed that, possibly with a few exceptions, all human beings are aware of their own existence, although we cannot be so sure that all human beings are equally aware of the existence of the Universe and that they form part of it. But the latter is due to cultural reasons, and not because there are brain differences that may prevent some persons from acquiring that awareness of belonging and of totality.



SEMINAR PAPER

The Universe is aware of its own existence through us. It knows itself by means of the human brain and it feels it exists and that it is alive through our senses and our *synesthesia*. We could state that human beings constitute the “*self-perception*” of the universe, the feeling of its own existence (or at least one of its organs of *self-perception*), that is, its kinesthesia (with a k), but at the same time we are our own synesthesia (with an s) of the cosmos: this sense through which the cosmos captures the sensation of its existence and perceives (or questions itself on) the significance and the direction of this existence.

Each human being, each one of the six billion human beings that now inhabits this planet, is a unique, unrepeatable and particular universe. Each one of us has covered, in nine months within our mother’s womb, the history of life on Earth, since it began nearly four billion years ago in an aqueous medium like the amniotic fluid within which our pregnancy develops, until the first human beings appeared on the Earth’s surface. Timothy Ferris states that no structure in the universe is as complex as the human brain, perhaps with the exception of what the Russian, Vladimir Ivanovich Vernadsky, and the French, Edouard Le Roy and Theilard de Chardin, called the *noosphere*, that is, the linking of all our brains through the biosphere.

Even in the case in which there would effectively be other conscious beings, through which the cosmos would perceive itself and would question itself on its *raison d’être*, we, as human beings will not stop being, perhaps not the “masterpiece” (as anthropocentric as it sounds), but at least one of the masterpieces of universal development.

To recognise this character in ourselves does not contrast with our awareness of our smallness both in terms of space as of time.

What is a human being in a Universe of the size of 10^{33} cubic light years?

What is a human being in the midst of 10^{22} stars that exist in the Universe?

What does the human lifespan mean (30 thousand days at most if one lives 82 years), in a Universe 12 billion years old?

In terms of dimensions or duration, we could say that it is nothing. But in terms of significance, we could consider that it is everything.

Thomas Berry stated that “human is that being in which the Universe is reflected and praises itself and its numinous origin by its unique means of conscientious self-perception. All living beings do this in their own way, but in humans this becomes a dominant mode of functioning. We do not think of the Universe, it thinks in itself in us and through us”.

Our ability for love, for discovery, for creativeness and for poetry in all their expressions (including our ability to scrutinise the Universe through academic and “popular” sciences and many of the applications of technology), make me feel proud of belonging to the human species.

We are the Worst Plague that Exists or has ever Existed on the Surface of the Earth

“Many large corporations promote crime and live on crime. There was never such a large concentration of financial resources and scientific and technical knowledge devoted to the production of death. The countries that sell more arms to the world are the same ones that are in charge of world peace. Fortunately for them, the threat of peace is weakening, the dark clouds are floating away, while the market of war is recovering and offering promising perspectives of cost-efficient butcheries. The armament factories work as much as the factories that manufacture enemies according to their needs.”

Eduardo Galeano

“Patás Arriba” (Feet Up)

No species constitutes a plague in itself, but an animal or plant species may become a plague if the mechanisms regulating its impact on the ecosystems of which it forms a part, disappear; the impact may come from either the size of the population or the ecological behaviour of the species, or, of course, from the explosive combination of both factors mentioned.

In natural ecosystems these regulation mechanisms are materialised and are carried out through the many interactions connecting one species with another and through the connection of living creatures (animals, plants, microorganisms) with the so-called *abiotic* components or supposedly non-alive entities of the ecosystems (minerals, humidity, luminosity, temperature, etc).

The growth of one species is controlled, among other factors, by the conditions that guarantee a habitat for its protection, to feed itself, to reproduce itself and to raise its young; by the amount of food available and by its “natural enemies” or predators that feed on that particular species. This live spider web of interactions determines that, for example, if the pressure of a species on its source of food is too large, the food decreases, and with it the possibility of the species to reproduce itself and consequently the species will decline, thereby reducing the pressure on the animal or plant species that it uses as food.

In contrast, if the size of the population of a species increases, there will be more food for its predators (the species that feed on it) and as a consequence there will be more predators, which will lead to a decline of the prey species. Hence, through permanent self-regulation mechanisms (based on a dynamic combination of positive and negative feedback) the natural ecosystems, as well as the so-called agro-ecosystems (productive systems managed by human beings based on the principles of natural ecosystems), remain at the *steady state* condition, that is translated into a harmonic relationship (although not necessarily “in equilibrium”) of the living species among themselves and of these with their surroundings.

If within an ecosystem, the trees that nest birds that feed on certain butterflies, are cut down, for which reason the birds must migrate, the butterflies might well become a plague. And if this felling is carried out to replace the trees by a monoculture of a plant that serves as food for the butterflies, this condition will be even more reinforced.



SEMINAR PAPER

We human beings have been slowly eliminating all the natural mechanisms that at one time regulated our impact on the ecosystems we live in, with which our species has acquired not only the condition of a plague, but of the most destructive of plagues that have ever existed or that exist today on this planet.

In the first place, we have ended with practically all the “natural enemies” threatening our existence (although, as we just saw, in the natural ecosystems, even when certain species are a threat for individuals from other species, in more global terms, they contribute to the survival of the species that is their prey). The few living creatures that we may consider our “natural enemies” are found at a microscopic level (viruses and bacteria). Scientists keep working to eliminate, or at least control, these “natural enemies”, for example through the search for a vaccine against malaria or against AIDS, or by fighting staphylococci and other microorganisms that harass our species.

In the second place, because of our effort, there are no ecosystems or environmental conditions that are completely intolerable for our species: we human beings have conquered the poles, the tropics, the coastal areas at different latitudes, the deserts, and we started our adventure in outer space and in the bottom of the oceans. Although outer space and the bottom of the oceans are not yet inhabited permanently by human beings, the activity of our species does have a notorious impact on them. At this moment, rotating around the Earth are several hundreds of tonnes of space scrap.

In the third place, we have been able to free ourselves from the mechanisms through which natural selection limits the possibility of survival of the “least fit” individuals from the strictly biological point of view, as well as the fact that we have been able to overcome – and we continue to overcome – the “life expectancy” of human beings. And although it is true that a very large proportion of the human population lives under the limits of poverty, which means that it is under conditions of hunger, it is also true that this hunger is not due to the fact that our species is not able to produce all the food we need, but that neither the resources are distributed with equity, nor at the global level, is there a priority to cover human needs, but to protect the economical interests of a few producers and intermediaries. Therefore we see that frequently in “developed countries” – and sometimes in our own country – “excess” food is destroyed to keep prices high. In theoretical terms, humanity may produce the food for twice or three times the number of inhabitants it has today. Another thing is the impact on the planet that that production would imply and the true possibilities of sustaining it on the long-run, that is, to carry it out in a sustainable way.

In the fourth place, the population of our species is increasing faster each day. “At present the world population is of some six billion human beings. If the duplication period remains constant, within 40 years (towards the year 2040) there will be 12 billion people; within 80 years, 24 billion; after 120 years, 48 billion.... However, few people believe that the Earth can sustain so many people.”

In the fifth place, no species has had the impact ability (not only at the local level but also at a global level) reached by human technology in its direct and intentional effects, as well as its indirect or accidental effects. Just to give a few examples, in a few decades we will have deteriorated the ozone layer that filters the ultraviolet rays coming from the sun, and that it took life nearly two billion years to form. The global heating phenomenon, produced by human contamination on the Earth’s atmosphere, has enhanced the destructive

capacity of hurricanes and tornados, as well as other natural phenomena as El Niño and La Niña.

Today the possibility of manipulating the genetic code in living creatures and even human beings is a fact, with consequences that are still unpredictable for the future of the planet and the species. We have the technological ability to transfer water from one basin to another, to create new chemical elements, to extract the energy enclosed in the atoms, to dry up coastal areas and swamps, to extract any mineral or substance enclosed in the Earth's crust, whether it is at the surface or at the bottom of the sea.

We do not know, however, what to do with a large amount of the garbage that all these processes considered as "development" produce, that more harshly invade the soils and sub-soils, the atmosphere and the reservoirs, as well as outer space that was uncontaminated a few decades ago. Referring to the loss of reciprocity in the relation between the human community and the ecosystems we occupy, Thomas Berry states that "what is happening now and the origin of our (ecological) tragedy, is our refusal to return what has been given to us; the industrial system is an effort to avoid this return, the price of our present comforts. We take from the Earth without giving back to it. It is that simple. We take the resources and return poisonous products".

In the sixth place, culture, that used to substitute the mechanisms of self-regulation existing in natural ecosystems in human society, through beliefs and conducts such as myths and rites that enforced them, or the *animism* of the so-called "primitive religions" (that recognised the sacred character of all beings that share the planet with us), are today ever more at the service of our condition as a plague. From the very fact that we lack a totalising view of the cosmos that would allow us to apprehend the Universe as a whole and to discover the role and the position of mankind within that complex trap that is the cosmos, to the disregard of the rights of other animal and plant species, rights that are inborn in their condition as living creatures, regardless of whether they are "useful" or not to the interests (especially economical interests) of mankind.

Our culture reinforces, through most of its expressions, the conviction that we human beings constitute the *raison d'être*, and the ultimate goal of this planet we live in and exploit. We have lost the awareness of the interactions and mutual dependencies between one species and another and between living creatures and the other elements forming the environment. As was already indicated, the scientists suspect, and with a high probability of being true, that life has been able to evolve to forms as complex as the human society, given the presence of the planet Jupiter in its orbit. They know, for example, that the existence of aerobic life on Earth depends on the cleanliness of the phytoplankton (microscopic plants in suspension) that live in the seas and whose photosynthesis generates most of the oxygen we breathe. Science also knows that the stability of the temperature in our planet depends on the ability of the tropical forests to regulate, also through photosynthesis, the amount of carbon dioxide present within the Earth's atmosphere. At the same time, it is known that in the biodiversity of tropical forests there are active principals that can cure many of the diseases known today, as well as diseases that are still unknown or that are still non-existent, but that, if today's rate continues, when the diseases do appear, we will have destroyed all the natural medicine that contains the substances able to cure them.

Since we have been overcrowded in cities that are apparently independent of the conditioning of nature, we have forgotten our dependence to seasonal cycles and even to the need of night and day. The availability of



S E M I N A R P A P E R

artificial light has made us forget that darkness fulfills a function as essential for the daily revitalisation of life, as the function fulfilled by the sun as a source of light and heat energy.

Instead of marvelling before the most tangible prodigies of the cosmos – of a cosmos that starts with our own bodies and of whose wondrous will of life, we, the human beings, are a tangible, concrete and immediate expression – instead of recognising the most evident interdependence that links us with other species and with other beings that share with us our most immediate habitat or that “*sacred community*” of the biosphere, we are delighted before the possibility of improbable dependencies, dictated by “occult” and dubious “sciences”. We are so bewildered by the possibilities of supernatural powers that we have lost the ability to recognise the daily miracles offered to us by nature, including the miracle of existence. As stated by the Colombian writer Arturo Guerrero, “we usually yearn for the stars at noon without realising that the sun is one of them”.

All this determines that we not only act, but also think as a plague.

We confer to ourselves the rights of life and death, of extinction and existence, over other living species and over the other elements of the environment, and we consider ourselves the only *raison d'être* of this planet, up to the point of rejecting anything that may become a hindrance to our predominance and of elaborating multiple philosophical and apparently “ethical” discourses to justify our right to exploit other forms of life or to destroy their habitats.

But at the same time we forget the sacred character of all human life, the value of each individual as a materialisation of the Universe, as an expression of the “sacred community”. This statement is not just mere rhetoric, in a country like Colombia where 40,000 persons are murdered in one year, where abduction is a lucrative industry and where there are one and a half million displaced persons, human beings that are violently torn from their customs, from their roots, from their territory, from their symbolic universe and from their history. We can only understand the profound human drama of the displaced persons if we imagine that from one day to the next someone decides to uproot us from our habitat, and we are forced to move to an unknown and hostile territory.

No other species reaches comparative levels of cruelty against itself and against other species as mankind. No other species is capable of performing the horrors of abduction and torture in any of its physical or spiritual forms. No other species enjoys or is enriched with the planned pain of other human beings, or are they amused with cruelty as in the human species. No other species promotes, as a form of amusement, the fights to death between other species, and even between human beings.

Our potential for cruelty and our destructive power in all its expressions (including so many perverse expressions of science, religion and politics and many ominous applications of technology), make me feel ashamed of belonging to the human species.

The Dimension of Our Dilemma: How can we Act in Favour of the Human Being without Stressing its Condition as a Plague?

“We need new ethical principles that can recognise the absolute evil of biocide (the destruction of the vital systems) and of geocide (the destruction of the planet). It is incredible that we should be so sensitive to suicide, homicide and genocide, and we have absolutely no moral principle to face biocide and geocide (...). What is human, considered at one time as the glory of creation, is now seen as a destructive force. What is human has become the terrestrial disaster. The doubt has even been stated, on the viability of the human species. The question is not if Christianity or other traditions are viable or not, the question is the viability of what is human, or, more precisely, the viability of the Earth in its basic vital systems, during the existence of humanity. This requires an extensive review of our thoughts on all human institutions, especially on religious traditions.”

Thomas Berry

“Reconciliación con la Tierra” (Reconciliation with the Earth)

If on the one hand, at the species level, we acknowledge ourselves as one of the masterpieces of universal transformation and we interpret human reasoning as one of the forms through which the Universe is aware of its own existence and questions itself on its *raison d’être*, and if at the individual level we learn to recognise in each human being a unique, particular and unrepeatable expression of that *“sacred community”* that is the cosmos, but, at the same time we become aware of our condition as a plague, we will be faced with an ethical dilemma, since all we do in favour of the human species, of its quality of life and of its happiness, we will be doing it in favour of the plague.

Personally, I do not conceive an ethic that does not have as its ultimate goal to improve the conditions of existence – either material or spiritual – of human beings. I believe, together with the priest Camilo Torres, that *“love is effective or it is not love”*, and that at the same time ethics, that is a tool of love, becomes an effective action through the multiple materialised expressions of human activity: the production of more and better quality food to cover the growing needs of the population; the development of vaccines and of treatments to avoid and cure diseases such as cancer and AIDS; the reduction of infant mortality; the prolonging of life with quality and material and spiritual dignity; the cure for inborn diseases; the risk management for the prevention of disasters or to reduce the losses and suffering they produce; the search for pacific solutions to conflicts; the disarmament of nations; the abolition of chemical, biological, informational and nuclear weapons... It would be impossible to list all forms through which several hundreds of thousands of human beings are devoted and have been devoted throughout history, to work in favour of our species.

Nevertheless, I repeat, unless we radically change the form in which we interrelate between ourselves and with our planet, everything we are to continue doing in favour of human beings we will be doing against the Earth.

Although at a punctual level it is valid that the progress we make, for example, with a view towards the reduction of poverty and increasing the opportunity of marginal communities, will contribute to the preservation



S E M I N A R P A P E R

of the ecosystems with which they interact, and of the non-human species that inhabit them, at a global level this will only be able to produce real effects in favour of the biosphere if we are able to globally revert the course of our species as a plague.

As Thomas Berry once said, “we need a profound cultural therapy”, an ethical revolution that may redirect the sense of all we will do for the benefit of the human species so that it may, at the same time, benefit the Earth.

Surely, everything stated in this text has already been said before. Therefore, far from trying to be original, our intention in writing this is to gather and stress the validity of multiple contributions of human thought that may help us solve the dilemma, especially for those, as myself, who will not renounce our commitment with the human species, even knowing that we may be contributing to the survival of the plague. Hence, I do not include myself in the line of what Umberto Eco calls “mystic ecologism” according to which “the suicide of all humanity is essential, it would have to perish to save a species that it has almost destroyed, mother Earth, which has been denaturalised and suffocated.”

It would be unconceivable that we should renounce the search for the cure of diseases that affect our species, that we would welcome the massacres and the wars as ways to reduce human population, that we would hinder – if it were in our hands – the possibility of saving the life of a sick child or of prolonging the dignified existence of an elderly person, or that we would stop working to avoid the transformation of phenomena, typical of the dynamics of nature, into disasters for human communities.

But I do believe in the need for a “mystic environmentalism”, that would allow us to feel as one with the cosmos – with that cosmos that starts and has its expressions in our own bodies – and that allows us to recognise and admire in each one of the beings and the phenomena surrounding us (also starting with ourselves), that “sacred community of subjects”, which Thomas Berry refers to.

Although it may sometimes seem to be exactly the opposite, this text is based on an attitude of hope for the future of the human species and of our ability to live in harmony with the Earth and with the other species that, together with us, form the biosphere.

In his epistolary dialogues with Carlo Maria Martini, Bishop of Milan, Umberto Eco asks himself if “there is a notion of hope (and of self-responsibility in relation to tomorrow) that may be common both to believers and non-believers. What can it still be based on? What critical function may a reflection on the end have, that would not imply a disinterest towards the future, but a constant judgment of the errors of the past?”

That hope may possibly be materialised in an ethical and pledged attitude in will as well as in reason, based on the understanding of the unity and interdependence between all forms of life that inhabit the Earth and with the Earth itself, and in our ability to know and feel as one with the cosmos.

We have in ourselves the possibility of compassion, not in the restricted sense appearing in the dictionary (“feeling of sorrow for someone else’s pain or grief”), but, returning to the etymology of the word, as the ability of sharing someone else’s passion without that someone else having to be necessarily a human being. To be able to feel in our own guts the feeling of all the other beings that are part of the cosmos, in other

words, the synesthesia or sense of being, of which we previously referred to above.

It is possible that the importance of having children live together with creatures of other species from their early infancy (as long as they create affective bonds with them and they are not treated as mere disposable toys), lies in that animals have an infinite ability to become our teachers in compassion. Our affective contact with another animal teaches us to understand languages that are not enclosed in words, and to communicate with other living forms through our skin, corporal language, intuition and love.

In the following paragraphs belonging to a classical but hardly disseminated text titled *Culture and Ethics*, Albert Schweitzer defines the way in which ethics should have as its essential goal a respect for life, and how this respect cannot start from anything else but the experience of unity between human beings with all the other expressions of life in the cosmos and how this life should be reflected in the giving of oneself “to the vital affirmation of the universe and of life”.

“All true knowledge becomes an experience. I know the essence of the phenomenon, but I get to understand it by an analogy of the will of life that exists in me. This is how knowledge of the world is transformed in me in the experience of the world. The necessary knowledge of this experience fills me with respect before the mysterious desire of life that encourages all. It urges me to think, and fills me with amazement, it makes me rise more and more towards the height of the respect for life.

“The true philosophy should emerge from concrete data of the awareness of existence, the most direct and understanding data of the consciousness of existence. This consciousness tells us: I am a life with the eagerness to live, in the middle of life that is eager to live. We are not dealing here with a sophisticated phrase. At each moment, its sense is renewed in my spirit. As in my will to live there is a desire toward a transcendent life, and toward that mysterious altitude of the urge to live called pleasure, and at the same time a fear of annihilation through that mysterious enemy of the will of life called pain; in the same way in which I recognise these tendencies in the will of life surrounding me, whether they express themselves in an understandable way or they remain silent. Ethics consists, therefore in this: in living according to the obligation of having the concurrence, within the respect for life, of all the will of life with life itself. Thus, we reach the fundamental and essential principle of moral: good is to sustain life and help it; evil is to annihilate it and place barriers. But this main principle that is essential of the moral not only means an order and a deeper study of the current concepts of evil and good, but also an extension of these concepts. True moral is the person (and only the person) that obeys the obligation of helping all life with which it is in contact, and rejects to do anything harmful to any living being. That person does not ask himself the point to which this or that life really deserves his compassion, or up to what point it is able to feel. Life, as such, is sacred to him. He has no fear that they will laugh at him and consider it sentimentalism. The fate of all truth is just that of producing a general laughter before being recognised as the truth. At other times it was considered a stupidity to hold that coloured persons were true human beings, and should be treated as such. This stupidity has today become an accepted truth. Today it seems exaggerated to extend the same consideration to all living objects, even to the most elementary expressions of life, as the existence of an ethic based on reason. But the moment will come in which we will be amazed that humanity would have taken so long to consider incompatible with ethics the



S E M I N A R P A P E R

damage that we produce today without a reflection on the life that surrounds us. Ethics consists of an unlimited responsibility toward everything alive.

“If the expression of respect for life as a generalised feeling seems hardly alive among us, we have to recognise that the feeling thus expressed is something that, after having been presented to a person’s reflection, will never leave him. Compassion, love and all praiseful enthusiastic expressions are given within it. With an incessant vivacity the respect for life works according to the principles determining it, and is devoted to the permanent, untiring activity of a responsibility that is not detained for any moment and at any time.

“For me, the fact of living is still a painful problem. Imbued with the respect for life in a world where the will of creation works at the same time as the will of destruction, and the will of destruction works at the same time as the will of creation. I can do nothing more than to abide by the solid fact that the will of life is presented within me as a will of life that would like to be one with the other wills of life.

“Ethics for the respect for life knows no relative ethics. Only the conservation and promotion of life can be considered as good. All annihilation and all damage to life, no matter what the circumstances originating them may be, should be considered as evil. It is not through a trend, imposed from outside, toward an equalisation of what is ethical and what is necessary, that man progresses through the path of ethics, but listening to the ever clearer voice of ethics in itself; letting himself be dominated ever more by the desire to maintain and promote life, and opposing with an ever growing decision, the need of annihilation of life, of damage to life. In ethical conflicts, man can only recur to a subjective decision. No one may tell him, in each case, up to what point the extreme limits of perseverance may extend in keeping and promoting life. He must decide for himself, on his own, letting himself be guided by the highest imaginable responsibility toward the life of other beings. We cannot allow ourselves, at any moment, to succumb to indifference. We can only find ourselves in reality when we live the conflicts more profoundly. A clear conscience is an invention of the demon.

“Only when in modern man the desire to again become a true man is aroused, can this emerge from the maze in which it is now forced to wander, blinded by the shadows of knowledge and the pride of power. Only then will he be in a position to effectively oppose the pressure of the relations with society that now threaten his humanity....

“With a responsible feeling toward culture we raise our sight above the peoples and states, directly toward humanity. To he who has ethically given himself in to the vital affirmation of the Universe and of life, to the future of man and of humanity, it is a cause of concern and of hope at the same time. To free himself, to rid himself of that concern and of that hope is poverty; giving himself in to it, is richness. This is our faith in these hard times: without knowing if we will get to see the dawn of a better future and only with the trust in the power of the spirit that may open the path to a humanity based on culture.”

As of Our Duties with the Biosphere (I)

“Considered in its greatest physiological extension, life is the planet’s surface. Saying that the Earth is a piece of rock of a planetary size inhabited by forms of life, is like saying that our body is a skeleton infested with cells.”

Lynn Margulis and Dorion Sagan

“¿Qué es la Vida?” (What is Life?)

Our main duty with the biosphere is to understand it not as something static, but as a dynamic, complex, non-linear process endowed with its own “order” (which, because it does not necessarily correspond to the human concept of order, is given the name “chaos”) and of its own “rationality”, that does not necessarily agree with human logic either. It is known that the biosphere is the complex spider web of living: biotic – beings and conventionally non-living ; abiotic – beings, and of interrelations between them that enable the whole Earth to be considered, not only as a rock bearing life that turns around the sun, but that the Earth itself is a living being.

In other words, that our main duty in relation to the biosphere is to acknowledge its own *entity* (to acknowledge its existence), its own *identity* (to acknowledge that it exists as a subject and not as an object) and its own *personality* (to acknowledge that it exists in its way, according to its own dynamics and its own “order”, and that it cannot be submitted by force to human order, that is, at the same time, an order that varies from time to time, according to the predominant ideology).

Later (or before: it does not matter), comes the duty of acknowledging ourselves as a part of the biosphere, which is expressed not only in that we *know* and *feel* as part of this spider web of interactions that connect some beings with others, but that we are aware of the direct and indirect consequences of our acts or omissions, and that we may assume the corresponding commitment and the corresponding responsibility, not only at an immediate level, but with the generations to come.

One of the greatest problems of cities, in terms of acquiring that awareness and of taking that responsibility, is that the harmful effect of the actions and omissions of “urban beings”, are often produced very far from the place where they are committed. If, for example, we leave the water faucet needlessly open, we do not have before us the ecosystem that is fed from the outlet of the aqueduct, neither do we generally have in mind nor in our imagination, the amount of interactions needed for the sun, clouds, plants and soil together to spout from the earth one sole drop of that water we are wasting. At the same time, if we throw into the garbage can a plastic, non-biodegradable, container, we do not have before us the effects that it will produce in the soil for several years, unless we live near a rubbish dump or a sanitary disposal area, which is quite unlikely when we belong to a social sector of the middle or upper classes.

As absurd as it would be to ask the liver not to feel as part of our body, or to allow the pancreas, the brain or the lungs to act independently, one from the other, as if the other organs and functions of the body did not exist, it is equally absurd to continue considering that the human species is able to continue acting behind



SEMINAR PAPER

nature's back.

Thomas Berry states that “we do not speak to the river, we do not listen to it. We have broken the conversation. On doing this, we have destroyed the universe. If we do not listen to the voice of the trees, birds, animals, fish, mountains and rivers, we are in trouble.”

One of the principles of the “guidelines for a policy for the citizen’s participation in environmental management” adopted by the Environment Ministry in Colombia in 1998, is the need to guarantee the participation of nature in the decisions that affect it. This document states the following to support this principle:

“Although sustainability does not constitute an exclusively ecological objective but mainly a human one (economical, political, social-organisational, cultural, educational, institutional), both the so-called civil society, as well as the State tend to leave out the participation of nature in the decisions affecting it, forgetting that this constitutes the basic substrate of the relations and environmental conditions that are the basis of existence and of the viability of the human species on the planet Earth. Although in most communities forming the present society, nature is normally not listened to, it always makes itself heard, sometimes in a dramatic way, through the wrongly called “natural disasters”, which are rooted from the reaction of the ecosystems to the aggressions of the human community of which they have been the victims. As impossible as it is to speak about sustainable development without the active participation of the communities, it is also impossible without the active participation of nature. The problem lies in that today we have limited knowledge on how to guarantee that participation in practice, or even how to identify, listen and interpret the indications and warning messages sent by nature.

“The inclusion of this “principle” within the guidelines to develop a participation policy has been a permanent reason for controversy.

“The implications of doing this may vary from the most pragmatic ones, that interpret the participation of nature as the realisation of a permanent monitoring of the changes in the ecosystems and of the dynamics of the Earth, with the aim of reaching an adequate risk management (with the objective of managing threats and reducing the vulnerability of the community to face them), to the most philosophical ones (in terms of the so-called “deep ecology”) that search nature’s acknowledged personality and personification, not only as a scenario, but also as a subject and star actor in environmental management for sustainable development.

“The reading of the ecosystems, through western science as well as through traditional knowledge, is a task that has already been undertaken by many institutional actors and the civil society forming part of the National Environmental System (SINA, acronym in Spanish), of Colombia, and it constitutes one of the raisons d’être of the research institutes belonging to the system. Risk management is, or should be, one of the aims of all the components of the National System for the Prevention and Attention to Disasters, closely interrelated with SINA.

“The fact that, under any name, nature’s right to participate in the decisions affecting it has started to be recognised, does not invalidate the inclusion of this principle in politics, moreover when there has been the

insistence in that the participation should constitute a variable that crosses horizontally all the integrants of SINA and all the fields and topics of environmental management.”

Derived from the above mentioned duties, is our obligation to allow the biosphere to “flow” according to its own rhythm and according to its own “logic”, which, as has been said, does not necessarily always agree with logic or with human priorities. When we try to alter the rhythms of nature to adjust them to human needs, we are generally building the conditions for future disasters. We do not have to submit nature to our own desires that are ever greater.

Fortunately our technology has not yet reached the ability to “control” the climate, which, since we are dealing with one of the most complex sub-systems within this whole system that is the biosphere, may produce more catastrophic consequences than beneficial ones, both for our species and for the planet of which we form part. If a minimum increase in the Pacific ocean water temperature is able to produce global disturbances such as the phenomenon called El Niño and its associate La Niña; or if, as was demonstrated by hurricane George that passed through the Caribbean and hurricane Mitch, through Central America, an average planetary temperature a few degrees higher could produce an increase in the destruction capacity of these phenomena, we can imagine what would it mean for the earth’s atmosphere if we could shorten or prolong the summer, transfer clouds from one region of the Earth to another, or provoke and manipulate the hurricanes, the storms or the tornados according to our will, as war weapons.

Through genetic engineering we have been able to intervene in other complex and chaotic systems, such as plant and animals, including human beings, to produce alterations, of which we do not yet know the long-term consequences or, if we can essentially control them, but as someone said, after the genie is out of the bottle, it is impossible to again imprison it. Therefore, it is urgent for ethics to progress faster than technology, with the aim of having those tools and possibilities used for the benefit of life and not to increase the potential damage of the plague.

That same human intelligence that makes me personally feel so proud of belonging to our species, is constructing “intelligent” genetic weapons, capable of identifying its victims and of acting only on those that have certain characteristics in their chromosomes: uses of technology that express the worse of the human plague, of which I am so ashamed to form part.

In our interest to discover our duties with the biosphere, let us call again on Thomas Berry when he stated that we should be aware that “*there should be equal opportunities for things to be as they are. Everything is on the top of the hierarchy in its way. When we talk about swimming, the fish are at the summit; when we try to fly, it is the birds; if we want to harvest peaches, it is the trees; if we are dealing with the specific being of each person, that person is at the summit; if it is the reflective thought, the best are the human beings. But it is not because we are the best in one field that we may be the best in absolute terms. The best in absolute terms is the planetary community, the community of species.*”

But at the same time we should be able to recognise in each individual and in each process, the complexity of the whole planetary community. Each individual, including each human being, is a *fractal* or qualitative summary of the complexity of the universe.



SEMINAR PAPER

Lynn Margulis and Dorion Sagan, referring to Arthur Koestler, explain this phenomenon in the following terms:

“The philosopher and novelist Arthur Koestler (1905-1983) used the term “holarchy” as the coexistence of lesser beings forming part of larger sets. Contrastingly, most of the people think that life on Earth is a hierarchy, a long chain of beings that ends in the human species. Koestler’s denomination is free from the connotation of “superiority” or of the control of the set by any of its elements. For the individuals constituting Koestler’s holarchy, he used the name “holons” that are not simple parts, but wholes that also work as parts. In his metaphysic formulation and terminology... life on Earth is not a created hierarchy, but an emergent holarchy that rose from the self-induced synergy of combination, coupling and recombination.

“In fact, all the existing species are equally evolved. All living beings, from a bacterial cell to a representative of the Congress, evolved from one same autopoietic ancestor that became the primeval live cell. The fact in itself of surviving is already a test of “superiority”. The paused explosion of life that has covered a winding course of four billion years until the present moment has made us all. The Veda intuition that the individual conscience is an illusion and that each one of us belongs to a sole prime substrate – Brahma – may perhaps be right in a certain sense: we share a common inheritance, not only in relation to chemistry but in relation to consciousness, one same need to survive in a cosmos whose matter we share, but that in itself is indifferent to our life and to our concerns.”

Finally, let us express something that is already implicit in the previous paragraphs: when we approach the biosphere as a whole that is complex, indivisible and alive, from the ethical viewpoint the division between biotic and abiotic is senseless. When an abiotic element, having no life, is integrated to the processes of life, its abiotic condition is relative. Even those fearing to fall into “animism” should recognise that for practical purposes that are so vital for the health of the biosphere and for that of the human body, its biotic and abiotic components are both equally important.

As of Our Duties with the Biosphere (II) Are Sustainable Development and Neoliberal Globalisation Compatible?

“The triumph of the free market economy over the state-owned system has not led to munificence for the poor, and unemployment has become a permanent wound for developed countries. I have said it many times and I will repeat it again: the market is an effective mechanism, but as all mechanisms, it is blind: with the same indifference it creates abundance and misery. On its own movement, it threatens the ecological balance of the planet; it corrupts the air, poisons the water, turns forests into deserts, and finally, damages many living species, among them man himself. Finally, and above all: it is not, nor can it ever be a model of life. It is not an ethic, but just a method to produce and consume. It ignores fraternity, destroys social bonds, imposes uniformity of consciousness and has made art and literature a business. The State is not the creator of richness. Many of us ask ourselves, has this situation no solution? And if it does, what is it? I would lie if I say that I know the answer.”

Octavio Paz

One of the greatest issues of humanity in this end of the millennium is the compatibility (or possibility of coexistence or existence at the same time) of the so-called “sustainable development” through which, according to its most well-known definition, it is expected that the present generations may cover their needs without affecting the right of the future generations to cover their own needs, and the neoliberal economic model that today rules the world, based on the globalisation of economy, far beyond any type of ecological, political or cultural frontier, and above any other consideration is ruled by “market laws”.

Globalisation starts from the basis that the economy constitutes a complex and dynamic system, a network of interrelations that connect all the inhabitants of the planet, and the inhabitants with their natural and cultural surroundings, and as a consequence, it states that no human groups or countries can be isolated from this global spider web.

The neoliberal character of globalisation determines that these interrelations must take place at the scenario of an open market, and that the ability of all and each one of the actors participating in this scenario to survive depends on its “competitiveness”, that is, of its ability to compete and “survive” in the market. The neoliberal economical model then adopts, in its most crude interpretation, the principles of “natural selection” described by Darwin, according to which only the “most fit” are able to survive. Here “fitness” becomes a synonym for “competitiveness”.

Neoliberalism and globalisation are apparently based on “natural laws”, which are transferred to the field of economy, both in the theory of evolution and in the postulates of ecology.

If we agree with Thomas Berry that “*human technologies should be coherent with the technologies of the natural world*” we could consider that neoliberal globalisation is a way of harmonising human activities with “the thought” of the Earth, and no one would dare to raise the question expressed on the title of this chapter, on the compatibility between neoliberalism and sustainable development.

However, as stated by a well known ex-president of Colombia, “one thing is one thing and another is another”.

Of course, ecology has shown us not only that all and each one of the biotic and abiotic components forming part of the planet are interconnected, but also that the Earth as a whole, because it is surrounded by a biosphere or spider web of living creatures that permanently interact in order to maintain life, may be considered in itself as a living creature with the ability for self-regulation and with an awareness of its own existence, and not only as an inert rock holding life.

Ecology has taught us also that the “administration” or “environmental management” of the planet should be carried out as a function of that globalism, given the fact that the biosphere constitutes the indivisible result of the dialectic interactions between all the ecosystems of the Earth, and in which the political frontiers between each country (properly called by someone the “scars of history”), or the ideological or cultural frontiers between human groups, are senseless.

It would seem logical, since economy (“home administration”) and the word ecology (“study of the relation between living beings and their environment”) that share in their root the concept of *oikos* or home, are



SEMINAR PAPER

based on the same consciousness of globalism.

At the same time, it would seem logical that the economy, that is a human construction, would adopt for itself the same evolution criteria that, according to Darwin, has operated on and by life throughout almost four billion years in which living creatures have covered the surface of the Earth, and that the survival of one and the disappearance of the other is determined by “organic” mechanisms of selection.

Why is it then that the incompatibility between sustainable development and neoliberal globalisation has been not only stated theoretically, but is increasingly evident in practice? Why is there in the world a growing number of environmentalists – as well as of thinkers and leaders that are not necessarily environmentalists – that are against the neoliberal globalisation of the economy, when ecology shows and demonstrates the globalised character of all the interactions found in our planet? To try to answer these questions we should keep in mind the origin of economy.

Our species has invented this “science”, economy, that theoretically studies the way in which human beings and our communities are related with the resources that are offered to us by nature and man’s own activity, but that in practice, more than explaining, it determines, orders, regulates the way in which these relations should work. The concept “resource” is created by the economy, and it refers to those goods or procedures to which we turn to obtain a certain objective, indicating that our resources are means and not ends in themselves.

In other words, a creature, an object, a “living” or “abiotic” process, including a person or a group of persons acquires the character of a “resource” (we frequently hear the words “human resources” and “human capital”) according to whether it is or may be useful, directly or indirectly for the aim of human beings. A resource is something *useful* at one moment and for a certain objective. That usefulness of the resource for human interests is what is conceded for a good or a service that Marx calls its “*use value*”; while the possibility of exchanging that good or service for another is given the name “*exchange value*”.

Each good has to a certain point a “*use value*” and an “*exchange value*”. Coffee, for example, serves to prepare a stimulating beverage, besides a host of treats (“*use value*”) and it can also be exchanged for cars, heavy machinery, and other manufactured products (“*exchange value*”).

Before the Spanish conquerors arrived, the cultures that lived on what today is known as Mexico and Guatemala, used the cacao not only as food and for rituals (the word chocolate means beverage for gods), but it was also used as money, that is, as a means of exchange.

Gold, that for the pre-Columbian cultures had a symbolic-religious character, a ritual and sacred “*use value*” (although it could also be exchanged for other products), had for the Spanish conquerors above all an “*exchange value*”. The yearning for gold was not for the gold itself, but for the power of the person possessing it, not in the newly “discovered” continent, where it was relatively abundant, but in the European society where it was a sign of power and richness.

From its origin, humanity has exchanged some products for others, initially through that elementary form

that is *bartering* (that has again appeared in Colombia as a consequence of the economic crisis). The communities in the mountains used to exchange – and now exchange – agricultural product of temperate and cold areas, for products from the coastal area and warm areas, and vice-versa.

Later, money was invented, having as its main value that of exchanging (although sometimes it may also have a “use value”: a coin, for example may be used to buy something, but it may also be used to “flip a coin”, or to loosen or tighten a wide slotted screw).

The truth is that, from the viewpoint of economy, every being, object or process in existence in this planet, should justify that existence either through the function of its “exchange value “ or its “use value”, and these values are determined, as mentioned above, as a direct or indirect function of human needs and interests. According to the predominating form of thought, the mere existence of a being does not concede it its right to exist. The plant species of which we ignore their use for human interest, we call “weeds”, and in consequence we do not only feel authorised, but also forced to destroy them.

The ever greater knowledge of nature and of the interactions and mutual dependence between the beings that form it, has been demonstrating the “usefulness” of everything that exists, and has been creating an awareness of the responsibility we human beings have in relation to other forms of life, but always as a function of considering that if we allow them to disappear, in some way, either directly or indirectly, it will be detrimental to us. We keep on being tremendously anthropocentric in our valuation of other species.

In practical terms, it is important and necessary to be able to demonstrate that all that exists in nature is useful to us as human beings, or that our survival depends, either directly or indirectly on the existence of other creatures and of many processes that are not “controlled” by us. That is, we find ourselves in the obligation of discovering and demonstrating the “use value”, or the “exchange value” of everything in existence.

If we lose the ability to establish ethical and “compassionate” relations with that “sacred community of subjects” that is the universe, we should turn to the utilitarianism of our species to defend the right of existence of other beings.

In other words, we should demonstrate that everything in existence, including human beings, offer us comparative advantages for survival in the world market. Everything can compete as merchandise or serves to increase the competitiveness of goods and processes of merchandise.

We base our need of respecting and conserving the integrity of tropical rain forests, not on the rain forests themselves, or because they are the expression of the exuberance of the will of life that animates the universe, but because without their function as a regulator of the composition of the atmosphere, the survival of the human species would be impossible, as has been demonstrated by global heating that is intimately linked to deforestation and the later burning of forests in the planet. And we feel committed with its biodiversity, not because it constitutes an expression of the “sacred community”, but because we know or we presume that in it there are multiple resources to cover the present or future needs of the human species.

This, of course, is ethically valid. We noted above that it would be unconceivable to have an ethic without



SEMINAR PAPER

considering in its ultimate goal, man's quality of life and happiness.

At the same time it is valid from the pragmatic point of view, that if we are dealing with survival in a world ruled by neoliberal principles, we turn to concepts such as that of *“environmental services”*, or the concept of *“ecotourism”*, that allow to sustain in terms of economical competitiveness, the respect and conservation of certain ecosystems and of the species and landscape forming them, as well as the features of the human cultures that form part of them.

Or, we argue on the importance of not contaminating a river, the atmosphere, or the soil, demonstrating that contamination is a sample of the “inefficiency” of productive processes, that lead to a lower competitiveness of the products in the national and international markets, especially now that these markets require the compliance of certain requirements of “environmental management” in their elaboration process. It should be acknowledged that in enterprise management the concept of *“eco-efficiency”* or *“ecological efficiency”* has been introduced, and forms an integral part of the sustainability of an enterprise.

That is, in many cases, it can be demonstrated that the respect for life (basis of ethics) is cost-efficient in economical terms, but it is a very serious question that if this cost-efficiency cannot be demonstrated, the “laws of the market” will determine the extinction of certain living creatures or the processes in which they participate, while determining the disappearance of certain “good manners” or ethical expressions, because they are not “competitive” in the market world.

If, for example, we only sustain the conservation of biodiversity as long as it offers competitive advantages, what will happen to it when through biotechnology the most advanced countries are able to synthesise the active principles of plants that form part of the biodiversity of the tropical ecosystems?

On the other hand, in Colombia, it is simple to demonstrate that the present levels of disintegration that have led the country to the verge of a collapse as an organised society – and that consequently make us a totally unsustainable community – are caused by the combination **inequity - corruption - violence** (all of which are, in one way or another, expressions of the absence of ethics in the respect for life). It is also possible to demonstrate that in a community like ours, dominated by corruption, in the short-term, ethics and solidarity become ballast, and not an advantage.

From this point of view, this reasoning that is expressed in terms of *“why can't I rob if all others do?”* seems difficult to refute, unless we can climb a few steps in the point of view of the ethical discussion and invoke a more elevated sense to human existence.

At the risk of falling into apparently dogmatic sentences, I dare to state that the only way out for the Colombian crisis is the general adoption of an ethic in the respect for life in all its expressions (that is able to counteract the combination mentioned above), but I know that the main obstacle for this to happen is in that, as already stated, in our situation ethics is a ballast and not an advantage for immediate economic survival. We need formulas to construct an economical and cultural situation in which ethics (and its different expressions of compassion and solidarity) may not only be desirable, but also possible in practice, or at least where the daily practice will not hamper them.

We must touch the pockets of Colombians demonstrating that ethics is cost-efficient (hence, the importance of concepts such as *“eco-efficiency”* that was already mentioned), but, more than considering cost-efficiency, we must be able to waken compassion (the ability to “share passion”: to feel in our own guts the feeling of others and the feeling of the cosmos), the feeling of belonging to the universe and its processes, and the reverence towards that “sacred community” of which we human beings are expression and part.

For this, as I already mentioned, it is essential to create the proper climate, a culture broth, a fertile matrix for ethics to enroot and prosper, and to demonstrate its advantages as a formula for survival and for daily coexistence.

In a world that supposedly rejects slavery as an aberrant form of violation of human rights, we human beings (just not to mention other living creatures), have become merchandise and objects with “exchange value”. Under the rules of the neoliberal globalisation game, not only the economical activities that for some reason stop being competitive are “extinguished”, but so are the local customs and even the cultures having values and attitudes that are considered ballasts in the market scenario, and of course, the human beings that lose their condition of being cost-efficient. The enterprises fire those who are about to reach ten years of service to avoid non-payable service loads. The governments are forced to eliminate all types of expenses and subsidies that apparently or actually “distortion” the market. The international economical bodies impose on the countries the obligation to reduce the size of their state structures, which means the unemployment of several thousand workers and employees and the decrease, in practice, of the services lent by the State to the most needy but “less cost-efficient” economical sectors.

In Colombia, even the armed groups that justify their existence and their procedures in the struggle against inequity, have turned the human beings into merchandise, in negotiable objects, and they have made suffering a source of political dividends and of economical resources. On turning to terrorism, murder, forced displacement and torture as forms of struggle (extortion and abduction are the forms of torture that are equivalent to forced disappearances), far from combating a system that degrades human condition, it legitimises the conception according to which human beings do not have dignity inherent to their own existence. Instead, they constitute usable “resources” according to the needs of the market, whether it be a financial market, a market for goods and services, or a market for political and social proposals – or for the absence of proposals. Whoever turns to homicide, torture, to displacement and to terrorism as a means for their struggle, is legitimising them and the right of his adversaries to use the same methods. But they are also legitimising – because they legitimise each other – inequity, corruption and violence.

When we hear in the news that a person is murdered, missing or abducted; or that there are a number of victims of a massacre or displaced families (and even that another enterprise is bankrupt or that the unemployment index has increased another point), we forget that we are not talking about abstract figures, but human beings, and that behind each one of those numbers there is not just one but many lives that are cut short, mutilated, inevitably traumatised. Today we are living in Colombia the consequences of the unhealed wounds of 40 to 50 years of violence, and very probably, the next two generations will have to suffer the consequences of the violence of the 1980s and the '90s.



SEMINAR PAPER

We need to have a “close shave” – and it is getting closer and closer to each and every Colombian – so that we may recognise, behind each abstract number, a tragedy, a face and a story.

On the other hand, we should ask ourselves: What does the concept “market” mean in cosmic terms, in the way that we conceive it and apply it today?

If globalisation has imposed its rules and conditions, we expressed this, it is all right that as individuals and as communities we develop strategies of “competitiveness” that may allow us to survive and progress in the scenario of a “market economy”, but only when these strategies do not imply the deterioration or disappearance of beings and processes that do have significance in cosmic terms, which, unfortunately, is what is happening to us today.

For the sake of survival in this fiction known as the market, in a few decades we will be deteriorating systems and processes that have taken several billion years for the “will of life” of the Universe to develop.

It is usually argued that throughout the history of life on Earth there have been a large number of mass extinctions of animal and plant species. However, this does not authorise human beings to provoke or accelerate new extinction processes through their desire for profit, because of ignorance or because of carelessness. This is equivalent to saying that a person has the right to kill another person because that person was going to die some day.

The impact of living creatures – and of course, of human activity – on their surroundings is inevitable. From precisely these transformations that the living creatures produce on the environment and of the changes that they, or other living creatures, are forced to make as a consequence of these transformations, emerges the concept of co-evolution.

But when this impact leads to the loss of the ability for the self-regulation of the eco-system, these, or the biosphere as a whole, are in charge of paying us back. When we act like a plague, the biosphere activates its self-regulation mechanisms to try to get rid of us. This has a cosmic sense, in contrast to the fiction of the “market” that does not have or will ever have sense beyond a few centuries of human history. After a few dozen generations, if our species has been able to survive, the tyranny of the “market” as we know it today and as it affects most of the human beings, will be overcome.

The “Emergent Behaviour” as a Source of Hope and of Vitality

In the world of “artificial life” (also known as AL or “A Life”), there is the concept of the *emergent* behaviour to refer to those complex forms of “conduct” of systems that are equivalent in nature to the flight of flocks of swallows or to the swimming standards of schools of anchovies, that do not emerge from such a complex and “intentional” programme (in the sense that the elements that form the system are programmed to execute certain manoeuvres), but from the repeated interaction in the virtual time and space of several thousands of objects (called “boids”, a contraction of “bird objects”) having a behaviour that is ruled by three simple instructions:

- Don't get too close or too far from the other objects existing in the virtual space, including the other "boids";
- Try to equal the speed and direction of the other "boids"; and
- Try to "fly" always towards the centre of the "boids" that are found in the immediate vicinity.

Craig Reynolds (a researcher in complex systems of the Los Angeles Symbolics Corp), who "discovered" the behaviour of the "boids", also found that without having a specific instruction for the population of the "boids" as a whole, and without considering the starting point of the different flying objects, these are reorganised by themselves in a spontaneous manner in the form of a school or a flock (that is, in a coherent unit) after evading an obstacle, which constitutes a surprise for the researchers after running the programme for several hours with the three primary instructions.

As in the flock of birds or schools of fish, hundreds of "boids" are detained at the same time, they reduce or increase their speed, they suddenly change their direction and they carry out flight patterns that, on intentionally searching through other means, would require complex computers and hundreds of thousands of hours of programming.

"The simulation starts with the "boids" distributed at random on the screen and they spontaneously get together to form a flock. The first instruction allows for the necessary separation between the "boids". The other two determine the cohesion and the direction of the flock".

The main conclusion derived from Reynolds' experiments is that in the virtual world as well as in nature and in society, behaviours of enormous complexity may emerge from iteration and reiteration of very simple individual components, allowing to concretise the hope that the large separation between the human species and nature, that has led us to become a plague, may begin its transformation through the consequent and coherent interaction of small and simple changes of our individual conduct.

"It seems easy to understand in what way an emergent order is produced from the basic rules that later rise to give place to more and more increasing levels of complexity. From intuition it can be seen how a correct selection of local norms may get to be transformed into global behaviour. The difficult thing to understand is how, starting from global behaviour, it may be possible to modify local behaviour.

Therefore, at a strictly environmental management level, it has been understood that the solution to the large ecological problems of the planet have to be sustained by a coherent sum of local solutions inspired by the same goal. In Colombia, for example, there are hundreds, and even thousands of concrete local experiences of environmental management, true "factories of hope", many of which have been verified and validated – and may be perfectly replicated by adjusting them to the specificities of each region and community – but that in most cases are still marginal and therefore insufficient to definitely and radically impact the predominant conception of development and the deterioration processes affecting the ecosystems of the country.



S E M I N A R P A P E R

At this moment we do not clearly see the “global” solutions to the problems dealing with violence that, as stated above, produce the displacement of 1.5 million Colombians and the almost always unpunished murder of 40,000 persons each year, without considering all the other disastrous consequences.

However, we are aware that at a planetary, as well as a national and regional scale we can purge our condition as a plague if we can become the protagonist of a deep cultural change – and we can say it clearly, a spiritual change – that may lead us to even redefine the concepts of religion and of humanity. The start of this cultural and spiritual change may possibly be the catalyser allowing that successful local experiences in environmental and social management may be able to modify the direction of development and the relations between nature and the human community.

How did Jesus Christ, with 12 barefooted fishermen, provoke the defeat of the Roman Empire, if not through the power of commitment, of the metaphor come true, of conviction?

Based on the idea of the gene, the British biologist Richard Dawkins has created the concept of the “*meme*” to refer to the “*unit of idea*” that, in the same way as the virus are carriers of genetic information, the meme has the ability to disseminate through a population and to infest a crowd.

The first time I found the *meme* concept in the media, was in *Time* magazine at the time of the mass suicide of the followers of the spiritual leader of the sect called “Heaven’s Gate” that led a group of Americans, first to castration, and later to a mass suicide, with the conviction that they would supposedly leave this planet in a space ship.

It seemed to me that if a *meme* of death was able to infest a community, the *memes* of life could surely provoke an *emergent behaviour* in the benefit of life on Earth and in favour of human happiness.

What elementary instructions could be followed by each one of us (persons, communities, organisations, countries) in the assurance that an *emergent behaviour* would evolve from the summing up of individual changes, which would be translated into a planetary transformation?

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Building Resilience to Climate Change through Adaptive Management of Natural Resources

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Abstract

The risks associated with climate change impacts are real but highly uncertain. Emerging insights from adaptive ecosystem management and new institutional economics argue that building resilience into both human and ecological systems is the optimal way to deal with future surprises, or unknowable risks. But do these emerging insights have implications for policy and strategy for climate change adaptation? And how does such management affect the vulnerability of particular social groups or stakeholders in resource dependent societies and vulnerable places? This paper outlines these issues with respect to management of critical resources in the context of Caribbean island states. We review emerging perspectives on collective action for natural resource management and use insights from these areas to inform the nature of future adaptive capacity and direction. A case study is presented of present day collective action for community-based coastal management in Trinidad and Tobago to demonstrate the importance of social acceptance of strategies which build coastal resilience. Yet all societies need to enhance their adaptive capacity to face both present and future climate change outside their experienced coping range.

The challenge, posed at both the scale of local natural resource management and at the scale of international agreements and actions, is to promote adaptive capacity in the context of competing sustainable development objectives.

Introduction

Climate change is happening now. An increasing body of scientific evidence suggests that not only will current human activities change the global climate of the future, but our own and our ancestors' actions have influenced the climate we currently experience (IPCC, 2001b). At present it is thought that the impacts could include a change in the incidence of diseases such as malaria (Martens *et al*, 1999), an increase in the percentage of the world's population experiencing water stress from changes in rainfall (Arnell, 1999), increases in the risk of hunger due to changes in food production possibilities (Parry *et al*, 1999), and increases in flood risk and wetland losses among other problems.

While we are sure that the climate is changing and that human activities are exacerbating any natural changes, we are not sure about the range of changes, the magnitude of future climate change impacts, nor about the global distribution of the impacts. What is clear is that there will be winners and losers from climate change. The question is therefore how do we minimise the short- and long-term costs of climate change? Decision makers will often take the path of least resistance which can include avoiding decision-making where conflict exists over the proposed policy path (Clark, 1996). Engaging stakeholders in developing policy and management strategies succeeds in building a constituency for the problem, raises awareness of the issues and often leads to support for decision-making (Olsen, 1993). This last factor is important where decision-making takes place under uncertainty as is the case of climate change. Inclusionary processes that allow stakeholders to engage in the decision-making process are becoming recognised as important steps that can contribute to more supported decision-making (O'Riordan and Ward, 1997). However forced consensus is not the same as finding a balance among competing objectives of different stakeholders (Kothari, 2001).

Responses to the climate change threat can be considered from two different starting points: either impacts first or vulnerability first. The latter approach requires us to consider who are the most vulnerable in society now and how we can direct development to improve the resilience of both the people and the environment. Studies in the area of vulnerability have proposed measuring national level vulnerability through the development of indicators and indices, such as (Crowards, 2000), and (Kaly and Pratt, 2000). Such indicators are useful in understanding which sectors and regions are most economically, socially and ecologically vulnerable. However, this knowledge needs to be translated into actions to reduce vulnerability. (Abramovitz *et al*, 2001) use the elements of the disaster cycle to categorise the main elements in reducing vulnerability, namely: mitigation, preparedness, response and recovery. This cycle implies that we need to change human behaviour, anticipate disaster, prepare for the worst and plan for recovery. Using the disaster cycle concept is almost akin to using the precautionary principle in environmental planning. It enables us to consider vulnerability reduction in a holistic manner, tackling it as an inter-disciplinary, cross-sectoral, inter-temporal, multi-species management challenge.

Some form of integrated response is clearly needed. Integrated management approaches are being promoted in complex natural systems management, especially where there are different ecosystems interacting and where there are linkages between human activity and ecosystem health, see for example (Cicin-Sain, 1993; Olsen, 1993; Turner *et al*, 1999). Adaptive management is an approach that involves implementing policies as experiments (Holling, 1978). It involves a continual learning process that cannot be separated into 'research'



SEMINAR PAPER

and 'ongoing regulatory activities' (Walters, 1986). Walters further suggests that adaptive management is necessary because, in most cases, full knowledge about a system does not exist, and optimum productivity is an unobtainable goal, hence an iterative management process that is fed by an ongoing learning process is about the best that can be achieved. Ecosystem management, on the other hand, is an approach that "integrates scientific knowledge of ecological relationships within a complex socio-political and values framework towards the general goal of protecting native ecosystem integrity over the long term." (Grumbine, 1994:31).

Adaptive ecosystem management offers one means of undertaking management in the face of uncertainty and risk. The adaptive approach requires that there is flexibility within the management framework to adapt and change as new information and understandings become available. The ecosystem concept requires that the complexity of the ecosystem is accepted, that planning takes place over the appropriate spatial and temporal scales in line with ecosystem changes and that the interactions of human behaviour with the environment are considered. We assume that such an approach can improve the resilience of people and the environment and hence reduce vulnerability. All four elements of the disaster cycle: mitigation, preparedness, response and recovery are tackled by encouraging a move away from mismanagement of resources through the implementation of an evolving management process that develops through an iterative process.

Learning-based, iterative, and inclusive management approaches have been developed within the larger area of integrated conservation and development approaches. For a summary of recent innovations in integrated conservation and development see (Brown, 2002). Such approaches offer pathways for vulnerable climate change, stakeholders to become involved in developing adaptation policy and ensuring that there is 'headroom for change' in the adaptation strategy, often through participatory methods. Using the case study of the adaptive capacity of a community in Trinidad and Tobago to environmental change, this paper explores the impacts of collective action on adaptive capacity and its scope to enable policy to be adapted more rapidly to changing environmental conditions.

In conclusion, we find that it is important that resilience can be built through the extension and consolidation of social networks, both at the local scale and at the national, regional or international scale. Social acceptance of any adaptation strategy is critical and such strategies need to be responsive to the changes that occur in both the environment and society. Hence management approaches need to be iterative and flexible enough to include and manage new information and knowledge as it becomes available.

Environmental Change and Community Response

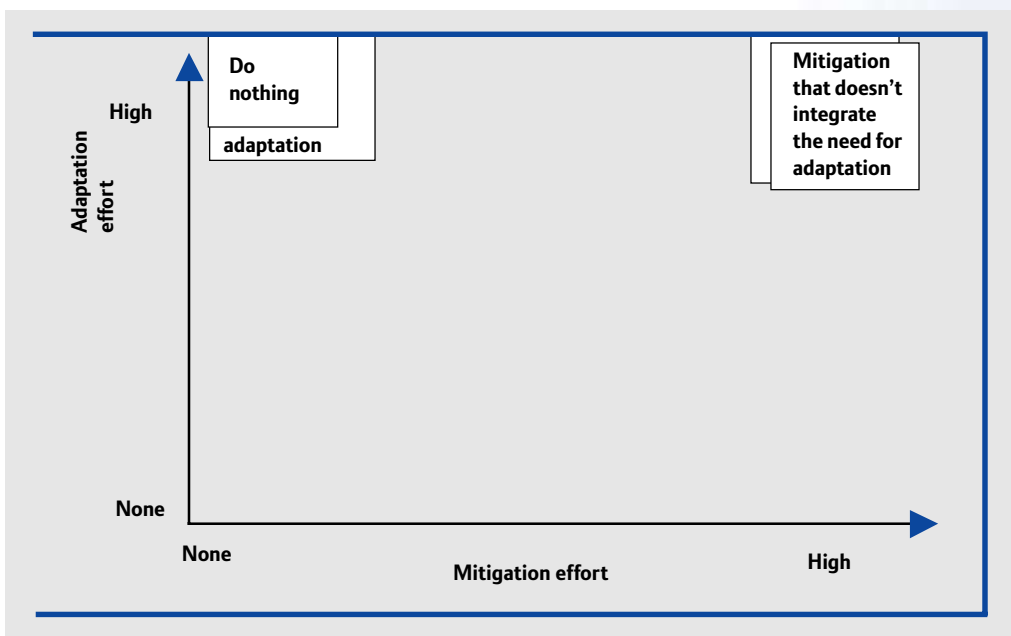
Climate change and its impacts are already starting to be observed and experienced across the globe in a myriad of ways. The most immediately obvious examples of climate change come from increasing incidence of coral damage from bleaching associated with the frequency of ENSO events and the deposition of African dust in the Caribbean, see for example (Shinn *et al*, 2000). These simple examples are merely indicators of the larger changes that are happening, see (IPCC, 2001a).

An increasing body of knowledge reveals that low lying small island states are likely to be uniquely vulnerable to climate change impacts, especially changes in hydrologic cycles (notably increases in both droughts and floods), temperature increases and sea level fluctuations, which could threaten coastal populations, rare coastal

ecosystems such as mangroves and coral reefs, and freshwater lenses through saltwater intrusion, (Carter *et al*, 2001; Nurse *et al*, 2001). In their assessment of the potential consequences of climate variability and change for the south-eastern United States, (Burkett *et al*, 2001) note that there is likely to be an increase in summer heat; agriculture could benefit from moderate warming (2 - 4°C) as long as rainfall does not decline; forest productivity will likely be affected, possibly through a decline in pine species, but an increase in hardwood productivity; sea level rise “will likely accelerate with dramatic effects on population centres, infrastructure and natural ecosystems in the low lying Gulf and South Atlantic coastal zone” (Burkett, *et al*, 2001:139); changes in minimum temperature and rainfall will likely alter ecosystem structure, as will changes in fresh water and tidal inflows. The impacts of these changes on the populations living in coastal areas or on small islands are likely to be immense.

The question then arises, what can be done now? Clearly there is still much uncertainty about the risks and the impacts. The scientific literature splits the options available to decision makers into adaptation and mitigation responses. Adaptation refers to the actions that people take in response to, or in anticipation of projected or actual changes in climate. These actions are designed to reduce adverse impacts or take advantage of the opportunities posed by climate change. Mitigation, on the other hand, refers to actions taken to prevent, reduce or slow climate change. It involves slowing or stopping the build up of greenhouse gases in the atmosphere (Hulme, 2002). However, there are clearly adaptive responses that are also mitigating responses, such as changing crop mixes to include more carbon-sequestering plants that are more resilient to the changing climate. It is in some ways more useful to think of the possible set of responses in terms of the effort and resources that can be spent on mitigating and adaptation activities. The response space that such a conceptualisation creates contains the full set of options available to decision makers, given their resources and desires to implement change, see Figure 1.

Figure 1: Response space to climate change





SEMINAR PAPER

Options range from no effort to high levels of effort to adapt and mitigate. The possible outcomes include both the do-nothing option, the win-win option that describes a situation of adaptation that offers mitigating benefits, as well as a host of other options. However, the considerations of what can be done to mitigate and adapt are in many ways another version of the larger sustainable development question. How can we develop now to allow the future generations to enjoy a lifestyle no worse than our own? How can more sustainable development be promoted in areas that are liable to be suffering the effects of climate change caused by the actions of those outside their control?

In this paper we propose that sustainable development can be enhanced through building community and institutional resilience. Resilience traditionally referred to the single state equilibrium of an ecosystem, where emphasis was placed on resistance to disturbance and speed of return to the equilibrium state (Pimm 1984). It was thought that environmental perturbations, such as groundwater reduction, habitat fragmentation, and inputs of nutrients or toxic chemicals into ecosystems, occurs gradually over time and ecosystems respond in a smooth and continuous manner to these stresses (Vitousek *et al*, 1997). More recent studies have shown that many different types of environmental change can trigger sudden shifts in ecosystems to alternative states; these events can be part of a continuous trend or a one off event (Scheffer *et al*, 2001). The natural sciences are not yet able to precisely predict threshold levels or carrying capacity for complex ecosystems or when such events might occur. Hence preventing environmental perturbations from surpassing threshold levels is not possible, given the state of scientific understanding; however, nor is it desirable, given the importance of ecosystem disturbance to promote system renewal and diversity change (Paine *et al*, 1998).

As it has become clearer that ecosystems have multiple equilibrium, that non-linear changes occur and that there are threshold effects whereby rapid transformation occurs, the definition of resilience has altered accordingly (Nystrom *et al*, 2000). Building on this knowledge, more recent definitions of resilience refer to the magnitude of disturbance that can be absorbed by a system before it moves from one state to another (Holling, 1995). Resilience therefore now considers stability as a central concept. Ecosystem management approaches that increase ecosystem stability rather than control the environmental disturbances are thus being promoted (Nystrom *et al*, 2000; Scheffer *et al*, 2001). In the field of coastal zone management, increasingly it is being proposed that ecosystem resilience may be enhanced through some traditional resource management practices; see for example (Berkes and Jolly, 2002; Trospen, 2002).

Drawing on the concept of ecological resilience, social resilience is used to refer to positive adaptation despite adversity (Luthar and Cicchetti, 2000). Social resilience has also been defined as the ability of groups or communities to cope with external stresses and disturbances as a result of social, political and environmental change (Adger, 2000). Three general characteristics of social systems may need to be present to enable societies to be resilient, notably: the ability to buffer disturbance, the capability to self-organise and the capacity for learning and adaptation (Trospen, 2002).

Research is revealing that individuals and communities have recently been adapting to climate change in the same way that they have coped with climate variability throughout history (Adger and Brooks, 2002). Adaptive capacity exists within communities to different degrees as shown in studies from coping with natural hazards. In New Zealand, after the eruption of Mt Ruapehu, it was found that self-efficacy, a sense of community and problem-focused responses were good predictors of community resilience (Paton *et al*, 2001). Most importantly,

Paton *et al*, recognise the importance of the nature of social relationships as a factor that can enhance resilience. In another example, in the Canadian arctic, the Inuvialuit people of Sachs Harbour have been making short term adjustments in the face of climate change over the past 10 years (Berkes and Jolly, 2002). Their adaptations include switching hunted species and changing the timing and methods of hunting. Flexibility within cultural traditions and networks make other forms of adaptation possible for this community, such as food sharing networks and intercommunity trade. The Berkes and Jolly study also found that newly evolving co-management institutions are creating linkages across scales, local, regional, national and international and hence transmitting local concerns to a wider audience and also being able to draw on the same wider community for assistance and advice.

The lessons from these studies are site-specific but they do establish some broad criteria by which to assess the adaptive capacity of communities. The nature of relationships between community members is critical, as is the access to and participation in the wider decision-making process.

In communities where there is less cohesion, for example one where there is more central planning of community life, it may be that another important factor is the structure of the governance institutions. In other areas, such as coastal zone management, the expansion of social networks has been noted as an important element in developing more robust management institutions (Tompkins *et al*, 2002). More specifically, drawing on (Cox, 1998) networks can be explored in terms of the access to power and representation that they provide to participants (networks of engagement) and the support they offer to participants in vulnerable positions (networks of dependence). The expansion of spaces of engagement appears to be critical to enhancement of resilience in communities being affected by, or likely to be affected by climate change.

The question is then, how can communities enhance their networks of association, most importantly, their spaces of engagement? Local groups and individuals often feel their powerlessness in many ways, although none so much as in the lack of access to decision makers (Brown *et al*, 2001). In this paper we propose that building successful collective actions, possibly in the form of co-management arrangements for natural resources can enhance the resilience of communities, as can maintaining ecosystem services and ecosystem resilience. The latter can retain or even expand the possibilities for adapting to climate change.

Ecological resilience at first thought does not seem compatible with social resilience; one concept focuses on environmental conservation, the other on social development. The means of enhancing both social and ecological resilience may be found in supporting communities in traditional management approaches where there has been identified and continued success in resource management in the face of environmental change. The way to achieve this may be through the application of adaptive ecosystem management that evolves through learning-based integrated resource management. Building community resilience through the expansion of the networks of dependence and engagement could facilitate this type of learning based management.

Underwriting Risk in Communities and in Government

Collective action is the co-ordination of efforts among groups of individuals to achieve a common goal, when individual self-interest would be inadequate to achieve the desired outcome (Olson, 1965). Co-management



SEMINAR PAPER

is one form of collective action whereby resource stakeholders work together with a government management agency to undertake some aspect of resource management. Many examples exist where forms of collective action have been attempted with varying degrees of success, for example in fisheries management (Lim *et al*, 1995), coastal zone management (Sandersen and Koester, 2000), and watershed management (Ravnborg and Guerrero, 1999).

In principle the concept of collective action seems to offer one solution to resource management. However, by working together, by consolidating their spaces of dependence, and by working with the government, to expand their spaces of engagement, stakeholders may in fact be building community resilience to better cope with climate change impacts. In practice there are several threats to successful implementation of collective action, notably the 'tragedy of the commons' (Hardin, 1968), and the 'prisoner's dilemma' (see, for example, Nicholson, 1985). These theories suggest that self-interest will generally drive individual behaviour and the outcome will be free riding behaviour or overuse of the resources. However, recent research suggests that 'free riding' behaviour is not the logical outcome of collectively managed resources (White and Runge, 1995).

Empirical evidence of successful collective actions for natural resource management, such as (White and Runge, 1995) and (Berkes *et al*, 1989), has contributed to the development of a set of general pre-conditions for successful collective action, see for example (Olson, 1965; Sandler, 1992; Steins and Edwards, 1999). Assuming that there is a link between the functioning of stakeholder networks and adaptive capacity, then these pre-conditions could also be the pre-conditions for more resilient communities. There are three principles for collective action on which there is broad agreement: smaller groups tend to be more successful than larger groups; the more equitable the distribution of endowments among members the more chance of success; failures of collective action can be overcome by the introduction of selective benefits and alternative institutional design. Underpinning these principles are the concepts of social discourse and the need for integration of diverse stakeholders' interests into collective decisions (Davos, 1998). Further evidence on these design principles for coastal resources is found in (Baland and Platteau, 1996) who demonstrate that the more unequal the distribution of benefits from collective resources, the greater the possibility of conflict and hence of collective action failure. The literature on deliberative and inclusionary processes for resource management supports these lessons, see for example (Owens, 2000), recognising that the barriers to community or individual action do not lie primarily in a lack of information or understanding alone, but in social, cultural and institutional factors.

At the institutional level, making decisions about what to do about climate change is complicated due to the existence of uncertainty about the size and distribution of the possible impacts, and the risks attached to making maladaptive decisions. However, complexity and uncertainty characterise environmental decision-making in all areas. Fisheries managers, pollution control regulators, coastal zone managers, flood control managers and others have to take decisions about the resource without full knowledge about the complexities of the resource they manage or the impacts of their decisions.

The reality of resource management in these and other areas is that much of it takes place in the face of risk and uncertainty. How to handle that risk and uncertainty has driven research in several areas. The different fields have each taken their own approaches to this challenge. However, in recent years consistent themes

have arisen from them, notably 'integration' and 'adaptation'.

Recognising the importance of learning from errors within past management process may generate new responses based on stakeholders' needs. Such learning-based or adaptive management systems are widely supported (see, for example, Kay and Alder, 1999; Turner *et al*, 1999; and Sorensen, 1997). Similarly integrated approaches are increasingly being promoted. The concept of 'integrated' policy is a recurrent theme in a wide range of resource management literature, including animal pest control, coastal zone management, rural development, forest management, health policy and planning, land use planning and climate change, see for example (Lawrence, 1997; Sorensen, 1997; Pinkerton, 1998; Wainwright and Wehrmeyer, 1998; Allen *et al*, 2001; Jones, 2001; Peattie *et al*, 2001). Initial work on the concept of integrated approaches in the area of coastal zone management suggests that three main issues require consideration, these are: comprehensiveness over time, space, actors and issues; aggregation of policy perspectives into one overall perspective; and, consistency among and between policy levels and management issues for the various sectors and at all levels of management (Underdahl, 1980). More recently emphasis is placed on the need for five areas of integration:

- Horizontal integration;
- Vertical integration;
- Planning, management, education and applied research;
- Planning should recognise the joint functioning of adjacent ecosystems and their inherently interactive processes; and
- Analysis of impacts should be trans-disciplinary.

Horizontal integration refers to cross-sectoral harmonisation of policy and practice relating to resource management, and vertical integration refers to the different scales of governance, from local to international, involved in management. Equally important are the management structures that exist and the potential for change within those structures, whether they are institutions, property rights or communities.

Integrated policy and decision-making can be developed by one of, or a combination of, four main approaches that relate to the process of decision making (Kay and Alder, 1999). Decision-making and planning can be 'rational', whereby problems are identified, goals and objectives are defined, alternatives considered, decisions made, plans implemented and then evaluated. This is the usual structure of natural resource management decision-making that has become entrenched largely due to the use of logframes and project cycles (Adger *et al*, 1999b). Alternative approaches include incremental planning theory, which has also been described as 'the science of muddling through' (Kay and Alder, 1999). Adaptive planning, based on the ideas of (Holling, 1978) and (Walters, 1986), both cited in (Lee, 1999), promotes setting management policies as experiments that can be scientifically tested. Despite significant interest in this approach in the academic arena there has been little success in applying it to management issues (Lee, 1999). The fourth approach, termed 'consensual planning' by (Kay and Alder, 1999) relies on deliberation of management issues by key stakeholders with the objective of building consensus.



An adaptive ecosystem approach may be the answer needed to bring together the lessons learned at the community level through collective actions and understanding networks, and at the government level through developing integrated ecosystem approaches. Ecosystem-based management approaches should recognise the complexity, interconnectedness and dynamic character of ecological systems; be suited to local conditions; incorporate people who are affected by or who affect the ecosystem; work across administrative boundaries; emphasise interagency cooperation and the need for organisational change (Imperial, 1999). The bringing together of the natural and social sciences within an integrated policy framework, coupled with a learning-based management system, may enable gains to be made in reducing vulnerability.

Adaptive Ecosystem Management for Natural Resource Management in Trinidad and Tobago

The apparently incompatible governance structures necessary for promoting social and ecological resilience are clear from experience. Autonomy, inclusive institutions and sharing responsibility for natural resources flies in the face of the dominant hierarchical institutional forms of government throughout the world. Similarly, adaptive ecosystem management overturns some major tenets of traditional management styles. This section outlines an experience in promoting new forms of governance to promote resilience in Trinidad and Tobago. It has to be noted that the resilience objectives (either social or ecosystem) are not explicit in the laws and institutional changes nor in the evolving community-based initiatives. Nevertheless, the need to promote sustainability in the present day resonates with the concepts of resilience and adaptation to climate change.

There have been management dilemmas associated with the Buccoo Reef Marine Park in Tobago for over 30 years, where the struggle to find balance between the drive for development and the need for conservation has left decision makers in a difficult position (Brown *et al*, 2001). Pushed from one side by the population demanding job opportunities and improvements in the quality of life the government has the option of developing a tourism industry. However, it is pulled on the other side as it has to deal with the issues of managing fish stocks; conserving the national 'natural' heritage for future generations of Trinbagonians; maintaining the quality of the environment for both residents and tourists; and maintaining the natural coastal defences provided by the coral reefs and mangroves to protect the island from storm and wave damage, see for example (Goreau, 1967; Laydoo *et al*, 1987; IMA 1995; THA 1999).

The contested objectives for the Buccoo Reef have not been resolved, and hence the area has become one of the many 'paper parks' that exist in name only. Paper parks are global phenomena whereby a protected area has been designated but effective management has not been implemented (Ticco, 1995). In response to many years of under-funding by the government, it was proposed that management could be enhanced by including the Buccoo Reef stakeholders in a participatory decision-making process for the area. This participatory decision-making process, termed the trade-off analysis framework involved identifying and engaging key stakeholders; identifying their interests and objectives for the resource; engaging them in a process of information dissemination and dialogue to explore their preferences for managing the area; collecting and analysing economic, social and ecological data to understand the impacts of different future scenarios on important criteria; data analysis; resolving conflicts that existed and finding areas of agreement among them, see (Brown *et al*, 2001).

The process brought together a mix of community stakeholders from different spatial areas, different socio-economic backgrounds and areas of employment with government stakeholders from different sectors, including tourism, fisheries, land use planning, town and country planning, economic planning and education. The intersect oral, multi-scale, integrated nature of the stakeholder engagement ensured that the diverse actors who influence or who are affected by the complex ecosystems in the coastal zone were all included. The decision-making process was dynamic and the multi-criteria model used to describe the human and ecological system interactions was flexible enough to be able to include new information about coastal processes.

The bringing together of the physical and biological systems through a multi-criteria analysis model and human-behavioural 'soft' systems through stakeholder engagement and conflict resolution was an important part of the integrated adaptive management strategy. It is the soft systems that both Berkes and Jolly (2002) and Paton *et al*, (2001) suggest are critical elements of community resilience. In the Tobago context it was found that social learning, which refers to the process of behavioural and knowledge learning by individuals in social environments through interaction and deliberation brought about a consolidation of the local spaces of dependence and an expansion of spaces of engagement (Tompkins *et al*, 2002). It may be the case that reducing the barriers to communication among institutions and communities promotes social learning (Glasbergen, 1996). Reducing communication barriers may be best achieved through engagement of stakeholders and through openness, sharing information and positively reinforcing feedback. One of the outcomes of this process was the creation of a cohesive multi-stakeholder group, which reached the conclusion that better solutions could be found by working with each other and with the government.

The application of this deliberative and adaptive trade-off analysis process brought about two critical changes at the community level and in the government level. First the various groups of previously conflicting stakeholders were mobilised to take action together, as they recognised that they had more power as a group than as individuals. The groups' cohesion introduced the potential for more flexible localised adaptive responses to environmental change. Open lines of communication meant that small modifications in behaviour at the community level could be instigated through group processes rather than through more formalised institutional change, which was required prior to the establishment of the group as few of the group members communicated with each other. One example of this was in the decision of boat users in the area to be more careful in their use of oil and gas in the marine area to reduce spillage in response to a discussion within the group that oil and gas spills in the marine area were a problem (Adger *et al*, 1999a). The creation of the multi stakeholder group immediately solidified the group's space of dependence and on this base grew the possibility of developing a more formalised co-management arrangement with the government decision makers.

The second critical change arose as the multi-stakeholder group also realised that by jointly speaking with a single coherent message increased their chances of being heard by the decision makers. Conversely, the decision makers found that the active support by the multi-stakeholder group for the decisions to be made enabled them to initiate changes in the management process without fear of making unsupported and hence unsuccessful resource management decisions. The integration of the stakeholders into the decision-making process expanded the stakeholders' space of engagement, which in itself provided them with the incentive to continue to work together.



Community participation in decision-making about natural resources can be beset by a myriad of problems, and may not always be in the best interests of either the targeted community or the natural resource being managed (Cooke and Kothari, 2001). Indeed, the creation of strong spaces of dependence, empowered communities and high self reliance will not necessarily lead to environmental health improvements (Tacconi and Tisdell, 1992). This may be particularly relevant in the case of climate change where those experiencing the impacts will not necessarily be causing the impacts, although the work of (Berkes and Jolly, 2002) adds credence to the idea that it is important to build resilient communities so that they are able to adapt to the coming changes.

In addition to community level adaptation through resilience is the importance of flexible decision-making processes that can accept new information and be modified on the basis of this information. Such learning based processes are anathema to the usual forms of governance which tend to follow a more rigid decision-making process. However, perhaps institutional flexibility is an area that requires developing further.

The Way Forward

The way forward in building resilience to climate threats requires a three-pronged approach:

- Cement localised spaces of dependence;
- Expand spaces of engagement; and
- Avoid being tied to specific response paths through the implementation of flexible learning-based management.

Climate change stakeholders may need to find ways to strengthen their spaces of dependence to support them in the face of change, but also to expand their spaces of engagement to enable them to find a wider support network, in the form of interaction with regional or national government, or international agencies. Social resilience in this context is promoted through at least two distinct networks:

- Networks and community relations of individuals and groups operating to cope with variability and change in everyday decision-making; and
- Wider networks of individuals or groups who may be able to influence the decisions that are being made at the local scale.

The use of integrated and adaptive ecosystem approaches may promote the expansion of these networks, and hence enhance social resilience. Similarly there must be sustained enhancements to ecological resilience, although again this may be achievable through the application of either traditional community-based adaptive responses that have proved successful in supporting ecosystem stability in the face of past environmental change, or through learning-based management, both of which require adaptive systems and governance structures that can change and develop as new information and understanding are introduced.

In the area of adaptation to climate change, the lessons that can be drawn from the fields of new institutional economics and ecosystem-based management offer new direction. Clearly, the nature of the relationships between stakeholders at the community level will determine their immediate response to climate change risks. However it is their networks that enable individuals to engage in the wider decision environment that will affect their longer-term resilience. The existence and the usefulness of these networks is determined by institutional as well as social factors.

At the community level, reducing the barriers to communication through sharing information and positively reinforcing feedback are important elements in consolidating networks of dependence. This could be achieved through collective action, whereby stakeholders work together to find areas of commonality on which they can work to provide support to the wider group. At the institutional level, integrated institutional structures may be better able to support the inclusion of climate stakeholders in decision-making processes, and to ensure that their needs can be addressed by as wide an audience as possible. Providing spaces for deliberation within decision-making processes can facilitate this as can opening up channels of communication and ensuring that all-important stakeholders are engaged.

In both spaces of exchange we need to be sure that we clearly identify who are the vulnerable stakeholders and ensure that any adaptive management processes are directed towards them. This might mean encouraging the evolution of new institutions that are sensitive to the resilience of the ecosystems which they are managing, and that are specific to climate change issues.



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Adaptation Responses from the Central American Energy Sector with Unintended Consequences to Global Climate Change

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Abstract

Traditionally in the Latin American and Caribbean (LAC) region, a majority of finance and technology institutions, governments, and energy producers have been mandated to promote the least expensive sources of energy, which in most cases result in higher sources of greenhouse gas (GHG) emissions. During the last 10 years, in addition to development challenges, the region has also faced changes in rainfall patterns due to climate change. As a consequence, a shift from hydropower to electricity produced from fossil fuels as well as an increase in CO₂ emissions have occurred. For example, data from the Central American interconnection project show that those countries have increased generation of electricity using fossil fuels from 9 per cent in 1990 to 35 per cent in 2001, with expectations to steadily increase thereafter.

Taking into account the Central American stated objectives¹, in previous publications we stated that providing energy for all – the poor and the rich – constitutes a win-win situation. Enthusiastically we proposed that looking at clean energy through the global public good lens increases our awareness of the interconnections between local/national interests to reduce poverty and regional/global interests to preserve biodiversity and

¹ ALIDES, the Central American Alliance for Sustainable Development signed in 1994, introduced an environmentally friendly common development agenda.

stabilise the climate. Why then is the Central American region doing the opposite and increasing both GHG emissions and the consumption of fossil fuel energy?

In this paper we discuss briefly that the atmosphere – one of global public goods – is being harmed by CO₂ and other gases resulting from the human production of goods and services. Our analysis centres on electricity production and exploring the possibility of avoiding the development path initiated by the 1850s industrial revolution and the use of CO₂ intense power sources. Hence, we focus on identifying some of the reasons that impede the use of alternative options in Central America, which would succeed in reducing the use of CO₂ intense fuels, such as charcoal and oil.

Policy makers should make adaptation decisions to solve climate change and economic development problems based on various forms of information: available, processed, and that with numerous limitations (for example, economical and environmental information). This situation has resulted in Central American countries abandoning their indigenous sources of energy – with great potential but affected by the climate (less rain) and the economy. The new sources are not only imported – increased demand of foreign exchange – but also CO₂ intense. Nonetheless, they are climatically reliable and require smaller initial investments than other alternatives.

We use the following definitions for mitigation and adaptive capacity from the IPCC. Mitigation is defined as an anthropogenic intervention to reduce the sources of greenhouse gases or enhance their sinks. Adaptive capacity is defined as the ability of a system to adjust to climate change, including climate variability and extremes, to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

This paper is divided in three sections. The first describes the structure of energy supply and demand in Central America and explores possible alternatives to fossil fuels. The second includes some anecdotic as well as factual, first-time evidence about the policymaking process that takes into account climate change scientific data and occasionally makes the wrong adaptation decisions². The final reflects on worrisome repercussions to other parts of the world of the applicability of Central America's policy approaches discussed here, and suggests some possible changes.

The Energy Context in Central America

Since the early 1990s the demand for energy has been growing in Central America. The local endowments in fossil energy, however, are negligible to supply the increasing needs while the potential of renewable sources is colossal. The climate phenomenon known as El Niño, itself associated with climate change, has been modifying the availability of non-fossil forms of energy, such as hydroelectricity. As a consequence, Central American governments, with the exception of Costa Rica, are prioritising the provision of reliable and affordable electricity rather than persisting in the use of renewables in the face of first evidence of changes in rainfall patterns and

² Mitigation is defined as an anthropogenic intervention to reduce the sources of greenhouse gases or enhance their sinks (www.ipcc.ch/pub/wg3spm.pdf, 6 June 2002 at 5:05 p.m.). Adaptive capacity is defined as the ability of a system to adjust to climate change, including climate variability and extremes, to moderate potential damages, to take advantage of opportunities, or to cope with the consequences (www.ipcc.ch/pub/wg2TARtechsum.pdf, 6 June 2002 at 5:00 p.m.).



other climatic events. The language of the scientific community and growing evidence of adverse climate effects is somehow not reaching the policy makers to allow them to make better-informed choices.

Fossil Fuel Resources and the Growing Demand of Energy

Historically, Central America refers to five countries: Guatemala, Honduras, El Salvador, Nicaragua, and Costa Rica. However, Panama is often included and we will follow that tradition. With the exception of Costa Rica, one of the most stable democracies in Latin America, the region has suffered from the civil wars or unrest in recent decades. Latest peace agreements in Guatemala and El Salvador, followed by the election of democratic governments in all countries and acceptable economic growth makes this region a stable one within the Latin American context.

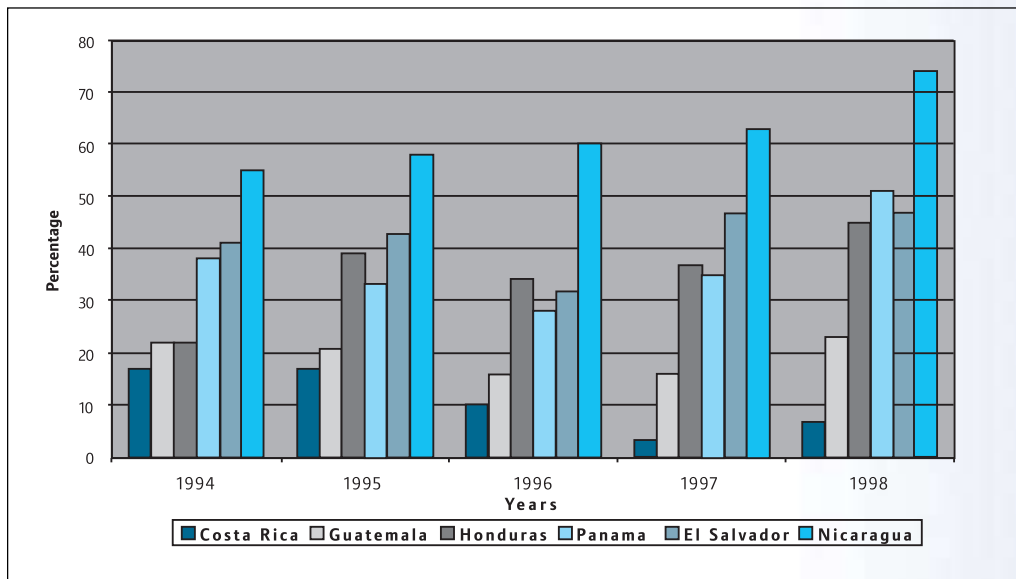
The most rapid growth in energy consumption over the past five years occurred in developing countries. As they seek to industrialise, raise standards of living, and accommodate population growth, they inevitably use more energy. For example, between 1996 and 1998 Central America's population grew an average of 2.43 per cent; while commercial energy use and electric power consumption grew an average of 3.24 per cent and 4.50 per cent, respectively (World Development Indicators Database).

The present structure of electricity production in each country of Central America depends on two major sources: hydropower (61.3 per cent) and fossil fuels. Hydropower is well developed in Central America and has been made possible thanks to the richness of the rainfall and easy accessibility to sizeable hydro resources in the region. Fossil fuels (gas, charcoal, and oil) are becoming more important sources of electricity production.

Figure 1 shows the percentage of electricity production in Central America based on fossil fuels. The figure clearly shows between 1994 and 1998 a significant growth in fossil fuel dependence, particularly in Nicaragua, Panama, El Salvador, and Honduras. Most of the oil used in Central America is imported. For example, net oil imports as a percentage of commercial energy use has increased in Panama from 69 to 73 per cent, in Nicaragua from 35 to 45 per cent, and in Honduras from 38 to 43 per cent. Only Costa Rica and, on occasion, Guatemala represent the reverse situation, with net oil imports for electricity use diminishing. Costa Rican policy is based on favouring of renewables under the assumption that increasing dependence on oil for the supply of electricity and other uses of energy is not the best economic bet for Central America considering international oil price volatility and the uncertainty associated with the cost of final electricity. Nevertheless, Costa Rican Chambers of Industry and Commerce are complaining that electricity prices are too high and make them less competitive in a global economy – some even argue that this situation is due to self-imposed policies favouring renewables³.

³ In 1998, the use of renewables represented approximately 2.2 per cent of the world's energy consumption. In May 2002, it was proposed that the WSSD adopt a global goal of 10 per cent renewables of total energy – similar to the European Union goal of 12 per cent – by 2010. This proposal is likely to encounter high opposition with the same arguments used by the Costa Rican companies.

Figure 1: Electricity production from fossil fuels in Central America (% of total)



Source: World Bank, World Development Indicators Database

The Impact of El Niño: Rain Makers or Fuel Switchers?

After the global energy crisis of the 1980s, most countries of the region reduced their dependency on fossil fuels for electricity generation (imported mainly from Mexico and Venezuela) due to planned efforts to increase the use of domestic sources of energy – in an effort to develop self-sustained policy and decrease the need for foreign exchange payments leaving the region. For instance, between 1975 and 1980 fossil fuel imports increased by 55 per cent, between 1980 and 1985 the increase was a mere 15 per cent. Between 1985 and 1990, however, imports increased again by 44 per cent. During the 1990s, all countries used more fossil fuels to produce electricity – varying from a minimum range of 16 to 39 per cent in Panama to a maximum of 49 to 75 per cent in Nicaragua. Costa Rica did not follow the same path⁴. It was the only country in Central America to maintain its fossil fuel dependency below 10 per cent. This corresponds to the country’s political choice for renewable sources of energy, as discussed earlier.

Two reasons contributed to the increased dependence on fossil fuels. First, El Niño was too long (1992-1995) and associated with dry conditions on the Pacific coast of Central America where most of the human settlements (IPCC, 2001) and historically all the electric infrastructures are located. Second, newly privatised utilities wanted to reduce capital investments and respond quickly to the demand for energy.

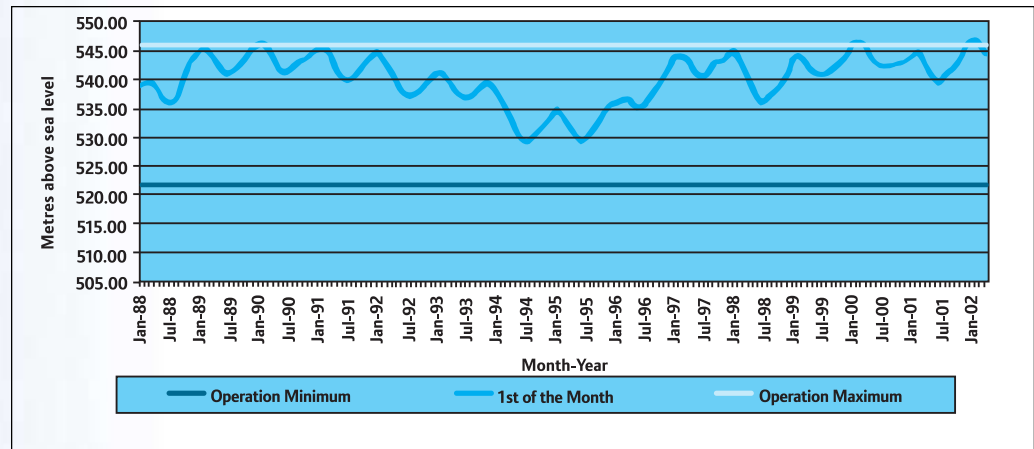
In 1994, as a result of climate changes, the authors witnessed Central American hydroelectric dams and reservoirs either stopping production or reaching their design capacity. For example, Cajon, the main hydroelectric dam in Honduras, stopped producing. Guatemala was suffering from black-outs and even rented

⁴ Transportation is excluded from the analysis. This sector uses mainly fossil fuels (liquid and gas) and the fossil fuel demand of this sector is growing sharply due to a reduction of import tariffs on vehicles, a growing population, and longer commuting distances.



a boat for power generation. In Costa Rica, Arenal Reservoir, which feeds electric plants representing approximately 22 per cent of installed capacity in the country, was operating only a few hours a day and close to its designed minimum level of water (see Figure 2). The fluctuations in the graph follow the seasonal changes (wet and dry) that occur in Costa Rica.

Figure 2: Monthly level of Arenal Reservoir in Costa Rica during period: January 1998-April 2002



Source: DSE, BFAK-C SIEN with information from ICELEC_CENCE_TECNOLOGIAS DE INFORMACION

The dry season occurs generally from December through April while the wet season is from May through November. The dry regions of the country become drier, longer as a result of El Niño and other climate changes. Therefore, the Arenal Reservoir is taking much longer to replenish and refill to normal working levels. As a result, in July 1994, the reservoir reached its lowest level of 529 metres above sea level, whereas at other times it was at a level consistently between 535 metres⁵ and the maximum of 546 metres. In 1995, the government of Costa Rica had to hire an airplane to coat rain clouds with silver in order to induce rainfall into the Arenal Reservoir. On other occasions, the excess rainfall on the Caribbean side drove the reservoir to its designed maximum causing water spills, increased erosion and other problems. Between 1991 and 1997, additional costs were added to electric bills – denoted as a thermal factor. Essentially, during this period the initial thermal factor of nearly one increased steadily to a high of nearly four.

Currently the new El Niño and other extreme weather events are disturbing the economic and social stability of Central America once again. During the summer of 2001, Nicaragua and Honduras suffered severe droughts in the Pacific areas that forced the United Nations and other agencies to supply food to rural areas’ residents usually dependent on self-sustaining agriculture. In severe contrast, by the end of October, the Atlantic coast had suffered floods and heavy rains as well as hurricanes and storms.

Recent findings of an IPCC working group reported that “there is ample evidence of climate variability at a wide range of time scales all over Latin America, from intra seasonal to long term” and El Niño “the Southern

⁵ One of the authors (Castro) was present on several occasions when President Reina from Honduras called his Costa Rican colleague, President Figueres, to compel the Costa Rican utility company (ICE) to export electricity to Honduras. On one of those occasions in 1995, President Figueres politely refused arguing that the general public would condemn him for putting Costa Rica at risk of suffering blackouts.

Oscillation, is responsible for a large part of the climate variability at inter-annual scales in Latin America” (IPCC, 2001).

Making Energy Investment Decisions under Increased Uncertainty: Why then is Fossil Fuel Generation Increasing?

Historically, the uncertainties in Central America were based on political and social unrest followed by economic shortfalls. Currently, all countries are facing high debt levels. In fact, two countries are considered highly indebted poor countries (under the HIPC initiative). These instabilities limit the ability of the governments to develop infrastructure that requires high initial investments.

During the first half of the 1990s, therefore, the region experienced the worst crisis of electricity shortages in its history. This situation led the way for the introduction of private investments in electricity generation – especially renewable sources, such as hydropower, the dominant source of energy in the region. According to the Latin American Energy Organisation, the region’s hydropower potential is approximately 594,000 megawatts but installed capacity totals a mere 124,000 megawatts (roughly 21 per cent)⁶.

Presently, added to the economic uncertainty, is the environmental instability. For example, El Niño is putting stress on water supply⁷ as the combination of higher evaporation (from warmer temperatures) and lower precipitation reduces soil moisture, water levels and flows. Global warming is thus threatening the production of hydroelectricity in Central America by changing the potential for natural evaporation and rainfall patterns including frequency, magnitude and location – all keys to designing a hydroelectric project. Not surprisingly, for Central American policy makers⁸, El Niño has become the symbol of increased uncertainty for electricity based on renewable sources as well as other consequences such as stress on agriculture, increase in forest fires, hunger threats, and immigration flows within the region (*La Nación*, June 6, 2002).

During the last decade, Central America has suffered an increasingly growing demand of water and energy but not always sufficiently covered by the increase in supply. This has led to all countries in the region suffering from low quality electricity (for example, voltage problems, brownouts) and even blackouts in Honduras. At the same time, similar problems have occurred in Quito, Ecuador, Sao Paulo, Brazil, and Santiago, Chile. Most recently, these problems even reached the United States during the California energy crisis. The energy sector of the region is in a permanent flux: continuous changes in the heads of the energy ministries,

⁶ In the last 10 years there have been no new hydropower projects financed by development banks or the governments and climate change was not in the scope of the analysis of the existing projects. However, assessment of future projects includes an increase in the variability of water levels for hydro projects. Personal communication with Gonzalo Aroyo of the Inter-American Development Bank, June 13, 2002.

⁷“During an ENSO event, drought can occur virtually anywhere in the world, though researchers have found the strongest connections between ENSO and intense drought in Australia, India, Indonesia, the Philippines, Brazil, parts of east and south Africa, the Western Pacific Basin Islands (including Hawaii), Central America, and various parts of the United States. Drought occurs in each of the above regions at different times (seasons) during an event and in varying degrees of magnitude.” (<http://enso.unl.edu/ndmc/enigma/elnino.htm>).

⁸ Personal communication with Ministers and policy makers of Mexico and Central America between May 2001 and May 2002. Also stated by the Commission of Central American Utilities at <http://www.ceac-ca.org.sv>.



high pressures for privatising when state-owned or for intervention and regulation when private, the devastating economic costs of the lack of energy is well documented (for example, job losses, export decreases), and reliability problems reduce the attractiveness to international companies⁹.

As a result of these increasing uncertainties it is difficult for environmental policy makers to promote the use of renewables based only on the old benefits: to reduce oil dependence and money transfer outside the region. To mainstream the promotion of energy, the Central American policy makers require new financial mechanisms and support to provide cleaner energy, such as hydro, biomass, and solar. It is important to discuss the following three possibilities.

- **Global interest rates:** One possibility is for international financial institutions to provide loans using interest rates taking into account global benefits. For example, currently in Central America, 12 per cent is the norm for long-term loans in US\$ whereas in developed countries 5 per cent is the norm. The main difference is due to country risk. Obviously this works against high initial investment projects such as hydro and other renewables. Unless the rate is reduced, it is a pervasive incentive against the use renewables.
- **New markets and partnerships:** Renewable energy is more competitive when environmental costs are considered. For example, wind energy projects in Costa Rica are competitive with fossil fuel alternatives because the Dutch government bought the CO₂ reduction certificates at US\$10 per tonne. Finland is exploring bio-energy in El Salvador and Nicaragua while Norway has supported other pilot projects in the region to develop the CO₂ market.
- **Technology transfer:** Many researchers believe that the costs and performance of renewable energy technologies have reached the stage where the number of economical applications in developing countries will be feasible (WEA, 2000). Accelerating access to new technology markets is a must. For example, the Dutch government is financing the use of efficient Compact Fluorescent Lighting in Honduras.
- **Reduce environmental uncertainty:** There are very few climate models showing the impacts in the Central American region, and in general in developing countries. There is a need for more and better modelling to facilitate the process of decision-making for hydroelectric projects. The national forecasts do not have enough credibility or data to help project designers.

To make matters worse there is the pending concern of the more than 10 million people in Central America alone that are without electricity. The Economic Commission for Latin America and the Caribbean⁹ estimates that the Central American population is composed of 5.9 million families, of which two million are off-grid (a 33 per cent non-electrification index). In Costa Rica, about 50,000 families do not have access to electricity (6 per cent of the population). In El Salvador, 350,000 families (27 per cent of the population) are excluded from the electricity grid and in Honduras 430,000 families (44 per cent). Moreover, the minimal data available from the World Bank that combines income and electricity services shows that the amount of people in

⁹ Between 1996 and 1998, one of the authors (Castro) participated in the negotiations with INTEL. Costa Rica was in final competition with Mexico, Chile and Brazil. Energy reliability, quality and pricing were major concerns of the company's location manager.

Nicaragua without electricity service is 272,000 families (31.9 per cent) and in Guatemala 749,000 families (41.3 per cent) – illustrating that less than 3 per cent of the poor have access to electricity in these two countries (World Bank, 2001). The established Millennium Development Goals of the United Nations Development Programme to halve the population excluded from electricity service will require an investment between US\$300 and US\$500 million¹⁰.

Conclusion

The demand for fossil fuels in electricity production has been rising significantly in the last decade in Central America. In parallel, the need to provide the poor with electricity and cleaner sources of energy will add to the development challenges of the countries. The small initial endowments in fossil fuels as well as growing concern for the risk of global warming have been incentives for governments to consider using clean energy. However, most countries of the region are paying more attention to reliability than prices and placing environmental concerns at an even lower priority. Policy makers will need clearer signals from two important sources: the scientific communities in the regions and reducing the uncertainty of the local impacts of El Niño and climate change; and developed countries willing to fulfil their responsibilities to the global environment. The former will require time and effort to translate scientific uncertainties into less complicated reporting for long-term decision-making and the latter will require more financial resources promoting sustainable energy including financial incentives for those developing countries willing to increase investments in renewable energy sources.

Villages that still remain without electricity often have low energy needs, are isolated and dispersed geographically. Connecting these villages to the conventional grid system can impose a financial burden on the public at large. Choosing to use renewable energy sources as a source of electricity for homes and businesses that generates less pollution is a great way to act locally to solve a global problem. However, financing for a renewable energy project is a crucial issue. In most of the developing countries, those who are potential customers of renewable energy systems live below the poverty line and do not have purchasing power to afford this technology.

The appropriate choice of clean energy systems depends on the context of each specific country, the local availability of the appropriate technology, and the emergence of innovative financing options. It has been a real challenge to expand and improve well-established energy markets beyond the major industrial countries. The international community is still struggling with making markets, those for goods and services as well as those for financial assets, work both efficiently and equitably.

Creating new markets, such as carbon emissions trading which internalises environmental costs to make renewables more competitive, will not be an easy task to accomplish. Yet, it would be a worthwhile challenge to tackle. As described here, we know that developing countries have available most of the positive assets/commodities in terms of clean energy and carbon sequestration potential. The task at hand is to provide them with the appropriate tools and instruments to value and trade those assets.

¹⁰ This calculation is made using 5 people per family and between \$1500-2500 per household solution.



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Disaster Reduction and Adaptation to Climate Change – A CARICOM Experience

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Abstract

Historically disaster reduction efforts in the Caribbean have focused on response to regional disasters most of which were climate-related – hurricanes, tropical storms, landslides, floods, drought. Not much effort was focused on disaster reduction (mitigation)¹ through instituting proactive interventions aimed at reducing the vulnerability of natural and human systems to climate-related disasters.

However with the emergence of a new paradigm in the disaster management arena, with more attention being paid to disaster reduction/prevention, there is an opportunity to develop strategic linkages between the climate change and disaster management communities in the region.

This paper explores opportunities for developing these linkages and examines ways in which efforts at disaster management and climate change adaptation can be mutually reinforcing and beneficial.

¹ The terms ‘mitigation’ and ‘reduction’ are used interchangeably, and it has been used here as it appears in the reference documents. However ‘mitigation’ in the context of disasters must be differentiated from its use in the context of a response to climate change.



Introduction

In the Caribbean, disasters caused by climate-related natural hazards such as floods, landslides, droughts, wildfires, hurricanes and associated storm surges have exacted a heavy toll in terms of the loss of human lives, destruction of economic and social infrastructure and degradation of already fragile ecosystems. Global climate change is predicted to exacerbate this situation. The period between 1960 and 2000 witnessed an exponential increase in the occurrence, severity and intensity of disasters, especially during the last decade (Table 1).

Table 1: Main Natural Disasters in the Caribbean (1979–2001)

Year	Country (Hazard Type)	Persons Affected	Damage US (000's) *
1979	Dominica (David and Frederick)	72,100	\$44,650
1980	St. Lucia (Allen)	80,000	\$87,990
1988	Dominican Republic (Flood)	1,191,150	
1988	Haiti (Gilbert)	870,000	\$ 91,286
1988	Jamaica (Gilbert)	810,000	\$ 1,000,000
1989	Montserrat (Hugo)	12,040	\$ 240,000
1989	Antigua, St. Kitts/Nevis, Tortolla, Montserrat (Hugo)	33,790	\$ 3,579,000
1991	Jamaica (Flood)	551,340	\$ 30,000
1992	Bahamas (Andrew)	1,700	\$ 250,000
1993	Cuba (Storm)	149,775	\$ 1,000,000
1993	Cuba (Flood)	532,000	\$ 140,000
1994	Haiti (Storm)	1,587,000	
1995	St Kitts & Nevis (Luis)	1,800	\$ 197,000
1995	US Virgin Islands (Marilyn)	10,000	\$ 1,500,000
1998	Dominican Republic (Georges)	975,595	\$ 2,193,400
2000	Antigua/Barbuda, Dominica, Grenada, St. Lucia (Lenny)		\$ 268,000#
2001	Cuba (Michelle)	5,900,012	\$ 87,000

* valued at the year of the event.

Source: OFDA/CRED International Disaster Database (EM-DAT) 2002. #USAID/Jamaica 2000, Hurricane Lenny Recovery in the Eastern Caribbean.

Within the region, losses incurred from a single hurricane event in some countries have exceeded their annual GDP. This trend poses a major threat to the sustainable development goals of the region and is being treated with some urgency by governments.

Global climate models predict that extreme weather events may occur more frequently and sea level rise would magnify the impact of storm surge and waves on coastal areas, while elevated sea-surface temperatures

and changes in sea water salinity would decrease the resilience and hence the protective capacity of natural ecosystems such as coral reefs and mangroves (IPCC TAR²).

Global concern about natural disasters led the international community to launch the International Decade for Natural Disaster Reduction (IDNDR 1990-1999) in order to increase awareness of the importance of disaster reduction. The experience of the decade has prompted a major conceptual shift from disaster response to disaster reduction underscoring the crucial role of human action.

Disaster Management in the Caribbean

In the Caribbean the emphasis in dealing with natural disasters was in the area of disaster response. With increasing frequency, countries in the region are facing situations in which scarce resources that were earmarked for development projects have had to be diverted to repair damage inflicted by disasters (Vermeiren). Recent experiences in some countries in the region confirm that economic growth only recovers slowly from a major natural disaster. If this trend were to persist, coping capacities of societies in the region are likely to be overwhelmed.

In these circumstances, if sustainable development is to be achieved in the Caribbean, countries will have to take effective measures to manage natural hazard³ risks and become more resilient to the negative impact of natural hazards and related environmental disasters.

The International Strategy for Disaster Reduction (ISDR), as the successor arrangement to the IDNDR was designed to respond to this need by proceeding from protection against hazards to the management of risk through the integration of risk reduction into sustainable development. The ISDR vision is “to enable all societies to become resilient to natural hazards and related technological and environmental disasters, in order to reduce environmental, human, economic and social losses.” This vision will find its realisation by focusing on the following four objectives:

- Increasing public awareness.
- Obtaining commitment from public authorities.
- Stimulating interdisciplinary and intersectoral partnerships and expanding risk reduction networking at all levels.
- Improving further the scientific knowledge of the causes of disasters and the effects of natural hazards and related technological and environmental disasters on societies.

² *Third Assessment Report of the Intergovernmental Panel on Climate Change*

³ A ‘hazard’ has potential to cause significant negative impacts on community elements and can be natural, human-induced or technological in nature. It is not in itself a disaster, but the potential cause of one. (*Comprehensive Hazard and Risk Management (CHARM): Guidelines for South Pacific Islands, 2001*)



In addition, the ISDR was mandated to:

- Continue international cooperation to reduce the impacts of El Nino and other climate variability.
- Strengthen disaster reduction capacities through early warning.

Countries in the region were involved in implementing the Caribbean Disaster Mitigation Project (CDMP) funded by the Offices of Foreign Disaster Assistance (OFDA) (1993 – 1999). The broad purpose of the CDMP was to establish sustainable public/private sector mechanisms which invariably reduce loss of life, reduce the potential of physical and economic damage and shorten the disaster recovery period in the project area. The project sought to make development more sustainable by strengthening the linkage between development and disaster reduction.

To support this objective, CDMP sought to achieve three programme results;

- Promotion of the acquisition and application of disaster mitigation skills, techniques and methodologies;
- An increased pool of professionals in the region with disaster mitigation skills;
- Incorporation of mitigation activities in post disaster reconstruction and recovery programmes.

Six project outcomes were posited:

- Reduced vulnerability of basic infrastructure and critical public facilities.
- Improved building standards and practices to reduce natural hazard vulnerability.
- Increased availability and access to natural hazard/disaster risk information for use by stakeholders.
- Increased community awareness of and involvement in disaster preparedness and mitigation measures.
- Improved ability of public sector and private property insurers to link premium structure to risk.
- Incorporation of mitigation activities in post-disaster reconstruction/recovery.

This project facilitated the shift of the disaster management paradigm from that of disaster response to one of disaster reduction as embodied in the ISDR. In the disaster community, the terms disaster prevention and disaster reduction have been used interchangeably. In the strict sense of the term, disaster prevention may be understood to allude to the adoption of measures aimed at avoiding disasters, which is not always possible. Disaster reduction narrowly interpreted implies that measures would be adopted to reduce or limit the severity of disasters. In a broader sense, disaster reduction involves all measures designed to avoid or limit the adverse impacts of natural hazards and related environmental disasters. Viewed in these terms, disaster reduction includes disaster prevention and has emerged as the all-encompassing concept.

Developing a Regional Risk Management Strategy

In recent years the traditional disaster management approach, which focused nearly exclusively on actions that can be taken immediately prior to, during or shortly after a disaster event to reduce damage, injuries and death has evolved and expanded to include natural hazards risk management. Hazard risk management focuses more on anticipating problems by ensuring that growth and development addresses the likelihood of hazards and their interaction with environmental systems. Traditional preparedness and response mechanisms often focus on individual hazard events, but risk management views hazard exposure as an ongoing process and aims at reducing vulnerability to those hazards across all sectors of society and the economy.

In 2001, a working group representing regional and national disaster management organisations, the private sector, regional technical institutions and multi and bi-lateral donors and lending institutions developed a proposed Strategy and Results Framework for Comprehensive Disaster Management (CDM) in the Caribbean (CDERA, 2001). This strategy was undertaken with the objective of integrated comprehensive disaster management into the development process within the region and emphasises hazard risk reduction. Supporting this development is the establishment of the Disaster Mitigation Facility (DMF) for the Caribbean, at the Caribbean Development Bank (CDB). The DMFC will focus on the incorporation of hazard risk management into development decision-making within the internal operating of the CDB, its borrowing member countries and partner regional institutions.

Hazard Risk Management

Hazards translate into risks and consequently disasters only when juxtaposed with vulnerable elements of human, natural and built systems. Given that little can be done to reduce the occurrence and intensity of most natural hazards (climate change being an exception), hazard risk arrangement activities and programmes focus on reducing existing and future vulnerability to damage and loss. The process of hazard risk management involves three primary, interrelated categories of risk management actions (“ Natural Hazard Risk Management in the Caribbean – Revisiting the Challenge” – discussion draft prepared for the Caribbean Group for Cooperation in Economic Development (CGCED) meeting 2002):

- Risk identification;
- Risk reduction; and
- Risk transfer.

Risk Identification

This involves developing an understanding of the particular hazard and the vulnerability of the human, natural and built systems exposed to this hazard. This is accomplished by carrying out the following activities:

Hazard Data Collection and Mapping: Involves identification of locations subject to hazards and expected severity of hazard effects and recording these through hazard mapping and development of GIS databases possibly constructed to reflect multiple hazards.



Vulnerability Assessment: These are carried out to determine which elements of the human, physical (built) and natural environments are susceptible to damage from the effects of natural hazards. Such information is considered critical in determining the scope of action which may be required in the risk reduction phase of the process.

Risk Assessment: This involves determination of the likelihood and consequences of each hazardous event and assigning levels to the risks based on the likelihood of an event occurring and the potential consequences that may emerge. The process provides critical information on the potential economic impact and costs associated with hazard related risks.

Post-disaster Assessment: This provides an opportunity to identify residual risks not identified in the preceding steps as a result of failure in identifying some existing vulnerabilities.

Risk Reduction

These activities are designed to minimise or eliminate damage from hazard events, can address existing and future vulnerability and be directed towards physical, social and environmental vulnerability. Risk reduction may involve the following measures:

Physical Measures: These may be structural or non-structural. Structural measures involve engineering interventions and non-structural measures are policy interventions that guide future development and investment towards reduced hazard vulnerability.

Socio-economic Measures: These refer to activities that help build individual and community hazard resilience through addressing underlying social and economic problems which expose communities to hazard risks, for example, settle in vulnerable areas.

Environmental Measures: These seek to increase that resilience of natural ecosystems such as coral reefs, mangroves and watersheds so as to enable them to continue performing their natural functions which in turn contribute to the protection of the natural and built environment, for example, beaches, coastal infrastructure.

Post-disaster Measures: This involves the implementation of necessary risk reduction measures during the recovery period following a disaster.

Risk Transfer and Financing

This is designed to reduce financial risk through risk transfer mechanisms provided that all efforts are taken to reduce the vulnerability of the assets to be covered. Mechanisms suggested for exploration are:

- Budget self-insurance;
- Market-insurance and reinsurance;
- Public asset coverage;

- Risk pooling and diversification; and
- Risk financing.

Climate Change in the CARICOM Region

During the last decade the Climate Change problematique emerged as a major area of concern for the small island and low-lying coastal developing states of the Caribbean region. Indeed at the SIDS conference in Barbados in 1994, climate change was identified as a major environmental issue which was to be addressed under the Barbados Programme of Action (BPOA). Although in its initial stages the climate change debate was mainly concerned with greenhouse gas (GHG) mitigation, it was realised that due to the inertia in the earth's climate system, regardless of global efforts to significantly reduce GHG emissions, projected changes in global climate would continue to be observed with dire consequences for SIDS and low-lying coastal countries. As a result it is now generally accepted that for these countries their immediate priority in terms of responding to global climate change is adaptation.

The Intergovernmental Negotiating Committee of the Climate Change Convention (INC/FCCC) agreed at its 10th Session that adaptation to the adverse effects of climate change would require short, medium- and long-term strategies which should be cost effective, should take into account important socio-economic implications, and should be implemented on a stage-by-stage basis in developing countries that are Parties to the Convention. The following sequence of activities was envisaged:

Stage I: Planning, including studies of possible impacts of climate change to identify particularly vulnerable countries or regions and policy options for adaptation and appropriate capacity building. In the medium- and long-term, two additional stages were envisaged for countries or regions identified in Stage 1 as being particularly vulnerable.

Stage II: Measures, including further capacity building, which may be taken to prepare for adaptation.

Stage III: Measures to facilitate adaptation (for example, insurance).

The Caribbean Planning for Adaptation to Global Climate Change (CPACC) Project was a project developed for 12 CARICOM countries and funded by the GEF. The project (1997-2001) was implemented by the World Bank, executed by the Organisation of American States (OAS) and everyday implementation carried out by a Regional Project Implementation Unit based in Barbados. This project was in fact a Stage 1 Adaptation activity as defined by the INC/FCCC. The project's overall objective was to support Caribbean countries in preparing to cope with the adverse effects of global climate change (GCC) particularly sea level rise in coastal and marine areas through vulnerability assessment, adaptation planning and capacity building linked to adaptation planning (CPACC Project Document, 1997). More specifically, the project sought to assist national governments to:

- (i) Strengthen the regional capability for monitoring and analyzing climate and sea level dynamics and trends, seeking to determine the immediate and potential impacts of GCC;



- (ii) Identify areas particularly vulnerable to the adverse effects of climate change and sea level rise;
- (iii) Develop an integrated management and planning framework for cost-effective response and adaptation to the impacts of GCC on coastal and marine areas;
- (iv) Enhance regional and national capabilities for preparing for the advent of GCC through institutional strengthening and human resource development; and
- (v) Identify and assess policy options and instruments that may help initiate the implementation of a long-term programme of adaptation to GCC in vulnerable coastal areas.

Project activities focussed on planning for adaptation to GCC in vulnerable areas, including regional sea/ climate data collection and management, impact and vulnerability studies, and the assessment of policy options.

It is quite evident that the activities carried out under the CPACC project parallel those undertaken in the disaster management community. In fact objectives (i) and (ii) correspond to the risk identification stage of the Hazard Risk Management (HRM) process now being adopted by the disaster management community in the region, and objectives (iii), (iv) and (v) fall neatly under the risk reduction phase of the HRM process. This is not surprising in that climate change adaptation seeks to achieve the same goals as the Comprehensive Disaster Management (CDM) strategy now being implemented in the region. Previously when disaster management efforts were focussed on actions that can be taken immediately, prior, during or shortly after a disaster event to reduce damage, injuries and death, that is, were reactive, there was no room for synergy between the climate change and disaster management communities. Now that the latter's approach to disaster management has a greater focus on "disaster reduction", that is, proactive and anticipatory action, there are excellent opportunities for closing the gap which now exists between the two communities and for closer collaboration in the execution of regional activities under the sustainable development agenda.

Adaptation to Climate Change in the CARICOM Region

The IPCC defines adaptation as adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory and reactive adaptation, private and public adaptation and autonomous and planned adaptation.

- Anticipatory adaptation is adaptation that takes place before impacts of climate change are observed and is also referred to as *proactive* adaptation.
- Autonomous adaptation is adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems and is also referred to as spontaneous adaptation.
- Planned adaptation is adaptation that is a result of a deliberate policy decision, based on awareness that

conditions have changed or are about to change and that action is required to return to, maintain or achieve a desired state.

- Reactive adaptation is adaptation that takes place after impacts of climate change have been observed.
- Private adaptation is usually pursued by individuals, households or private companies and is usually done in the actor's rational self interest whereas public adaptation is usually directed at collective needs and is implemented by governments at all levels.

Given those definitions there is a compelling nexus between disaster reduction and anticipatory and planned adaptation when dealing with climate change hazards. Unfortunately there are no close links between the disaster management and climate change communities, although recently steps are being taken to rectify this discrepancy. Further the disaster community is seldom concerned with increasing the resilience of natural ecosystems hence facilitating the role of the latter in autonomous adaptation.

The CPACC Project which considered impacts of sea level rise on coastal infrastructure identified distinct physical impacts that are expected to occur with climate change (CPACC Report on Coastal Vulnerability and Risk Assessment⁴; CPACC Issues Papers 6). The most significant of these were:

- Submergence of low-lying wetland and dryland areas;
- Erosion of soft shores by increasing offshore loss of sediment;
- Increased salinity of estuaries and aquifers;
- Rising coastal water tables; and
- Increased and more severe coastal flooding and storm damage.

It is anticipated that because a significant amount of coastal infrastructure and population centers are situated within two kilometres of the coast in most Caribbean countries, these impacts will affect many aspects of coastal economic development – tourism, agriculture, and water supplies.

A study prepared by the National Oceanic and Atmospheric Administration's National Ocean Service (NOS) (Lewsey *et al*) as an input to the follow-up project to CPACC identified the following trends that are increasing the Vulnerability of Caribbean Coastal Infrastructure and Land Uses to Climate Variability and Change:

- Increasing population density and growth rates;
- Growth of the tourism industry: a paradigm shift from agriculture to uncontrolled coastal development;

⁴Under Component 6 of the CPACC Project studies on coastal vulnerability and risk assessment were carried out for three pilot countries.



- Lack of land-use planning and development controls;
- Location of coastal infrastructure in hazardous areas;
- Inadequate waste disposal systems – compromise resilience of natural ecosystems;
- Quality of building construction and insurance incentives;
- Destruction of ecological buffer systems;
- Continued reliance on top-down approaches to land-use planning;
- Destructive agriculture and forestry practices.

The study further observed that some of the specific effects of climate change on coastal infrastructure and settlements, natural resources and habitats will likely include:

- Destruction and loss of infrastructure in low-lying coastal areas arising from sea level rise;
- Greater property damage and loss from increased hurricane activity;
- Flooding of low-lying areas from storm run off and storm surge;
- Increased costs of sea defence mechanisms;
- Increased costs and reduced availability of insurance coverage for property;
- Dislocation of coastal populations, particularly squatter communities;
- Destruction of hotels and other beach front properties due to the effects of sea level rise, storm surge and hurricanes;
- Increased demand and competition for coastal lands as a result of land lost to sea level rise;
- Reduced demand for tourism and subsequent changes in islands employment structure;
- Changing patterns of port development and infrastructure as a result of sea level rise that include higher maintenance costs and increased dredging;
- Salt water intrusion into coastal wells and other freshwater resources;
- Destruction of coral reefs as a result of bleaching from elevated sea surface temperatures;
- Loss of mangroves to sea level rise in areas where coastal topography, mangrove systems and coastal infrastructure do not allow sedimentation to keep pace with rising sea levels; and

- Increased coastal erosion.

The vulnerability assessment study undertaken by CPACC for Barbados revealed that much of the coastal infrastructure is located in vulnerable areas and is likely to be inundated under projected rising sea levels. This infrastructure includes utilities, fire stations, police stations, designated hurricane shelters, desalination plant, fuel storage and processing facilities, hospitals, major coastal highways, Government Headquarters and the Coastal Zone Management Unit (CPACC Report on Coastal Vulnerability and Risk Assessment for Barbados).

The NOS study also identified a suite of generic responses which are designed to reverse the human impacts on environmental degradation in the Caribbean:

- Strengthen regulations to protect ecological buffers;
- Strengthen building codes;
- Develop regulations to phase out development in high hazard areas;
- Develop comprehensive land use plans;
- Institute land protection tools for ecological buffers and vulnerable coastal lands;
- Implement market based incentives to promote sustainable tourism;
- Develop reforms to link property insurance with construction quality;
- Preserve and restore ecological buffers;
- Develop an ongoing communications plan for improving public awareness and environmental education; and
- Map hazard areas in the coastal region and undertake risk analysis related to climate change.

Several of these responses which are being considered as adequate for addressing climate change adaptation in the region parallel those which are being identified as suitable responses to facilitate disaster reduction. Some of the tools used, information and skills requirements are similar – hazard maps, vulnerability assessments, valuation of natural resources, public awareness, risk analysis and early warning systems. However, as climate change science improves so that reliable regional climate models and region-specific climate change scenarios become available, greater precision will be injected into regional projections of climate change impacts on critical physical and socio-economic systems in the region. This in turn will better inform policy and other interventions necessary as part of a country's adaptation strategy. Until such time as these tools become available the strategy being adopted in the region is based on the assumption that in strengthening the region's resilience to the impacts of present day climate variability countries would have embarked on the road to decrease the region's vulnerability to long term climate change. It is this assumption that informed the process of developing National Climate Change Adaptation Policies and Implementation Plans for Caribbean



countries under the CPACC project. Hence through an extensive process of stakeholder consultations, use of expert knowledge and the experience of coping with present day climate variability, countries were able to articulate policy interventions and other actions which would contribute to reducing their present day vulnerability to impacts arising from climate variability. To the extent that these interventions and actions also contribute to the sustainable development agenda of the country, there will be a greater chance that they will be implemented. Response to present day climate variability therefore offers an excellent strategic vehicle to start insinuating climate change adaptation into National Development Plans.

Risk Management

Under another project, Adaptation to Climate Change in the Caribbean (ACCC) funded through the Climate Change Development Fund (CCDF) of the Canadian International Development Agency (CIDA), the region has been implementing a project which seeks to build capacity for integrating adaptation to climate change into the physical planning process, in the private sector and governments, using a risk management approach. Risk management has been regarded as providing an excellent framework for facilitating decision-making in an environment of uncertainty. Given the uncertain nature of climate change science at this juncture it is therefore not surprising that the risk management approach is being adapted to facilitate the choice of appropriate policy options for dealing with climate change adaptation.

Under the ACCC project use is being made of the Canadian Standards Association (CSA), “Risk Management Guidelines for Decision Makers”, an approved National Standard of Canada. These guidelines are being adapted to assess climate change risks in the Caribbean. The project is designed to:

- Identify how a risk management approach can address climate change risks in the Caribbean;
- Review appropriate sectoral approaches for integrating risk management into climate change adaptation planning and management;
- Identify mechanisms whereby risk management processes can be integrated into existing legal, institutional and policy frameworks;
- Identify an appropriate process to initiate the integration and consideration of risk management processes between the various sectors; and
- Integrate sectoral adaptation measures into National Development Planning.

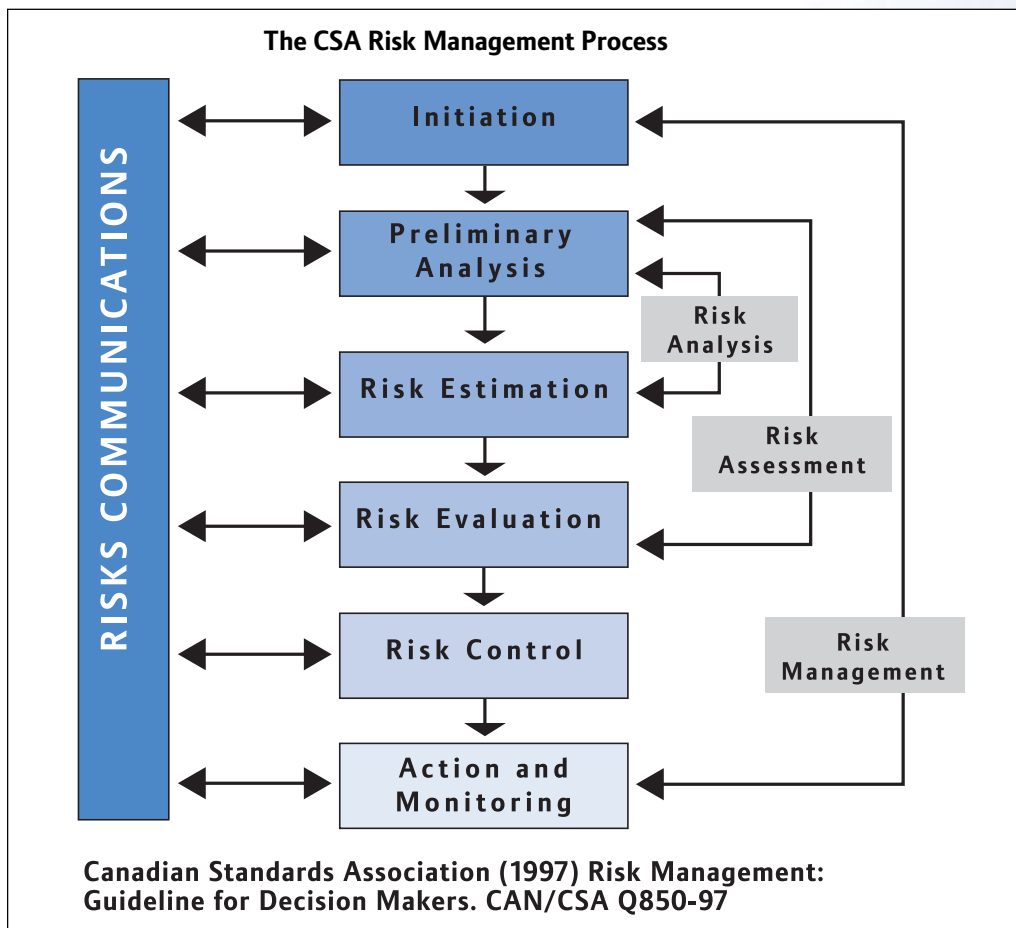
CAN/CSA-Q850-97, Risk Management: Guidelines for Decision Makers

The decision making process described in the CSA Risk Management Guideline (CAN/CSA-Q850-97) consists of six steps that follow a standardised management or systems analysis approach (Figure 1).

The process is iterative and allows for the return to previous steps at any time throughout the process. The features of the Q850 approach are that it:

- Incorporates stakeholder perceptions of the acceptability of the risk into the decision process, providing for more informed decision-making and ensuring that the legitimate interests of all affected stakeholders are considered;
- Incorporates a risk communication framework into the decision process, ensuring reasonable and effective communication among stakeholders;
- Provides a standardised set of terminology used to describe risk issues, thus contributing to better communication about risk issues; and
- Provides for an explicit treatment of uncertainty.

Figure 1: Steps in the Canadian Standards Association risk management decision-making process



Source: CAN/CSA Q850-97 Risk Management: Guideline for Decision Makers

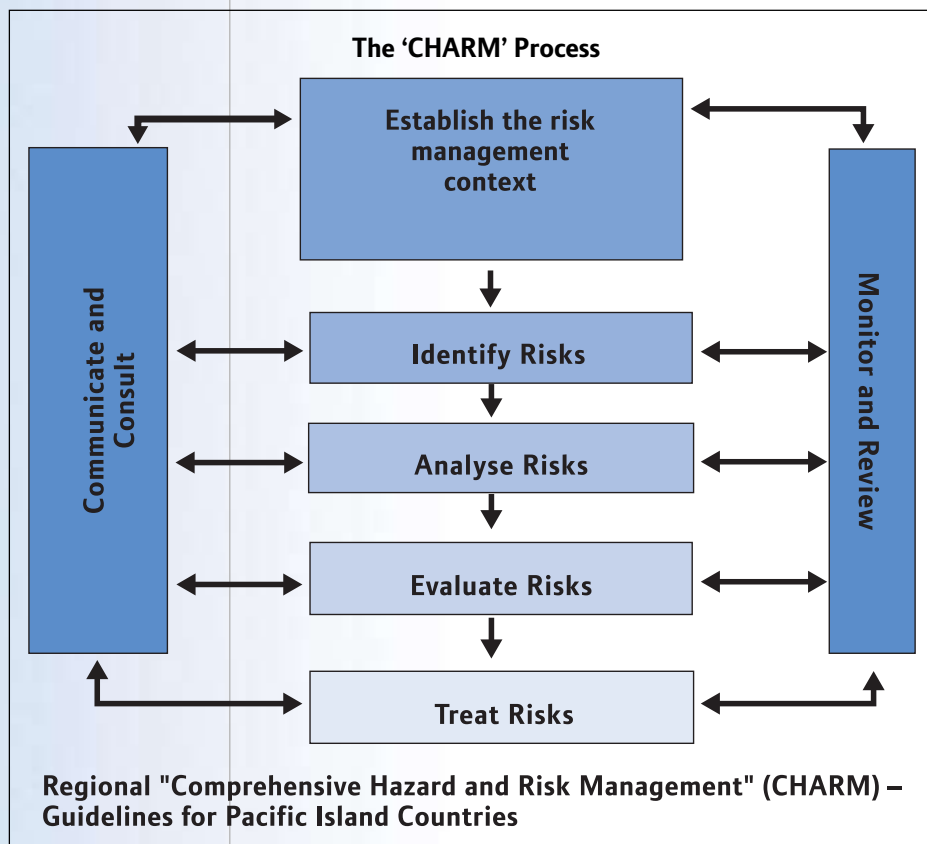


Comprehensive Hazard and Risk Management (CHARM): Guidelines for South Pacific Island Countries

As part of our efforts to explore the use of the risk management approach to deal with climate change risks we are also examining the utility of the Comprehensive Hazard and Risk Management (CHARM) process developed and applied in the South Pacific Island Countries. CHARM is modelled on the AS/NZS 4360:1999 standard to ensure it meets accredited standards and thus recognised regionally and internationally. It is defined as “a comprehensive hazard and risk management tool and/or process within the context of an integrated national development planning process”.

By aligning the CHARM process with National Strategic Development Plans, Pacific countries seek to move from a disaggregated sectoral approach towards a broader integrated programming approach that will promote the achievement of sustainable outcomes. The major goal of the CHARM model is to develop a national risk and treatment option matrix that has considered the activities of all agencies and targets the gaps in the matrix. The major steps associated with this goal are contained within the five main steps of the AUS/NZS 4360:1999 Standard (Figure 2) and the process is underpinned by a continuous requirement for:

Figure 2: Steps in the ‘CHARM’ risk management process



Source: Comprehensive Hazard and Risk Management (CHARM): Guidelines for Pacific Island Countries

- Communication and consultation;
- Monitoring and review; and
- Effective documentation.

Given the similarity of conditions existing between the South Pacific and Caribbean SIDS, an exercise is being conducted to determine which aspects of both the Canadian and the CHARM processes can be utilised to develop a risk management methodology best suited to Caribbean circumstances.

Conclusion

Recent developments in the region leading to the greater focus of disaster management on reduction efforts afford an excellent opportunity for a closer liaison between the disaster management and climate change adaptation communities. Such a liaison will be beneficial and mutually

supportive. Skills developed in the disaster management community over years of dealing with the aftermath of climate-related hazards are easily transferable to support activities required for the identification of and implementation of climate change adaptation options. Similarly information and experience generated by dealing with disaster management is relevant for use in climate change studies in the region. As more precise tools for the latter are developed (climate change scenarios, regional models) by the climate change community, greater confidence will be imparted into the process of identifying feasible options for climate change adaptation and disaster reduction. There will be a need to close the existing gap between the disaster reduction and climate change communities to rationalise terminology utilised by both, methodologies adopted (risk management, vulnerability assessments, hazard mapping, damage assessment), and the use of already scarce human and financial resources. Finally, most disaster reduction efforts seem to be focussed on dealing with impacts on human, natural and built systems and the protection of these from damage, while ignoring the functions which natural ecosystems play in the entire spectrum of disaster reduction. Strengthening the resilience of natural ecosystems to climate impacts is an essential part of the climate change adaptation strategies which are now evolving. Collaboration between these two communities will ensure the insinuation of this consideration into disaster reduction strategies.



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Linking Adaptation to Climate Change and Disaster Mitigation in the Eastern Caribbean: Experiences and Opportunities

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Abstract

The Third Assessment Report (TAR) of the IPCC highlights the increasing threats to sustainable development presented by projections for global climate change. The TAR also recognises the peculiar circumstances of Small Island Developing States (SIDS) and identifies them as among the categories of countries most vulnerable to climate change.

Much of the vulnerability of these island countries to projected anthropogenic climate change derives from their existing high levels of weather/climate related disaster risk particularly hurricanes and droughts. In most instances such climate-related disasters can be expected to worsen with climate change.

The increasing scientific knowledge of climate change therefore presents formidable challenges for development planners and policy makers in public and private sectors to ensure that climate change considerations are factored into present and future development plans. In the case of disaster and risk management programmes this is particularly important from at least two perspectives:

- *Ensuring that present disaster mitigation efforts incorporate knowledge of projections for climate change, and*



- *Ensuring that existing, and future development activity, does not increase risk levels taking into account projections for climate change.*

The paper first provides an overview of the eastern Caribbean region including identifying some of the existing challenges and threats to sustainable development. This is followed by an indication as to some of the likely impacts of climate change in the region based on IPCC estimates and scenarios. An attempt is then made to give an overview of some of the structural and other factors that have minimised the opportunities for integration of risk management and climate change portfolios. Finally an attempt is made to identify opportunities for strengthening the integration of climate change concerns into disaster mitigation and risk reduction efforts as part of wider attempts to achieve sustainable development.

Overview of the Eastern Caribbean

Physical Features

Four eastern Caribbean Countries –Antigua and Barbuda, Dominica, St Kitts and Nevis, and St Lucia – constitute the collective “case study” for the assessment. Geographically, the countries occupy part of the eastern boundary of the Caribbean archipelago and consist primarily of the top of ancient submerged volcanoes, the principal exception being the island of Barbuda which is a low lying coral island. The region’s volcanic origin has resulted in a generally rugged topographic profile, particularly in inland areas, forcing human settlements and activities onto often narrow coastal belts. Volcanic and seismic activities continues in most islands, most notably in Dominica and in the island of Montserrat where an active volcano since 1995 has forced the evacuation of two-thirds of the population.

The climatic features of the islands are characterised as tropical maritime and are influenced primarily by the presence of the Atlantic Ocean and Caribbean Sea. Average temperatures range from a high of 31°C in August to a low of 27°C in January. Climatic conditions, particularly micro-climates, vary quite substantially throughout the islands being influenced by altitude and position in relation to the prevailing winds. Rainfall amounts vary widely, from a high of 10,000mm (400 inches) for interior regions of Dominica to 900mm in Antigua and Barbuda during low rainfall years. Variability in rainfall is, however, a feature of the climate and periodic drought conditions affect the islands. All of the islands are also affected by the annual Atlantic hurricane season lasting from May to November. After an extended period of relative dormancy the years since 1995 have seen intensified hurricane activity with many of these systems directly impacting these islands. There is general consensus that since 1995 the region has entered a more active period of hurricane formation, possibly linked to multi-decadal changes in global weather and climate.

The islands display a range of terrestrial and marine biodiversity, with biodiversity being particularly rich in coastal and marine environments where coral reef, mangroves, and sea-grasses provide habitats for various species. Notwithstanding their small size, a number of endemic species exist in terrestrial and marine environments. The natural resources of the region – its climate, soils, fisheries, and beaches – provide the basis for the principal economic sectors of tourism and agriculture.

Socio-economic Characteristics

The modern history of the islands can be dated to the period of European settlement in the 16th and 17th centuries resulting in the extermination of the indigenous population¹ and the introduction of slave labour from Africa. Population figures vary from 160,000 in St Lucia to 40,000 in St Kitts and Nevis. As with most other developing countries, a youthful base heavily dominates the population pyramid. Traditional intra-island and external migration continues to be an important feature of social and labour mobility although rates of migration to North America and Europe have slowed as immigration policies have tightened in those countries.

The agricultural sector continues to be a primary source of employment and foreign exchange, particularly the important banana industry in St Lucia and Dominica, and sugar cane in St Kitts and Nevis. In all countries small farmers, including producers of livestock, vegetables and poultry, provide the core of agricultural production and make important contributions to nutrition and food security. The fisheries sub-sector consisting of migratory pelagics, near-shore pelagics, demersals, lobster and other fisheries also provides an important element of the agricultural sector contributing to exports, employment and nutritional inputs. Overall the sectoral contributions of agriculture vary from 15 per cent in Dominica to 3 per cent in Antigua and Barbuda.

Table 1: Sectoral Contribution of GDP in Constant Prices: 2000

	Agriculture	Hotel & restaurant	Government services	Construction	Manufacturing
Antigua and Barbuda	3%	15%	16%	13%	2%
Dominica	15%	2%	15%	8%	5%
St Kitts and Nevis	5%	5%	15%	19%	12%
St Lucia	8%	15%	12%	9%	12%

Eastern Caribbean Central Bank, 2001

Tourism presently constitutes the most dynamic element of the regional economy in terms of employment, foreign exchange receipts, and inter linkages with other sectors of the economy. The tourism product is based on the region's natural assets, primarily coastal but also terrestrial and increasingly cultural resources. Beach dominated tourism is the principal form except in Dominica where the country's rich forestry, mountainous terrain, and volcanic geology provide world class eco-tourism attractions. In addition to stay-over visitor arrivals, cruise tourism constitutes a major and growing component of the tourism market. Tourism demand is generally greatest during the winter seasons from December to April as cold conditions in Europe and North America prompt vacation travel to the Caribbean.

As in most small states, governments are forced to adopt a vigorous role in promoting economic activity so as to overcome the natural limitations imposed by small size and lack of economies of scale.

¹ One remaining community of indigenous Carib people remains in Dominica.



A number of environmental stresses already confront attempts to achieve sustainable development. These include coastal erosion, deforestation and attendant impacts on watersheds, marine pollution, solid and liquid waste management, and loss of biodiversity. Additionally the close linkage between the natural resource base and the principal economic sectors of tourism and agriculture means that impacts from present climate variability, particularly droughts and hurricanes, have significant socio-economic impacts. As micro-economies, lacking economies of scale even in their dominant sectors, the development options open to these countries are likely to be extensively impacted by climate change.

Climate Change Projections for the Caribbean

The TAR points out that an analysis of observational data for the Caribbean indicates that the region has experienced increases in surface air temperatures that are in excess of the global average. Empirical evidence suggests an overall drying tendency for the eastern Caribbean that appears to correlate with available meteorological data.

In terms of sea level rise the analysis of sea level trends is complicated by the lack of available historical records. However, coastal areas in all of the islands already experience often severe rates of coastal erosion, in many instances exacerbated by inappropriate construction in coastal areas. Projections for an accelerated future sea level rise are particularly ominous for these countries where all major settlements and most public infrastructure are located within 2 km of the coast. Storm surge and its devastating impacts will also be affected by both sea level rise and intensified storm activity.

While global climate models are presently unable to accurately represent such small land surfaces as those of the eastern Caribbean it is nevertheless possible to arrive at certain conclusions as to some of the likely impacts of certain projected parameters of climate change. In fact a number of the IPCC projections for climate change are particularly relevant to any discussion of the linkage between climate change and disaster risk management in the eastern Caribbean.

Based on an ensemble of several global climate models, the eastern Caribbean can expect to see a continued trend towards drying, with consequent impacts on water supply, agriculture, health etc. Temperature projections of approximately 1.4 to 5.8°C can be expected by 2100 based on IPCC estimates for global temperature rise.

Significantly, increases in the sea surface temperature are expected to drive the formation of stronger, and possibly more frequent, hurricane and tropical storm activity. Temperature increases of the magnitude projected would also have significant adverse impacts in terms of natural resource productivity and effects on human health.

All these scenarios point to a situation where already high risk and vulnerable communities and States will experience heightened levels of risk as a result of climate change. In many instances a combination of vulnerabilities relating to poverty and resource availability make certain communities and groups particularly high risk in terms of the types of adverse impacts that can be anticipated from climate change. This points to the need, where appropriate, to integrate climate change and risk management concerns and activities. Table 2 below provides an indication of IPCC projections for changes in extreme events in the 21st century.

Table 2: Examples of Impacts from Projected Changes in Extreme Climate Events

Projected changes during 21st century in extreme climate phenomena and their likelihood	Representative examples of projected impacts
Simple Extremes	
Higher maximum temperatures; more hot days (very likely)	<ul style="list-style-type: none"> ● Increased incidence of death and illness in high risk groups (elderly, infants etc) ● Increased heat stress in livestock and wildlife
Increasing minimum temperatures (very likely)	<ul style="list-style-type: none"> ● Extended range and improved habitats for some pests and disease vectors ● Increased flood, landslide, and mudslide damage
More intense precipitation events (very likely)	<ul style="list-style-type: none"> ● Increased soil erosion ● Increased pressure on government and private flood insurance systems and disaster relief
Complex Extremes	
Increase in tropical cyclone peak wind intensities, mean and peak precipitation intensities (likely over some areas)	<ul style="list-style-type: none"> ● Increased risks to human life, risk of infectious disease epidemics, and many other risks ● Increased coastal erosion and damage to coastal buildings and infrastructure ● Increased damage to coastal ecosystems such as coral reefs and mangroves
Intensified droughts and floods associated with El Nino events in many different regions (likely)	<ul style="list-style-type: none"> ● Decreased agricultural and rangeland productivity in drought and flood prone areas ● Health impacts associated with droughts and flood events ● Decreased crop yields ● Decreased water resource quality and quantity ● Increased risk of forest and bush fires

Adapted from IPCC, 2001

Opportunities and Constraints to Inter-linkages

Within eastern Caribbean territories the opportunity exists for increased interaction, networking and integration of elements of work between the principal portfolios with direct stakeholder concerns in advancing work relating to integrating climate change into risk management and sustainable development concerns:

- Disaster risk management agencies, and
- Climate change coordinating agencies (generally Ministry of the Environment).



Two inter-related factors have contributed to the levels of coordination, networking, and integration of work programmes within and between the two portfolios in relation to climate change:

- Evolution of the climate change debate, and
- Institutional constraints.

In terms of the evolution of the debate relating to climate change, international attention and focus has been directed through the negotiating process of the UNFCCC. Article 2 of the UNFCCC provides that the ultimate objective of the convention is the stabilisation of emissions of GHG emissions in the atmosphere at levels that would prevent dangerous anthropogenic interference with the climate system. The principal thrust of the negotiating process has therefore been the international attempt to reduce emissions, culminating in the 1997 Kyoto Protocol and subsequent efforts to enable its early ratification.

The emphasis of the convention on GHG reduction has meant that adaptation issues have been to a great extent less adequately covered than climate change mitigation efforts.

This is reflected in the protracted negotiations relating to article 4.8 of the UNFCCC and the modest progress made in this regard with the decisions of COP6.5 and COP7 for establishment of an adaptation fund for non-annex 1 countries and a special programme of assistance – so called National Adaptation Plan of Action (NAPA) – for least developed countries.

The result of the process of evolution of the negotiations was initially to sideline adaptation issues vis-à-vis climate change mitigation and therefore to delay the inevitable identification of the need to strengthen the linkages between climate change adaptation and risk management initiatives and programmes. Equally significant is that attempts by developing countries to have disaster management issues incorporated into climate change assistance programmes have met with resistance from annex 1 countries concerned about the lack of adequate scientific evidence to distinguish present day climate variability from future climate change, and about the potential costs involved in including disaster response measures within the framework of the UNFCCC.

The principal advocates for early adoption of stronger adaptation measures within the UNFCCC process have been the AOSIS group of countries comprising island States from the Caribbean, Pacific, Indian Ocean, and Mediterranean regions. Indeed adaptation has always been defined as the primary concern of these countries characterised by their miniscule contributions to global GHG emissions and high levels of vulnerability. A concern of AOSIS countries in relation to the issue of financing for climate change adaptation is the three-phased approach adopted by the Global Environment Facility².

² GEF Operational guidelines provide that the GEF will provide full cost funding for Stage 1 adaptation activities undertaken within the context of formulation of national communications. Stage 1 is envisaged as “planning, which includes studies of possible impacts of climate change, to identify particularly vulnerable countries or regions and policy options for adaptation and capacity building” UNFCCC decision FCCC/11/CP.1. See <http://www.gefweb.org/public/opstrat>

This three-tiered approach has artificially separated the component elements of the climate change impact assessment and adaptation process, and has probably impeded the progressive development of adaptation tools and methods including the opportunity for developing the intellectual, institutional, and operational base for integration of risk management into climate change methodologies and implementation.

From an administrative perspective the initial focus of the UNFCCC on the highly politicised issues surrounding climate change mitigation concerns (primarily GHG reduction) has meant that the expertise for participating in climate change programmes and activities has largely been the responsibility of ministries of foreign affairs and/or the environment, with disaster risk management and meteorological agencies often not directly involved. This has had the double effect of reducing the effective sensitisation of the risk management communities to climate change issues as well as inhibiting the incorporation of risk management issues into the debate.

The non-participation of the disaster/risk management community however is also reflective of the limited institutional capacities existing within these agencies in such small states. Given the constraints of personnel and resources alongside the strong demands for disaster response services, risk management agencies have been forced to focus their efforts on providing hands on relief and advice to local scale emergencies ranging from hurricanes to industrial accidents. As the responsibilities and capabilities of these agencies have expanded they have encompassed additional advisory and technical roles. However, the agencies have been too small and lacking in the necessary capabilities to get extensively involved in climate change issues at this time.

In all instances some progress has been made in having representatives of the risk management agency participate in the various advisory committees set up to coordinate work relating to climate change and particularly the preparation of the National Communications report³. This has facilitated the two-way flow of data and information between the two communities. There has also been training and other activities that have enabled disaster management officials to obtain a better understanding of climate change concerns. Preparation of the various National Communications required under the UNFCCC has also seen the incorporation of data and experiences from various risk management sources into the work on vulnerability and adaptation. There is likely to be increasing recognition of the significance of climate change among senior risk management officials and the need now exists to extend such awareness to other levels and to factor such concerns into risk management programmes.

A principal obstacle in this regard however is the lack of the climate data that is necessary for enabling integration of climate change into risk management. As a recent report on climate observation systems in the Caribbean and Central America has noted there are important gaps in atmospheric, terrestrial, and oceanic information that inhibit a better understanding of current climate variability as well as any changes taking place in the regional climate. Such information will be required for enabling risk managers to better factor climate change concerns into their decision-making. This is especially important in view of the tremendous uncertainties that still surround the likely timing and magnitude of climate change.

³ Article 12 of the UNFCCC requires Parties to the convention to “communicate” information including “a national inventory of anthropogenic emissions....and sinks, a general description of steps taken or envisaged by the Party to implement the Convention, and any other information that the Party considers relevant”.



Integrating Risk Management and Adaptation to Climate Change

The TAR points out that adaptation to climate change has the potential to reduce the adverse effects of climate change although not without costs. The report also indicates that the key elements of adaptation to climate change are likely to relate to climate variability and extremes and not simply to changes in average conditions. The TAR notes that enhancement of adaptive capacity should therefore serve to reduce the vulnerability of regions and sectors to climate change, including climate variability and extremes and can therefore be seen as supportive of ongoing attempts at sustainable development.

This makes even more important the role of risk management as an instrument for climate change adaptation since there will need to be an enhanced capacity at all levels to cope with more intense storms and other extreme events. In the context of the eastern Caribbean this means that already high levels of exposure to weather extremes, particularly hurricanes and droughts, will intensify: this will have policy and planning implications for human settlements, health, and other sectors.

Adaptation measures recommended in the context of eastern Caribbean countries include:

- Strengthened land-use planning and development control;
- Integrated coastal area management;
- Strengthened disaster response capability;
- Watershed management;
- Insurance; and
- Improved health sector monitoring.

In all these areas the need is to be able to factor climate change concerns (rising temperatures, storm activity, sea level rise etc) into these programmes. All reflect a proactive response to climate change adaptation and are consistent with risk management approaches to physical and economic development. The aim is to begin the incorporation of climate change concerns into development guidelines so that sectoral activity can proceed in the context of a changing climate and without undermining the natural resources upon which economic activity is based.

An integral element of climate change is the continuing uncertainty that surrounds, and is likely to continue to surround, the timing and magnitude of climate change. This points to the need to continue the collection of climatological data so that this can feed into climate models and other assessments of the impacts of climate change in the eastern Caribbean.

At the same time it has to be recognised that current tools for climate change adaptation planning are necessarily in their infancy so that adaptation options must be constantly reassessed and revised as the information base

on climate change evolves.

Directions for Programming

Climate change will be virtually all-pervasive and therefore will affect most aspects of life. From this perspective it is important that guiding principles be established for ensuring that programmes developed for economic and social development incorporate concerns for climate change impact and adaptation. These guiding principles should include:

- Country-driven objectives to ensure that activities are congruent with wider development goals;
- Stakeholder involvement and input in project design, implementation, and monitoring; and
- Possible use of indigenous adaptation technologies and methodologies.

A number of initiatives are required to achieve the desired levels of integration of climate change into risk management assessment and policies and then to facilitate the wider adoption of risk management principles into development planning. Notwithstanding the need to further develop the data-base there is sufficient understanding of the likely pathways of climate change to promote active adaptation where this is also consistent with other sustainable development goals.

Notwithstanding the initial actions undertaken by eastern Caribbean countries substantial technical and financial support will be required from the international community in implementing the adaptation priorities indicated above. The following areas are identified for possible programme development and implementation for building climate change risks into national decision-making. They provide a set of outputs and activities that aim at enhancing adaptive capacity as the principal response to the impacts of climate change⁴. They are intended as possible priority areas for facilitating the necessary linkage between climate change and risk management concerns, and for having these concerns integrated into development activity:

- Land use planning as a primary mechanism for minimising the impact of climate change,
- Strategic awareness building activities for key decision makers,
- Media information and sensitisation activities on climate change,
- Development and field testing of climate change adaptation planning frameworks,
- Sharing of best practices and guidelines for risk management and climate change adaptation (for example, in coastal areas),

⁴ Many of the proposals are adapted from “Adverse Effects of Climate Change: initial actions relating to the adverse effects of climate change in accordance with article 4.8 and 4.9 of the convention”. Tom Downing, Youba Sokona, and Joel Smith. March 2000. Unpublished UNFCCC workshop presentation.



- Consideration of climate change concerns/risks at the planning phase of investment and development projects,
- Implementation of adaptation demonstration projects that enable practical disaster risk management and that meet existing development needs, for example, coastal protection,
- Development of a meaningful international adaptation financing framework for funding of climate change adaptation projects in small island countries that addresses priority areas,
- Strengthening of atmospheric, terrestrial, and oceanic information data-bases including retrieval and storage of historic data,
- Infusing risk management concerns into national communications,
- Modelling of projected climate change impacts on key natural processes and ecosystems in small islands.

At the same time it is critical to realise that adaptive capacity is dependent on a wider range of variables encompassing such aspects as economic development, effective levels of public participation in decision-making, and technological development.

Consequently eastern Caribbean states must continue, and indeed intensify, wider processes of facilitating processes for sustainable development incorporating issues of social equity and empowerment, environmental protection, and economic development.

Conclusion

Projections for global climate change indicate that the small island countries of the eastern Caribbean can expect to experience a number of adverse impacts deriving from changes in such climate parameters as rainfall, temperature, sea levels, and storm/hurricane frequency and intensity. While all these changes can be anticipated to have adverse effects, the projections for more extreme weather events in regions like the Caribbean mean that the roles of risk management agencies are likely to be especially affected by anticipated changes in global climate. This points to the need to strengthen links between climate change and risk management “communities”. Specifically, knowledge pertaining to climate change needs to be fed into, and inform, risk management policy and planning.

Climate change represents a cross-cutting set of issues that will require adjustments/adaptations based on best available information and knowledge. The essential challenge is to incorporate that knowledge into sectoral and cross-sectoral activities and to ensure that risk management paradigms are adjusted to reflect the emerging scientific data and observations on climate change at global, regional and local levels. There is the need to establish an enabling environment for the adaptive measures required if the present efforts of these communities to achieve sustainable development are not to be thwarted. This is especially important in that national development programmes and projects planned for the future will be affected by climate change.

Additionally, activities now being undertaken will themselves affect the natural resource base and therefore its potential for responding to any adverse impacts of climate change. It is therefore crucial that policy makers take early actions to begin to integrate climate change considerations into their development planning. The programme priorities identified above should go some way in building adaptive capacities for reducing vulnerability and enabling sustainable development.

For small communities, the costs of adaptation are likely to be considerable from a financial standpoint and will require partnerships at all levels – community, sectoral, national, regional, and international. Assistance will, however, be required from the international community for financial and technical support. During the present period of shrinking resources and increasing demands it becomes even more imperative that there is congruence between agencies and organisations involved in related aspects of sustainable development planning and programme implementation.



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Risk Management and Adaptation: Reflections with Implications for Africa

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Abstract

Africa, like other regions, is prone to disasters, including natural ones. Climate change effects will be devastating, as they will be played on a canvas of weak risk management institutions and practices, and a low level of resilience. The knowledge and information base for decision-making on risk management is also low. Within this context, operationalisation of concepts for risk management and adaptation needs to be built on the principle of common but differentiated needs, strongly integrate local knowledge and practices, and, emphasise on capacity development.

The perspectives in the paper are those coming from the development side of the equation. The focus is on how to facilitate sustainable development through integrating risk management and adaptive management in sustainable development policies and strategies, with an emphasis on the African situation. It covers issues of concepts and policy as well as practical considerations, interventions and guidelines.

The paper first briefly discusses the Africa problematic regarding disasters and climate change, followed by a presentation of some conceptual issues relating to risk and adaptive management from an African angle. It also discusses operationalising risk management and adaptive management through interventions to build resilience in Africa and integrates these two approaches in sustainable development strategies. The paper



concludes with some recommended roles for UNDP in the process of facilitating the culture and practice of adaptation in Africa.

The Africa Problematic

Africa is subject to a high degree of climate variability that results in high vulnerability to natural disasters and extreme climate events, particularly droughts, floods, and epidemics, the most common hazard events, as seen from Table 1. In contrast, volcanoes, earthquakes and cyclones/hurricanes occur less frequently. In general, Table 2 shows that there has been an increase in the annual frequency of large-scale disaster events in Africa since 1985, compared to the frequency since 1970. The Africa Environment Outlook confirms this trend of increasing occurrence and severity of natural disasters, particularly in the Sahel (UNEP, 2002 A). In terms of country incidence, Ethiopia, Mozambique, Tanzania and Sudan experienced the highest number of disaster events. In terms of population affected, these countries, in addition to Malawi, were the worst affected.

Africa contributes least to the problem of climate change. The region accounts for only 7 per cent of global emissions of greenhouse gases, 3.5 per cent of global total carbon dioxide and 7 per cent of methane (UNEP, 2002 B). The average per capita annual GHG emissions from Africa is 0.3 tonnes of carbon while in cumulative terms, Africa accounted for only 4 per cent of cumulative GHG emissions from 1900 to 1999 (World Resources Institute, 2001). Furthermore, Africa's forests act as a significant global carbon dioxide sink. Ironically, Africa is most vulnerable to adverse climate change effects due to the high dependence on agriculture for livelihoods, and the low financial resource base and capacity to adapt to or mitigate these effects.

The continent's high vulnerability to climate change is expected to result in increased average temperatures and worsened variability of rainfall with its attendant deleterious effects on already stressed livelihoods in several areas of sub-Saharan Africa. According to the Africa Environment Outlook, average annual rainfall in Africa has been on a declining trend since 1968, while the incidence and severity of drought in Africa is expected to increase due to global warming (UNEP, 2002 A, B). Crop yields in Southern Africa could decline by 20 per cent. Many parts of the continent, including the Gulf of Guinea, the eastern Africa coast and the Western Indian islands are at risk from rising sea levels and malaria-carrying mosquitoes would likely spread to the southern end of the continent during the next decades (UNEP, 2002 A).

The regional situation is an aggregation of adverse effects at the national level. For example, in Ghana the Environmental Protection Agency's climate change vulnerability assessment (1990 - 2050) showed that the effects of long-term decline in natural resource productivity will be exacerbated by climatic change effects due to increasing temperature, and falling precipitation resulting in decreased availability of both surface and ground water resources. There would also be shifts in agro-climatic zones: the northern savannah zone will become drier, shortening the transition zone whilst the coastal savannah will also tend to move northwards. Furthermore, vulnerability assessment of climate change affect on agriculture showed that by 2050, the yield of maize will decrease by 7 per cent compared to the 1990 levels while millet will be least affected due to its higher drought tolerance (Republic of Ghana, 2000).

These negative expected outcomes of extreme weather events, climate change and climate variability on the socio-ecological systems in Africa need to be addressed through the application of appropriate risk and adaptive

management concepts and practices.

Some Conceptual Issues (Relating to Risk Management and Adaptive Management with African Angles)

Vulnerability Relations in Socio-ecological Systems

The relationship between human security, ecological resilience and development sustainability depends on the interactions between factors determining social, biological and physical aspects of global change in an inter-linked manner. As we know, human livelihoods, well-being and security depend on ecological services, such as air, food, fuel and medicines. In Africa, this dependence is more marked for some services, particularly those relating to basic needs, due to the lower level of socio-economic development, than in other regions. For example, in Ghana a 1998 survey showed that 38 per cent of the national population earned some income from forest product activities (Arnold and Townson, 1998). In addition, forests and other natural resources contribute to the natural, physical, financial, human, and, socio-cultural and spiritual capital profile of the poor that determine their livelihoods strategies and outcomes in several ways (Vordzorgbe, 2001). Due to poverty in Africa, the net deleterious impact of human activity on ecosystems is heightened, thereby compromising the goal of achieving sustainable development.

Vulnerable ecosystems are directly related to vulnerable communities and societies, but not in a linear or one-to-one relationship. These communities adapt and can survive, even after vulnerable ecosystems die away, due to human adaptation, including utilising other ecosystems to meet human livelihood needs and migrating. A community living in a vulnerable ecosystem need not necessarily experience the same degree of vulnerability as the ecological system supporting it; how the community fares depends on the nature and extent of the relationship between the two entities of that physical space. If the ecosystem has little direct impact on the livelihood of the community, the relationship is weaker and more tenuous. However, in Africa the relationship is quite strong, and directly proportional, since livelihoods are more dependent on ecosystem health.

Effects of Climatic Change on Hazards and Vulnerability

Climatic change affects both vulnerability and hazards; the link is through human actions and interface. For example, in the Sahelian zone of Africa, reduced rainfall due partly to worsening desertification, arising partly from autonomous climate change and human action or inaction, results in increased land degradation and crop failure (hazard) and susceptibility to famine (a vulnerability). Once more, the level of development determines the relative impacts; in situations of low development (and greater reliance on ecosystem benevolence), climate change affects both, but impacts vulnerability more. In developed regions, climate change affects hazards more than vulnerability. Hence, the key to developing or strengthening adaptive capacity in Africa to address climate change and its effects is to focus on reducing vulnerability. This viewpoint is supported by the observation that, given Africa's poverty status, we cannot afford to concentrate solely on classical mitigation efforts; we need to prioritise our risk management requirements by focusing on developing adaptive management systems and initiatives.



Table1: Number of Large-Scale Disaster Events and Number Affected in Selected African Countries 1970-1985

Country	Floods	Drought, Famine, Food Shortage	Epidemics	Forest Scrub Fire	Tropical Cyclone/ Hurricane/ Typhoon	Volcanoes Infestation	Insect	Landslides	Earthquakes
Angola	1 (100,000)	5 (3,186,000)	4 (47,311)						
Benin	10 (1,868,727)	7 (2,125,000)	8 (4,119)	2 (7,200)					
Burkina Faso	5 (102,796)	17 (7,038,290)	14 (90,463)						
Burundi	1 (3,600)		3 (30,598)						
Cape Verde	1 (112,000)	12 (10,000)	1 (2,996)		2 (7,722)	1 (6,306)			
Central Afr. Republic	4 (43,614)	3 (NA)	1 (418)		1 (1,850)				
Chad	5 (88,355)	20 (8,091,000)	5 (27,644)		2 (1,300)		2 (NA)		
Comoros		3 (300,000)	1 (450)		4 (115,052)	2 (25,000)			
Dem. Rep. of Congo	3 (63,056)	2 (800,000)	14 (10,453)		1 (NA)	1 (8,010)		1 (148)	9 (61)
Djibouti	6 (489,000)	4 (355,000)	3 (3,241)		4 (775)				
Ethiopia	16 (858,951)	25 (60,880,64)	6 (103,688)		4 (775)				
Ethiopia	16 (858,951)	25 (60,880,064)	6 (103,688)			2 (2)	2 (NA)	2 (29)	
Gambia	16 (858,951)	13 (651,000)	3 (1,769)		1 (5,000)				
Guinea	2 (13,066)	3 (NA)	2 (24,030)						1 (21,436)
Guinea Bissau		8 (NA)	4 (40,656)	8 (1,500)			3 (NA) incl. tsunami		
Lesotho	3 (180,000)	5 (1,001,500)	1 (500)		3 (250) storms				
Liberia	1 (5,000)	1 (NA)	3 (1,887)		1 (2,000)		1 (1,00,000)	1 (200)	
Madagascar	2 (68,443)	5 (2,316,500)	1 (NA)		20 (5,348,830)		1 (NA)		
Malawi	10 (1,013,226)	6 (16,507,267)	4 (736)						1 (145,391)
Mali	4 (49,195)	13 (5,202,000)	8 (5,202,000)				5 (NA)		
Mauritania	3 (10,500)	17 (6,769,156)	5 (1,065)				4 (240,000)		
Mozambique	11 (4,281,300)	16 (26,490,000)	9 (272,119)		6 (4,008,251)			1 (2,500)	
Nigeria	4 (257,992)	14 (7,734,199)	10 (110,037)				3 (NA)		
Rwanda	2 (1,921,678)	4 (2,262,000)	3 (5,1120)						
Sao Thome & Principe		3 (93,000)	2 (1,063)						
Senegal	7 (340,500)	13 (7,264,998)	3 (3,797)				4 (NA)		
Sierra Leone	1 (200,000)		8 (910,781)		2 (12,000)				
Somalia	9 (1,190,500)	6 (783,500)	9 (41,093)		1 (NA)				

Country	Floods	Drought, Famine, Food shortage	Epidemics	Forest Scrub Fire	Tropical Cyclone/ Hurricane/ Typhoon	Volcanoes Infestation	Insect	Landslides	Earthquakes
Sudan	11 (3,347,165)	12 (25,350,000)	10 (27,408)	1 (NA)			4 (NA)		2 (10,015)
Tanzania	17 (769,879)	10 (9,430,000)	12 (54,246)	1 (NA)	1 (2,500)				
Togo	3 (176,905)	5 (600,000)	5 (8,264)						
Uganda	3 (183,280)	7 (1,559,000)	8 (103,031)					1 (NA)	4 (52,000)
Zambia	3	5 (2,996,201)	5 (24,521)				2 (NA)		

Table 2: Analysis of Large-Scale Disaster Events in Selected Countries 1970-1998

Country	Total Events	Total Killed	Total Affected	Annual Frequency since 1970	Annual Frequency since 1985
Angola	10	3,108	3,333,311	0.36	0.69
Benin	27	646	4,005,046	0.96	1.07
Burkina Faso	38	9,731	7,038,290	1.25	1.15
Burundi	5	286	34,198	0.17	0.23
Cape Verde	17	141	139,024	0.61	0.46
Central Africa Rep.	9	63	45,882	0.32	0.30
Chad	34	7,243	8,208,299	1.21	NA
Comoros	10	36	440,016	0.36	0.38
Dem. Rep. of Congo	23	2,795	881,728	0.82	1.38
Djibouti	17	245	848,016	0.53	0.69
Eritrea	3	NA	21,979	0.6 (1993)	–
Ethiopia	56	1,211,263	66,738,870	2.0	2.8
Gambia	22	439	661,769	0.76	0.69
Guinea	8	616	58,532	0.29	0.30
Guinea-Bissau	18	1,083	47,581	0.64	0.77
Lesotho	12	40	1,182,250	0.43	0.69
Liberia	8	593	1,009,087	0.28	0.38
Malawi	21	1,244	17,666,620	0.75	1.46
Mali	30	6,866	10,453,195	1.07	1.77
Mauritania	29	2,373	7,020,721	1.03	1.23
Mozambique	43	115,015	35,054,170	1.57	1.67
Nigeria	31	6,179	8,102,228	1.11	1.46
Rwanda	9	257	4,188,790	0.32	0.39
Sao Thome & Principe	8	181	94,063	0.17	0.15
Senegal	27	367	7,609,295	1	1
Sierra Leone	11	729	222,781	0.39	0.69
Somalia	25	25,658	2,015,093	0.92	1.31
Sudan	40	156,126	28,734,588	1.48	2.15
Tanzania	42	4,516	10,256,625	1.5	2.23
Togo	13	948	785,169	0.46	0.85
Uganda	23	728	1,897,311	0.82	1.62
Zambia	15	2,549	5,171,625	0.54	0.87



Resilience or Adaptation

Resilience is a higher-order goal than adaptation and should be the target of risk management development. Resilience depends on the ability to absorb shocks without altering the state of the system, to self-organise, and, to learn and adapt. Hence, adaptation, although preferred to mitigation in Africa's circumstances, is necessary but is not a sufficient condition for enhancing resilience. Inordinate focus on adaptation, without adequate attention to building the strength of the human and ecological systems to withstand shocks, to reorganise when buffeted by stresses, and to maintain previous states would not achieve resilience. There is the need to adopt a positivist approach of using adaptive management to facilitate resilience.

In the African context, given our weak institutions and structures for risk management, the first order of business should be to strengthen the shock absorbers in any given socio-ecological system and develop the capacity for reorganisation. The difficulty with the mitigation route in Africa lies in the challenge of pursuing sustainability within the context of risk and uncertainty, that is achieving manageable risk that leads to resilience within the constraint of low financial and technological resource availability in the region.

Panarchy and African Socio-ecological Systems

There is an aspect of African philosophies that is of critical importance to building resilience to climate, and other sources of change. This is about how the African perceives and relates to nature. The lives of most Africans are not decoupled from nature. Instead, the two are intricately linked and bound by close physical, biological, spiritual and cultural ties. This approach to the humanity-nature relationship implies that the African does not feel that society can control nature or be placed in an adversarial relation with nature. This orientation of inter-dependence between man and nature permits and promotes long-term adaptation and resilience. We do not take nature for granted, but instead adopt a flexible attitude to harnessing its bounty while anticipating its surprises.

This traditional way of life of Africans is both a facilitator of and a hindrance to resilience. The positive aspect is the underlying concept of dynamic symbiotic man-nature relationship. The negative side is that traditional life inhibits or retards change required for resilience. The challenge is how to balance these two aspects in building adaptive capacity for resilience in Africa.

To a large extent, this tension between constancy and change, and, permanence and renewal within African socio-ecological systems, mirrors the basic paradox that exists in the interactions between nature and people captured by Holling (2000): the paradox of the importance of change in the face of the necessity for stability in social-ecological systems. As the saying goes, change is the only constant in the universe. Within the context of evolving complex adaptive systems, panarchy ensures that adaptive cycles of growth, accumulation, restructuring and renewal perpetuate in transformational cycles nested at various scales of time, depending on the system. Thus, through panarchy, sustainable development ensues via the engendering of adaptive capability (Holling, 2000). This simultaneity of slowly adapting traditional life systems, more rapidly changing modern systems, and, physical systems that transform according to their own cycles offers a conducive setting for the development of resilience in socio-ecological systems in Africa.

Risk Management or Adaptive Management

Adaptive management and risk management are complements in creating and maintaining resilience of socio-ecological systems. Risk management is part of human adaptation while adaptive management is also part of risk management. Both adaptive management and risk management are concerned with achieving resilience in human-ecological systems in Africa, as in other regions. Further, the constituent processes of both approaches are phased and recursive. However, both approaches address issues of resilience from opposite sides of the equation: risk management focuses on the object or source while adaptive management deals with the subject. However, this distinction becomes blurred when one considers that risk management, including disaster mitigation, also deals with the impacts of risk on the subject while adaptive management, in turn, also involves disaster risk reduction.

Some other characteristics of the two strategies are as noted in Table 3.

Table 3: Some Features of Disaster Risk Management and Adaptive Management	
Disaster risk management	Adaptive management
● Reactive, but has proactive elements	● Proactive, but contains reactive elements
● Deals with extreme and frequent as well as slow-onset events	● More suitable for slow-changing phenomena and processes
● Risk measurement is largely based on ex post probability of occurrence and magnitude of impacts of hazards	● Risk management is mainly based on probability information derived from subject's attitudes to risk
● Seeks to reduce risks as much as possible	● Seeks to increase the survival or coping level of human society at any level of risks
● More concerned with single-disaster event management	● Deals more with the management of the total situation connected with disaster impacts, including connected risks

We need to note that in human adaptation, the concept of human society includes both human communities and their socio-economic, cultural and political inter-relationships, as well as natural ecosystems within the physical space of those human communities. This is the holistic concept of life propounded by Africans. However, we recognise that human and natural systems will adapt somewhat autonomously, achieving social and ecological resilience, respectively, albeit not totally independently. Furthermore, given the level of development of mitigation capabilities in Africa and the cost of such programmes, we propose that we focus more attention on improving conditions for the adaptation of human systems in Africa than on conventional protection measures that promote adaptation to protect natural systems.



Planned Versus Autonomous Adaptation

Planned adaptation (prospective risk management) is anticipatory hazard management or reduction, albeit with strong elements of disaster mitigation. Planned adaptation can also be described as forward-looking vulnerability reduction and pre-emptory resilience evolution. It has elements of both programmed and autonomous responses. There cannot be completely or purely planned adaptation because the timing and scale of occurrence of climate change and natural hazard events and effects are largely unknown. This assertion applies more to adaptation to climate change effects than natural hazards. Furthermore, it is difficult for all members of any given society to adapt in similar ways to any given risk complex. Hence, there will be variations in any planned adaptation response. In practice, planned adaptation will supplement autonomous adaptation.

It is instructive to note that adaptation to climate change effects on the supply of ecological services has both supply and demand aspects. Both aspects involve spontaneous or autonomous adaptation and planned adaptation based on deliberate policy directions. For example, with regard to water resources, supply adaptation measures include improved water storage, water body pollution control in settlements, migration from water-stressed locations, afforestation to improve dry-season flows in river basins, zoning of agriculture away from water body boundaries, and, artificial recharge of ground water resources. Within the African context, resource, policy and institutional constraints limit the options of supply adaptation to short-term, mainly private, measures. On the demand side, adaptations decisions involve forced reductions in use and planned improvement in efficiency of use and loss reduction.

Implications of Emphasising Autonomous Adaptation for Operationalising Risk Management

Planned adaptation is necessary but not sufficient; it is only part of the solution complex but plays the key role of providing the parameters, incentives, institutions, policy and legal and regulatory framework for autonomous adaptation. As indicated earlier, there cannot be purely planned or autonomous adaptation in a mutually exclusive manner. But given the low level of development in Africa, planned adjustment has a key role to play in engendering effective autonomous adjustment. Where socio-economic development is low, as in Africa, the scope for autonomous adjustment is low. But that condition of low public resources in developing countries reduces or weakens the ability of the state to promote or finance planned adaptation. This is the development constraint or dilemma of integrating human adaptation and risk reduction in developing countries. However, it is instructive to note that in Africa and other developing countries, community links and social security networks naturally promote or point to a preference for autonomous survival which is a precursor to planned adaptation.

De-emphasising planned adaptation in favour of autonomous adaptation of communities and individuals implies de-emphasising the use of international response mechanisms for ex-post mitigation, in favour of developing national and local level indigenous risk management capabilities for disaster management, community hazard assessment and local livelihood security planning. Local-level processes facilitate autonomous responses.

This shift towards autonomous adaptation also requires a global initiative built on the perception of risk management as a global common good, particularly risks from changing environment due to climatic change.

To facilitate the emergence of this initiative, we need to be clear about the objectives, payoffs and potential costs. The main objective should be defined in human terms and be about achieving people-level impact that enhances social capital, involves a variety of actors, promotes broad-based ownership for agreed actions, increases access to knowledge of, and, disseminates best practices in risk management and human adaptation. The acceptance of climate change and natural hazard risk as a global public good will facilitate adequate international response to disasters in Africa.

Operationalising Risk Management and Adaptive Management in Building Resilience in Africa

We advocate that adaptive management and risk management processes are integrated into the sustainable development strategy of African countries. This implies a concern with the need to protect livelihoods against risk and uncertainty from climatic change. However, it is very important to realise that climate change is only a factor, albeit a key one, in shaping the adaptive response of Africa to her development needs within the historical and present context of her situation. Thus, optimal development policies and strategies for Africa's total development will have to take into account other considerations, such as poverty, globalisation, technology and investment.

The paper identifies some essential factors to be addressed in operationalising adaptive management in Africa. These cover the following:

Integrating Adaptive and Risk Management in Long-term Sustainable Development Strategies

This is the only way to institutionalise the practice of risk management within the development administration regime of African, and other, developing countries. This involves, among others, establishing a long-term vision that integrates environmental considerations with other pillars of sustainable development and ensures convergence, complementarity, coherence and coordination between the components of the integrated framework, including determining ways of handling trade-offs among adaptation and other strategy processes (OECD, 2001).

In integrating climatic risk management in development management, the role of economic policies and frameworks, particularly poverty reduction strategies, in risk management and adaptive management becomes important. Economic frameworks derived from the Washington Consensus, such as Structural Adjustment Programmes (SAPs), focus on markets and tend to weaken public support for the poor and marginalised who need most attention in developing effective climatic risk management strategies. However, markets are weak in Africa and require public support to be able to provide the requisite elements of effective risk management. Furthermore, Poverty Reduction Strategy Papers (PRSPs) are medium-term processes with three-year timeframes and may not suitable vehicles for incorporating long-term risk management development programmes. Thus far, none of the first five full PRSPs completed directly or explicitly covers the development of climate change risk adaptation interventions as policy instruments for reducing poverty in the countries that prepared them.



Building Adaptive Management Strategies on the Foundation of Indigenous Knowledge Systems and Traditional Coping and Survival Practices

Traditional risk management and response systems are very flexible in addressing issues of livelihood sustainability arising from environmental and natural risks. These range from risk reducing technologies through informal social relations to share risks to formal institutional support mechanisms. Examples of traditional mechanisms include traditional land tenure systems that help reduce vulnerability of migrant farmers, assistance from family and social and community networks, and traditional taboos on community natural resource use (Vordzorgbe, 2001). Given their relative effectiveness in according some degree of resilience to both human and natural systems, there is a strong role for traditional knowledge systems, practices and institutions. However, several of these coping strategies are unable to assure livelihood security from extreme events and require expansion, deepening and strengthening as well as integration in more robust risk management mechanisms linked to national, regional and global systems.

Developing and Strengthening the Analytical and Planning Base for Instituting Adaptive and Risk Management

This involves, among others,

- Supporting relevant national institutions to institutionalise modelling climate change and impact scenarios; many African countries require assistance in developing the capability to undertake integrated assessment modelling.
- Facilitating modelling of human and natural systems to characterise panarchy relations in Africa as part of the process of developing Africa-specific planned adaptation models and understanding autonomous adaptation in the region.
- Supporting the application of risk assessment approaches, including formal quantitative risk assessment, to natural disaster and climatic change risk management in Africa. This includes undertaking integrated environmental risk assessment as a diagnostic and planning tool, that goes beyond environmental impact assessment, in Africa (PAES, Geoplan International, CLEIAA and World Bank 2001).
- Developing policies based on application of socio-economic analytical frameworks that take account of risk and uncertainty, such as safety-first rules and cautious sub-optimising behaviour (incorporating notions of safety, danger distance and information feedback) in development programming (Anderson, Dillon and Hardaker 1977, Day 1979). These models of decision analysis bring more realism to the analysis of the behaviour of human societies and individuals in response to disaster and climatic change risk and uncertainty than conventional risk-less Pareto-optimal neo-classical economic theory.
- Applying scenario planning as a risk management tool necessary to identify likely future outcomes and corresponding actions to achieve those outcomes in the development of integrated sustainable development plans that incorporate climatic change and disaster risk management interventions. We should note that

adaptation, whether autonomous or planned, is but one mechanism for engendering resilience (International Council for Science, 2002).

Basing the Development of Risk Management Capabilities on an Enhanced Science and Technology Foundation

A key element in the role of the development factor in risk management is the extent and degree of application of science and technology (S&T). As known, S&T enhances understanding and development of coping capabilities with regard to environmental phenomena, thereby facilitating achievement of resilience. The Second Report on International Scientific Advisory Processes on the Environment and Sustainable Development (UNEP, 2000) highlighted the general need for specialised scientific knowledge of environmental and biosphere dynamics. This injunction is perhaps more pertinent to the African situation than other regions due to the lower level of application of S&T. There is the need to strengthen the scientific base of risk and adaptive management capabilities in Africa through enhancing the application of S&T in improving adaptive management capacity, including the development and widespread adoption of ecosystem-friendly technologies, particularly for energy, transport, industry, agriculture, settlement development.

Incorporating the Gender Dimension in Integrated Adaptive and Risk Management Strategies

In Africa, as elsewhere, it is women, the poor and the socially disadvantaged that bear the brunt of disasters while being least endowed to address climate change impacts. Given the crucial but differentiated gender roles in coping with climatic change risks, there is the need to integrate gender considerations in the development and application of risk management processes (UNDAW and UN/ISDR 2001).

Utilising Multi-stakeholder Processes in Developing Adaptive Management Processes

Strategies for adaptive management and risk management involve the collaborative efforts of diverse groups of society and require ownership by concerned stakeholders to be effective. Achieving this calls for the adoption of multi-stakeholder process (MSP) approach in developing adaptation and resilience strategies. This approach will facilitate dialogue among various stakeholders, such as policy makers, resource managers, traditional authorities and local major groups, on climate change and adaptation policies and programmes. Furthermore, given the importance of indigenous knowledge systems in developing adaptive management in Africa, the need for MSP is critical.

Building Bridges and Staying Engaged through Partnerships for Facilitating Adaptive and Risk Management Practices

Using MSP engenders linkages with various stakeholders in the form of partnerships for the effective design and implementation of adaptive management frameworks. Furthermore, the state needs to develop public-private partnerships in this area. In Africa, this need is even more pressing because of the weak nature of both the state and civil society, including the private sector. To facilitate this process, there is also the need to form a network or platform of regional and global partnerships for addressing issues of risk management in Africa and elsewhere.



Enhancing Information, Education, Communication and Awareness

Efforts to reinforce improved environmental monitoring through multilateral environment assessments such as the Millennium Ecosystem Assessment are necessary, but the outcomes need to be regionalised and their recommendations brought effectively to the attention of leaders of developing countries to enhance the chance of their application. For example, most governments and leaders in Africa are unaware of the Integrated Global Observing Strategy (IGOS), its components, sponsoring agencies and its themes. Hence, a substantial amount of awareness creation, education and data simplification and localisation would be required to make the outputs of the IGOS useful to national risk management processes in Africa. Also, there is the need to bring the notion of climate change and possibility of resultant hazards home to communities far away from hazard locations or where current risks are low as a way to increase awareness of disaster effects. Furthermore, since we are starting from a lower level of information and knowledge on adaptive and risk management in Africa, we need to vastly improve the information and knowledge base through various means and initiatives.

Developing Risk and Adaptive Management within the Context of Conflict Management

Disasters and other stresses often result in conflicts in access to and use of natural resources. Given the high frequency and magnitude of conflicts in Africa, there is the need to integrate the management of both phenomena, including through applying conflict management principles to risk management, particularly at the response and mitigation stages.

Placing the Development of Adaptive Management within the Context of Africa Region and Global Frameworks

The operationalisation of the concept of adaptive management in Africa needs to be within the context of existing development frameworks. African development is currently receiving heightened attention due to growing international support for the New Partnership for African Development (NEPAD) and the upcoming World Summit for Sustainable Development (WSSD). Consequently, development efforts in adaptive and risk management must be linked to WSSD outcomes, particularly the planned special initiative for Africa, and NEPAD. The Environmental Action Plan for the Implementation of the Environment Initiative of the NEPAD contains a specific programme area on combating global warming and climate change in Africa. This programme will, among others, provide support to countries to determine the region's vulnerability to climate variability, to develop and promote appropriate climate change adaptation strategies and programmes, and, to develop and implement Clean Development Mechanism (CDM) projects (UNEP, 2002 B). The Draft Plan of Implementation for the World Summit for Sustainable Development also calls for support to Africa to address adaptation needs relating to climate change, climate variability, extreme weather events and sea level rise, as well as to deal effectively with natural disasters, including their humanitarian and environmental impacts (United Nations, 2002). This support includes assistance for capacity strengthening, including at the local level, for effective disaster management, including observation and early warning systems, assessments, prevention, preparedness, response and recovery.

Developing Capacity of Individuals, Organisations and Governments at the Community, Local, National, Sub-regional and Continental Level to Develop and Institutionalise Adaptive Management in Africa

Capacity development for risk and adaptive management is required in all the areas discussed in this section as well as to develop African capacity for international negotiations, and, access of African countries to adaptation projects financed under the UNFCCC. However, these areas of support need to be informed by some guiding principles for effective development assistance in risk management:

- In promoting adaptive management, the key role of the precautionary principle becomes evident and paramount. This is most pertinent in the case of Africa where the information and knowledge gap in risk and adaptive management is largest.
- Africa is at the lowest level of disaster mitigation, since the region has received relatively less support in institutionalising disaster risk management. Therefore, operationalising risk and adaptive management in Africa with international support must be informed by the principle of meeting common needs but with special priority for Africa based on its special situation and needs (Rio Principle 6).
- In addition, Africa deserves special treatment because of the ecological debt the world owes it due to the high levels of carbon sequestration and minimal GHG emissions and effluents discharge from the continent.
- There is an additional case for special treatment for Africa in developing risk management capacity in developing countries. Globalization has resulted in increased marginalisation of Africa. In interaction with climate change effects, that are expected to be most disastrous in Africa due to the low resilience factor, Africa is a double loser (Olmos, 2001).
- Successful capacity development for effective risk management will need to be guided by some considerations presented in Vordzorgbe (2002). The first is that capacity development is a multi-faceted process. This requires adopting the systemic, integrative and multi-modal approach that considers: (i) the norms and culture of the recipient partners, (ii) the public and private processes and interactions that are in play, (iii) the interests of all stakeholders.
- Integration of the technical, institutional, sectoral and other aspects. This ensures capacity development that is sustainable and accountable, and, promotes ownership by partners. The second factor is to balance the need for detailed up-front preparation with more incremental approaches to learning by doing. This requires implementing small capacity development initiatives, rather than big projects, sensitivity to the national context, and showing long-term commitment. This approach directly complements adaptive management. The third requires effective operational mechanisms for pooling of donor partner resources in designing and implementing common intervention initiatives in any capacity development partnership, partly through reform of aid management systems by all partners.



In addition, target or recipient partners have to ensure the following:

- Existence of a development framework from which capacity needs are derived;
- Realistic needs assessment based on sound and comprehensive capacity analysis;
- Willingness to modify the legal, regulatory, institutional and policy framework to make capacity development work;
- Ability to provide agreed counterpart resource and other requirements to ensure that capacity development programmes are implemented as planned;
- Conducive environment and incentives for individuals, institutions and systems to exercise their developed capacities;
- Location and gender balance in capacity development initiatives;
- Policy stability and transparency; and
- Long-term commitment to agreed capacity development goals.

Finally, capacity development for disaster and adaptive management should to be guided by the recommendation of the First Pan-African Capacity Building Forum in Mali in October 2001: there is the need for a new paradigm, a new relationship based on mutual trust and obligation, respect, and shared vision and commitment, a new model and instruments based on partnership, local ownership and empowerment, and, a practical framework for implementation, taking into account the complexity of the process of capacity development.

Some Recommended Roles for UNDP

The championship role of the UNDP in supporting the development of risk and adaptive management in Africa must be based on its comparative advantage in this area. It is the only integrated development agency in the UN system, it has local presence and a long history of involvement in issues of disaster and risk management, it plays a co-ordinating role of the UN system at country level and is perceived by national leaders as a neutral agency sympathetic to African issues. Furthermore, the UNDP focuses on upstream activities of capacity building support for empowerment and participatory approaches, and, knowledge networking. Thus, the UNDP, in cooperation with ISDR and UNEP, is well placed to play a leading role in institutionalising adaptive management in Africa.

Despite this strong institutional capability and competence, UNDP's global role in adaptive and risk management must recognise that: its activities have been more prominent in the Latin America and Caribbean region than in Africa in the subject matter and that it has focused relatively less on developing the scientific and analytical knowledge base of climate change, climate variability and extreme weather events than other relevant UN and non-UN agencies.

Consequently, applying the concept of differentiated responsibilities, the thematic role of the UNDP could be as:

- *Facilitator* engendering change in the environment for disaster risk management and adaptive management practice.
- *Advocate* for coordinated, timely and enhanced action in several areas, including marshalling political leadership commitment, promoting modifications in policy, legal and regulatory frameworks conducive to adaptive management, and supporting the coordination of mobilisation of financial resources at all levels.
- *Catalyst* source of ideas and seeding actions to elicit response from other actors.
- *Capacity developer* for enhancing adaptive management practices, as discussed earlier in this paper. This last role would be expected to feature highly on the agenda of the recently launched UNDP Capacity 2015 Programme.



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22. Wilches-Chaux, Dr. Gustavo	Consultant	Colombia



Agenda

Seminar Host: UNDP, Cuba

Seminar Sponsor: UNDP Bureau for Crisis Prevention and Recovery (BCPR)

Moderator: Dr. Allan Lavell

Monday, June 17

Welcome and Opening Remarks 1:00-1:30 pm

- Welcome remarks by the Government of Cuba, Dr. Gisela Alonso Domínguez, Presidenta de la Agencia de Medio Ambiente, Ministerio de Ciencia, Tecnología y Medio Ambiente (CITMA)
- Remarks by **Mr. Andrew Maskrey**, BCPR
- Remarks by UNDP Resident Representative - **Mr. Luis Gómez-Echeverri**

PAPER PRESENTATIONS

Part 1 - Problem Definitions and Concepts 1:30-2:30 pm

- Dr. John Soussan (with Dr. Ian Burton): **Adapt and Thrive: Combining Adaptation to Climate Change, Disaster Mitigation, and Natural Resources Management in a New Approach to the Reduction of Vulnerability and Poverty**
- Dr. Hans Foussel (with Dr. Richard J.T. Klein): **Vulnerability and Adaptation Assessments to Climate Change: An Evaluation of Conceptual Thinking**
- Dr. Thomas Gutierrez (Cuba): **Extreme Events, Risk and Adaptation: What we Know and What we Need to Know**

Part 1 - Continued 2:45-4:30pm

- Dr. Fernando Ramírez: **Global Climate Change and Risk: Thoughts Without Quotes...to Confuse Us even More**
- Dr. Maxx Dilley: **Managing Risks of Climate-related Losses on Decadal Time Scales**
- Mr. Pascal Girod: **Scaling-up: Resilience to Hazards and the Importance of Cross-scale Linkages**
- Discussion

Part 2 - Bringing Things Together: Policy and Issues 4:30-5:30pm

- Prof. John Hay: **Sustainable Development through Risk Management: Integrating Disaster Reduction and Adaptation to Climate Variability and Change**
- Dr. A.R. Subbiah: **Establishing a Common Ground to Bring Together Disaster Reduction and Climate Change Communities – Challenges and Opportunities**

Tuesday, June 18

Part 2 - Cont'd 8:30-10:00am

- Dr. Ian Burton: **Risk Management and Burden Sharing in Climate Change Adaptation and Natural Disaster Mitigation**
- Mr. Gustavo Wilches-Chaux: **Ethical Basis of Risk Management**
- Dr. Emma Tompkins: **Building Resilience to Climate Change Through Adaptive Management of Natural Resources**
- Discussion

Break

Part 3 - From Concept to Regional Perspectives and Experiences 10:15-12:30pm

- Mr. Rene Castro: **Adaptation Responses from the Latin American Energy Sector with Unintended Consequences to Global Climate Change**
- Dr. U. N'O Trotz: **Disaster Reduction and Adaptation to Climate Change – A CARICOM Experience**
- Dr. José Llanes (Cuba): **The Caribbean: An Opportunity for Cooperation in the Reduction of Risk and the Adaptation to Climate Change**
- Mr. Brian Challenger: **Linking Adaptation to Climate Change and Disaster Mitigation in the Eastern Caribbean: Experiences and Opportunities**
- Dr. Seth Vordzorgbe: **Risk Management and Adaptation: Reflections with Implications for Africa**
- Discussion

Lunch

Keynote Presentations

- **Dr. Gustavo Wilches-Chaux**
- **Dr. Al Binger**

Discussion Theme 1 - Problem Definition: Concepts and Semantics

2:45-4:00pm

Break

Discussion Theme 2 - The Context for Adaptation and Risk Management

4:15-5:45pm (Development, Sustainability, Security)

Wednesday, June 19

Discussion Theme 3 - Relating the Two Problems Conceptually and in Programming Terms 8:30-9:45am

Discussion Theme 4 - Practical Considerations, Policy, Interventions and Guidelines 9:45-11:00am

Break

Summary and Integration of Results 11:15-12:30pm

Programming and Next Steps Confirmation of Meeting Outcomes 12:30-1:30pm

Concluding Remarks 1:30-1:45pm

- Remarks by **Mr. Luis Gómez Echeverri**, UNDP Resident Representative
- Remarks by **Mr. Andrew Maskrey**, BCPR



Abbreviations

CCA	Common Country Assessment
CCAD	Comisión Centroamericana de Ambiente y Desarrollo (Centro-American Commission for Environment and Development)
CCAIRR	Climate Change Adaptation through Integrated Risk Reduction
CDM	Clean Development Mechanism
CEJA	Commonwealth Environmental Journalists Association
CEPAL	Comisión Económica para América Latina y el Caribe (Economic Commission for Latin America and the Caribbean)
CHARM	Comprehensive Hazard and Risk Management
CIFOR	Center for International Forestry Research
COP	Conference of the Parties
DDRMA	Departamento de Desarrollo Regional y Medio Ambiente (Department for Regional Development and Environment)
DFID	UK Government Department for International Development
EDI	Environmental Degradation Sub-index
ENSO	El Niño Southern Oscillation
EU	European Union
EVI	Environmental Vulnerability Index
FLACSO	Facultad Latinoamericana de Ciencias Sociales (Latin American Faculty of Social Sciences)
GCC	Global Climatic Change
GCM	General Circulation Model
GCM	Global Climate Model
GDP	Gross Domestic Product
GEC	Global Environment Centre
GEF	Global Environment Facility
GHG	Green House Gas
GNP	Gross National Product
HIPC	Highly Indebted Poor Countries
ICE	Information Centre for the Environment

IDNDR	International Decade for Natural Disaster Reduction
IGCI	International Global Change Institute
IISD	International Institute for Sustainable Development
IMA	Institute of Marine Affairs
IPCC	Intergovernmental Panel on Climate Change
IRI	Intrinsic Resilience of the Environment to Risks
ITDG	Intermediate Technology Development Group
IUCN	International Union for Conservation of Nature and Natural Resources
KP	Kyoto Protocol
LAC	Latin American and Caribbean
NAPA	National Adaptation Plans of Action
NASS	National Adaptation Strategy Studies
NGO	Non Governmental Organisation
OECD/DAC	Organisation for Economic Co-operation and Development/ Development Assistance Committee
PICCAP	Pacific Islands Climate Change Assistance Programme
PNUD	Programa de las Naciones Unidas para el Desarrollo (United Nations Development Programme)
PRSP	Poverty Reduction Strategy Paper
REI	Risk Exposure Sub-index
SIDS	Small Island Developing States
SOPAC	South Pacific Applied Geosciences Commission
SPREP	South Pacific Regional Environment Programme
SURF	Sub-regional Research Facility
TAR	Third Assessment Report
UN	United Nations
UNDP	United Nations Development Programme
UNDAF	United Nations Development Assistance Framework
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VARG	Vulnerability and Adaptation Resource Group
WG	Working Group
WMO	World Meteorological Organisation