



GOVERNMENT OF KIRIBATI

FRAMEWORK APPROACH TO VULNERABILITY & ADAPTATION ASSESSMENT

A user manual to assess and guide vulnerability assessment studies

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Ministry of Environment, Lands and Agricultural Development
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The technical views contained in this document were of the authors, members of the Climate Change Study Team 2010, Management of the Environment and Conservation Division and the Ministry of Environment, Lands and Agriculture Development.

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1.0 Introduction

One of the tasks under the Second National Communication (SNC) Project is to develop a Kiribati Vulnerability and Adaptation (V&A) Assessment Methodology (KVAAM). The Climate Change Study Team (CCST) assumed this responsibility under the direct guidance of the Environment and Conservation Division (ECD) of the Ministry of Environment, Lands and Agricultural Development (MELAD).

Due to increased international academic and research institution's interest on Kiribati vulnerability to climate change, local recipient sectors will or probably have experienced proliferation of information on climate change. These important information should be fully understood and utilized where necessary

This Kiribati V&A Assessment Methodology (KVAAM) is prepared as a tool to assess studies and assessment reports that have already been prepared. It will also assist in determining whether, from much of the information already available in reports on the vulnerability of Kiribati to climate change, additional information is needed to undertake more studies. If it is so decided, then the KVAAM and its Annex 1 will guide any commissioned studies as to types of information that are to be researched and produced. The KVAAM would be also instrumental in understanding synergies from different reports which may be used for informed decision-making and adaptation.

The KVAAM will also be instrumental in documenting synergies and lessons learned from related vulnerability assessments of other sectors. This would be meaningful to understanding our vulnerabilities and in designing our adaptive responses.

Reinforcing the necessity of the KVAAM and the fact that it is the first methodology designed to enhance understanding on climate change reports, the elements and concepts underpinned in the KVAAM framework are also subject to be reviewed and improved, at any particular time, by the Climate Change Study Team in consistent with their professional discretion.

2.0 Background

Kiribati people's sense of their vulnerability to climate change and the associated rising sea level ranges from total pessimism to full denial of the international concern about climate change. The Government position is close to total pessimism as demonstrated in various phrases used by officials to describe Kiribati vulnerability, such as "our future is bleak", "we should listen to what scientists say on climate change", "we are on the frontline", "we are the most vulnerable", "retreat is no option for adaptation because we will fall at the other edge of the land into the ocean", "merit-based relocation is an option for adaptation", and "climate change is a security issue". On the other hand, the general public in their preoccupation in the business of living do not reflect often as to how climate change could have further impoverished their livelihood, now and in the long term. They are more likely to deny or simply make climate change seemingly irrelevant to their normal way of life.

Government's acute sense of vulnerability has come about from its awareness and participation in international strategies to meet the grave challenge of climate change. At the local level, apart from gathered local experiences such as overwash of coastal areas or salt water intrusion to "bwabwai" pits and ground water wells, government is informed by technical studies and reports by external scientists. From our reading of these reports, we have the sense of common features about the reports. Features of these technical studies and reports include;

- Most reports are usually not easy to understand;
- Few reports adopt climate scenarios against which vulnerability assessment is based, most do not;
- Some do not from the very start consider climate change is a real cause of environmental problems, particularly those that are highlighting the vulnerability to sea level rise,

- Most are usually site specific, and single sector based (as should be),
- Nearly all reports do not take into consideration local knowledge and information.

Typifying the first bullet point are some of the work of NIWA to establish sea level rise and rainfall scenarios. Examples from the second group are a SOPAC study (Solomon 1997), and IGCI study (IGCI 1999) adopts scenarios that were based on IPCC global scenarios at the time. The latter study was used in WB Study 2000 (Bank 2000), to evaluate the costs of damage that could be expected by 2050 in the absence of actions now. These studies are often contained very technical information and not ease to understand by Government stakeholders.

The very first study on Kiribati (Howorth 1982a) is an example of the third group. But still, there are few studies carried out more lately that would also be included in the same group.

Examples of site specific studies include those that relate to Bonriki ground water lenses, and several other SOPAC studies of coastal changes. The former is also very clear on climate scenarios that they use (Falkland 1997).

Under KAP I and NAPA wide national consultations to define instances of vulnerability, and to identify coping strategies, and the reports on these consultations are examples of local knowledge and information being taken into account. But when detailed studies were commissioned to understand the nature of vulnerability, and to design appropriate adaptation measures, it is then that local knowledge is ignored. It is usually technical information provided by hired consultants that determine which adaptation measures must go ahead and how they should proceed. And it is government that is held responsible for implementing these measures and activities.

One of the objectives of KAP 1 was to mainstream adaptation throughout Government planning processes. This remains to be the challenge, but it is also

indicates the need to extend any vulnerability and adaptation assessment to include the question of mainstreaming. Additionally, the World Bank (Bank 2000) would suggest that economic valuation of adaptation options identified from assessment of physical vulnerability of a system would be useful to be part of such assessment.

While not suggesting that more studies should be carried out, it is felt that where the types of studies are necessary, then it will be useful for government to know what are the specifics about vulnerability and adaptation that a project/consultant intends to provide in accordance with a consistent methodology for particular sectors and sites. It will be also useful for the Government to give comments on studies proposed to be undertaken to assess a certain vulnerability sector and issues. The methodology should also allow for inputs on studies required to quickly progress with effective adaptation measures. This Kiribati V&A Assessment Methodology (KVAAM) sets out the types of information and steps to be followed to obtain that information.

The KVAAM is based on the IPCC Common Methodology for coastal V&A (M.L. Parry 2007). But other methodologies such as those that are published for US In-country Climate Change Studies have also assisted in clarifying ideas about this assessment methodology. More importantly however, is that the KVAAM is based on Kiribati (both Government and public) understanding of what it means to be vulnerable to climate change scenarios.

3.0 Definitions

These terms were presented and discussed at one of the meetings of the CCST.

Adaptation. Initiatives and measures to reduce the vulnerability of natural and human systems against actual or expected climate change effects. Various types of adaptation exist, e.g. anticipatory *and (or)* reactive, private *and (or)* public, and autonomous *and (or)* planned.

Adaptive Capacity. The whole of capabilities, resources and institutions of a country or region to implement effective adaptation measures (M.L. Parry 2007).

Approach/Methodology. A complete framework, that is outline (*not intended to require much further development*) that prescribes an entire process for the assessment of vulnerability and adaptation and offers a broad strategic approach.

Scenario is defined in a dictionary as “a description of how things might happen in the future”. From certain IPCC reports, we have a sense of future time, which is factual, and how “climate” might turn out. It is a plausible future climate.

Baseline years may be just in relation to a period (e.g. 1969-1990), or a comparable period to years of climate change scenarios (e.g. 2040-2060 baseline years, and climate change scenarios years) which then is called “future baseline” or “baseline scenarios” without the forcing (due to anthropogenic emissions of ghg) of climate change.

Climate is the averages of key weather variables, and of measures of variability, calculated over a period of 30 years, 1961 to 1990, or 1971 to 2000 say. This is factual.

Climate scenario is future plausible climate from modeled response of the climate system to enhanced greenhouse effect and natural climate (internal forcing in the climate system) combined.

Climate change is as defined in the UNFCCC:

“a change in the climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods”.

Climate change scenario is the difference between the climate scenarios (natural and human induced) and the baseline climate (natural) in the comparable time period.

Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, *including* climate variability and extremes. It is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and the adaptive capacity. (M.L. Parry 2007). To take “climate change” in the sense that UNFCCC defines it, would relate vulnerability to only what has been experienced. But we also wish to understand how Kiribati would be affected by projections of “rate of climate change”, in other words, how climate scenarios would affect Kiribati.

4.0 Kiribati Vulnerability and Adaptation Assessment Methodology

Aims

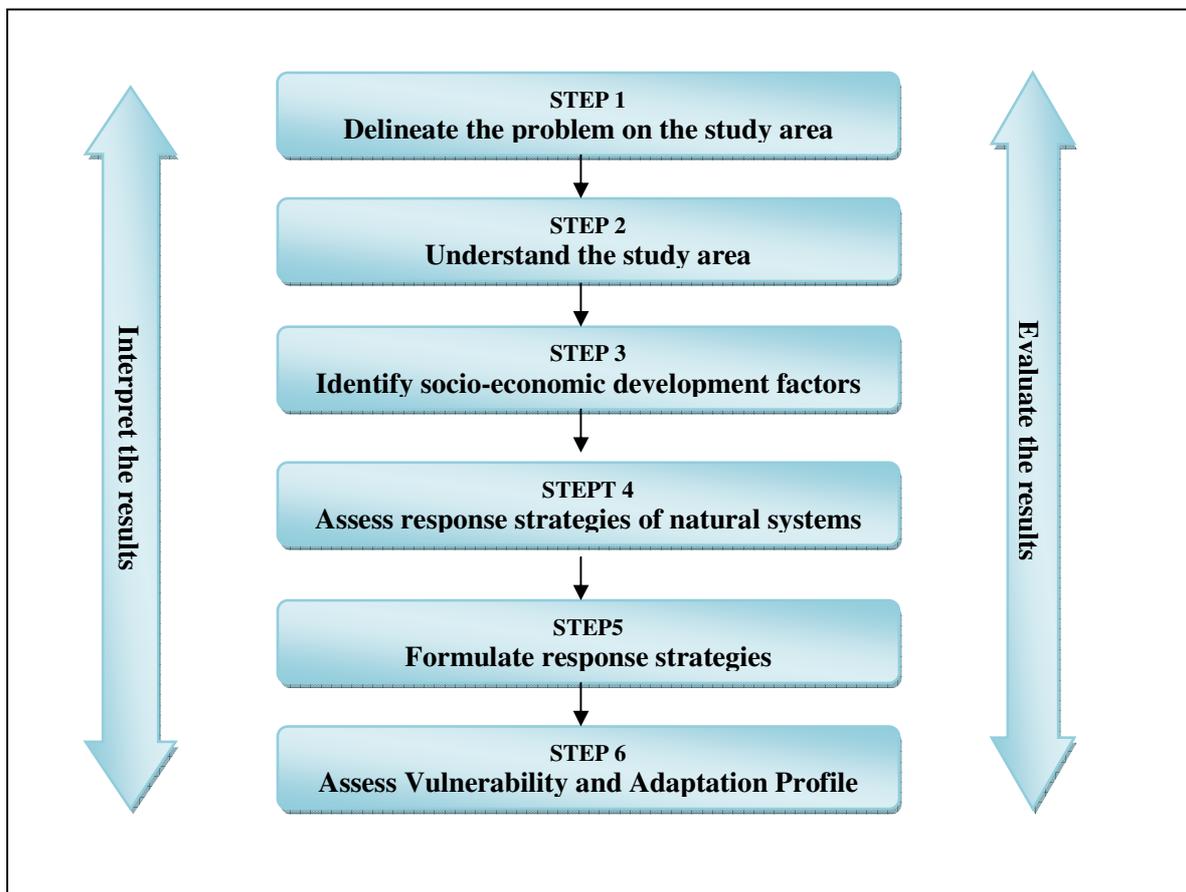
- To set out steps to identify essential elements in various technical reports on Kiribati vulnerability and adaptation options, to climate change.
- To provide a framework method for Government sectors to review existing reports and proposed projects.
- To enable local perspectives that contribute towards the form this KVAAM takes, to be taken into account in any vulnerability and adaptation assessment.
- To ensure that V&A are guided toward Kiribati understanding on what it means to be vulnerable to climate change scenarios and the adverse effects. That knowledge gained from the review using this method can be then be used to assess adaptation options.
- To ensure that the results are actionable.

As pointed out above, the KVAAM does not suggest there is need to undertake more vulnerability and adaptation assessment. However should this need arise, because it is so necessary, then the KVAAM should provide guidance on what particular information is e meaningful for national needs and actions? Since many relevant studies and reports have been produced, they need also to be taken into account in any later studies that may have to be undertaken.

The KVAAM designs therefore that for any subsequent studies that are undertaken, earlier related studies be reviewed, local perspectives be taken into account, and the results or recommendations of the subsequent studies are easily understood by The KVVAM will assist and guide Kiribati officials with their informed decision making and effective adaptation activities.

This methodology was also developed with in mind the need to facilitate government and other officials in their reviewing and understanding of existing technical reports on vulnerability assessment or climate change related to their relevant sectors. Kiribati officials are strongly encouraged to use this user guide where seen necessary, But also to use in providing comments and actions to better able decision-makers to use knowledge provided in reports.

The flow chart below was provided for ease of understanding on the underlying concepts and logic underpinning the methodology.



The detail description of key elements to be investigated and the process in each of the steps is explained in specific sections below. The information contained in Annex 1 will also be useful in undertaking assessment of reports using the KVAAM.

Step 1. “Delineate a study area” or equivalently “Define the Problem in the study area”

Our aim of V&A and actions is that the vulnerability of Kiribati circumstances from climate scenarios and in particular from climate change scenarios is reduced through adaptation activities. There are three information components under this step: climate change scenarios; time frames; and purpose and scope of the study using the KVAAM. It is important to ensure that there is coherency not only of elements within each component but moreover across the components.

Climate change scenarios

Climate change scenarios should be consistent with those that are published in the latest IPCC publication and relevant to the purpose and the time frames of the study. For Kiribati purpose, scenarios are projected climatic conditions at appropriate time frames of future period. These conditions must include surface temperature, rainfall, and sea levels, but in addition where the purpose of the study requires, other appropriate variable such as humidity, soil moisture should be provided.

The researcher/consultant shall be able to adopt any tools or guidelines, such as synthetic¹ scenarios, temporal and/or spatial analogue scenarios, downscaling² of global scenarios. or any other construct. We have to realize that the CCST is not expected to construct scenarios, but it is expected to understand any that may be produced in any vulnerability and adaptation studies.

Time frames

These will go together with climate change scenarios. Time frames must be the same as those that are adopted for the climate change scenarios. On the other hand, time frames could first be determined, and then a projected climatic condition, that is scenarios, is constructed.

¹ Synthetic scenarios describe techniques where particular climatic (or related) elements are changed by a realistic but arbitrary amount, often according to a qualitative interpretation of climate model simulations for a region.

² Various specialized techniques that consultants can use and need to explain.

Kiribati may decide on the time frames, and leave the construction of the projected climatic conditions corresponding to the selected time frames to the researcher/consultant.

Purpose and scope

Ideally, Kiribati government should decide when, where and for what purpose any study on vulnerability and adaptation is required. This is an obligation under the UNFCCC³ which requires parties to “formulate, implement, publish and regularly update national and, where appropriate, regional programmes containing measures to mitigate climate changeand measures to facilitate adequate adaptation to climate change” (Art.4 1 (b)). This requires that Kiribati has plans and programmes for mitigation and adaptation. However, many decisions of the COP⁴ stress the importance of the programmes to be based on sound scientific information and therefore the desirability to have external technical inputs in adaptation planning.

But this creates in Kiribati the sense of lack of control over, and reliance on external initiatives for studies on vulnerability and adaptation measures. This does not encourage Kiribati government to drive the process of adaptation which usually begins with some form of vulnerability and adaptation assessment studies.

To empower the Kiribati government in this area, the CCST can be another mechanism to facilitate this process. CCST will need to be involved from the early stage of any study on climate change vulnerability that may be initiated from any on-going project, or from other sources. CCST involvement will inform members to be more able to understand and therefore review and provide advice to government on technical reports and recommendations from these studies.

One of the purposes of any vulnerability and adaptation assessment is therefore to empower Kiribati to be able to plan and implement adaptation activities. Some of the considerations relevant for determining the scope of the study include felt needs

³ United Nations Framework Convention on Climate Change

⁴ Conference of the Parties to the UNFCCC

of the communities arising from environmental changes that are potentially exacerbated by climate change technical considerations such as the availability of tools and data, and sites characteristics. . These considerations imply that concerned communities, Kiribati government, and consultants for a vulnerability and adaptation assessment study to be carried out, should first jointly decide on the scope of the study.

Step 2. Understanding the (Inventory of) study area with correspondence to Step 1.

The study site comprises of natural and human systems. The purpose and scope of the study will determine what systems are relevant and to which categories they are to be allocated.

The systems, natural and human, should be described in their current state and variability over time from the past. Projections into the future under the condition of no climate change, and under condition of climate change scenarios can be useful.

Natural systems

Climate conditions for Kiribati must be included among the natural systems. The conditions should include temperature, rainfall, and sea level rise. The mean, variability, extremes, trends, and correlations of the variables should be assessed and used as a check for the reliability and consistency (with them) of the climate change scenarios adopted in Step 1.

Impacted variables of the natural systems can include those that describe wave climate, land area, water lens, and biological diversity. The purpose and scope of the study will largely determine which other components of the natural systems are relevant to include. The researcher/consultant will decide.

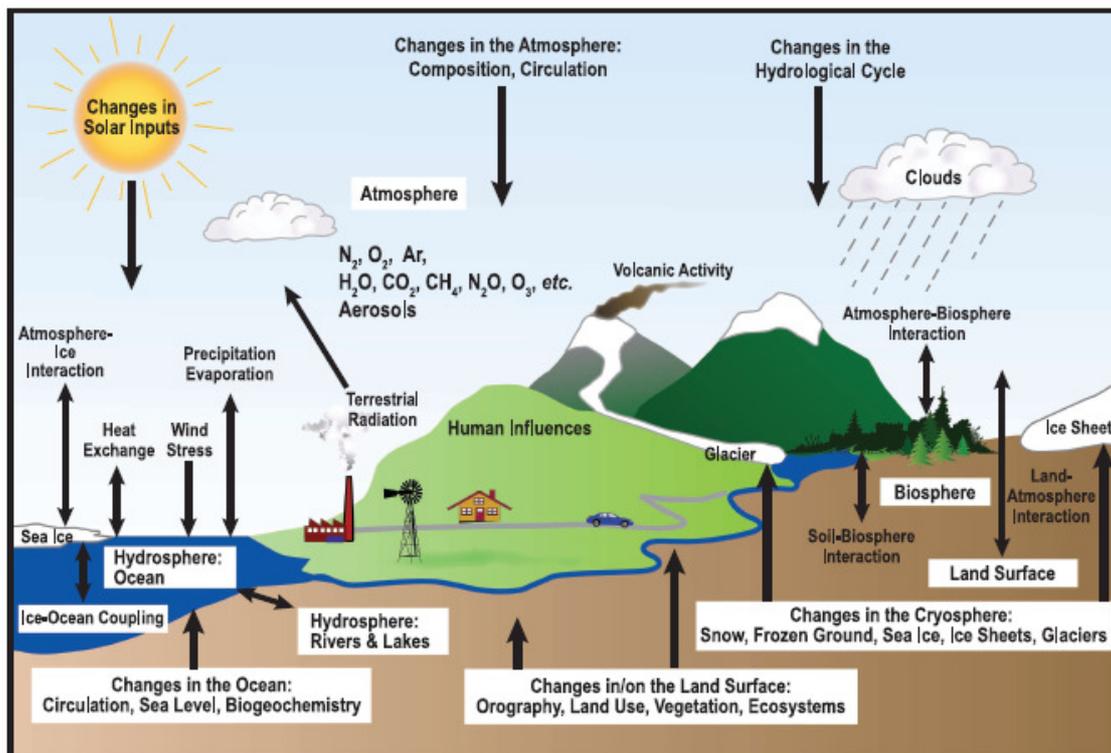
Human systems

Human systems are categorized as development factors, demographic, and institutional. These must be described in the same way as the natural systems are described.

Demographic factors relate to information about people who are immediately and directly affected by any change in the components of natural systems selected for the study. Development factors are about the livelihood of the people, their activities including fisheries and agricultural and interactions with the resources on which these depend.

Institutional factors should include regulatory measures and management practices on human activities to protect the sustainability of the natural systems. Culture of the people is quite important to take into consideration. Therefore, culture and social practices should be considered including activities that tend to be destructive to the natural systems.

Figure 1 Inter-relationship of human and natural systems



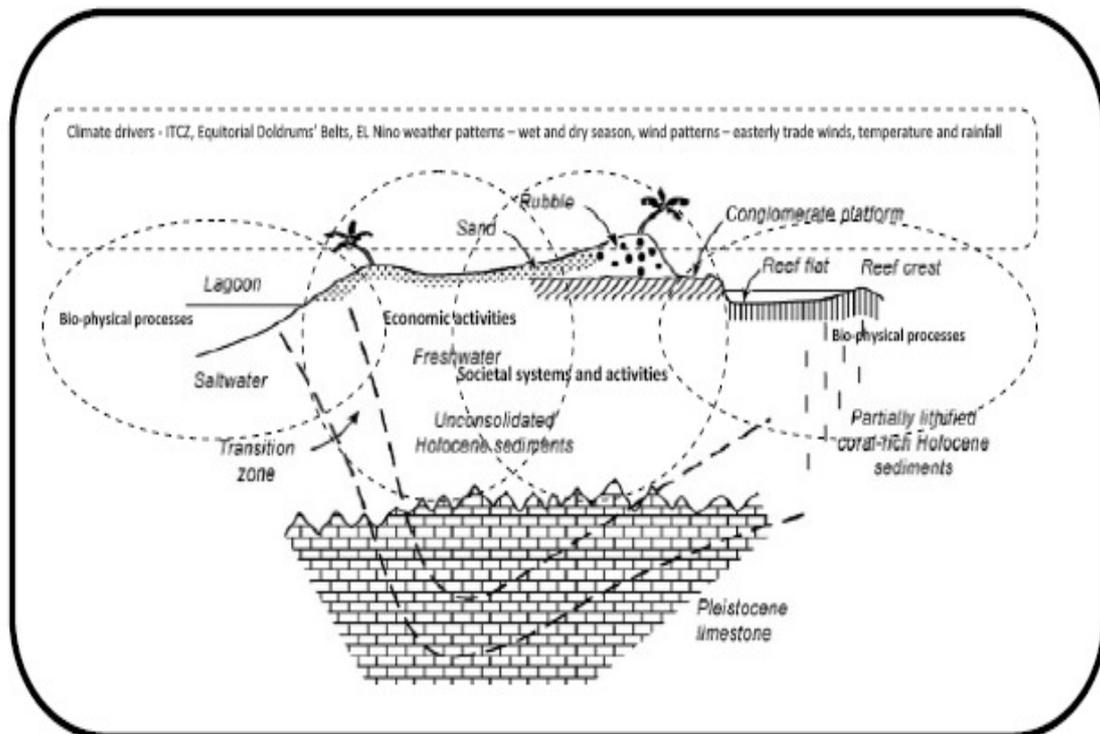
Source: (M.L. Parry 2007)

Step 3. Identify relevant socioeconomic development factors that may interact with and modify assessments in Step 2

From Step 2, the natural systems and human systems have been characterized in terms of their mean state, variability, extremes, trends, and may also include projections under climate change conditions and under no climate change conditions.

Are there any development factors that are not considered under Step 2 as part of, or expected to have influence on either the natural systems or the human systems? Such factors can include policies that are in the pipeline for adoption or implementation. For example, there may be a policy to establish a primary school close to the study site. Such factors should then be used to review and revise the outputs of Step 2.

Figure 2 Interaction of bio-physical and social-economic systems on an atoll



Source: adapted from (Woodroffe 2008)

Step 4. Assess responses of natural systems to, and physical changes arising from, climate scenarios (variability + enhanced GHE)

Good practice on vulnerability assessment requires that impacts of climate change on the natural systems be first assessed and using the knowledge obtained, proceed with assessing how the human systems are or will be affected by and respond to those impacts of climate change on the natural systems.

We need to recognize the interaction between our activities and the natural systems, that is, natural systems degraded by climate change can make our activities less productive but also our activities can reduce the ability of the natural systems to maintain and continue their richness to support or provide for our activities and needs.

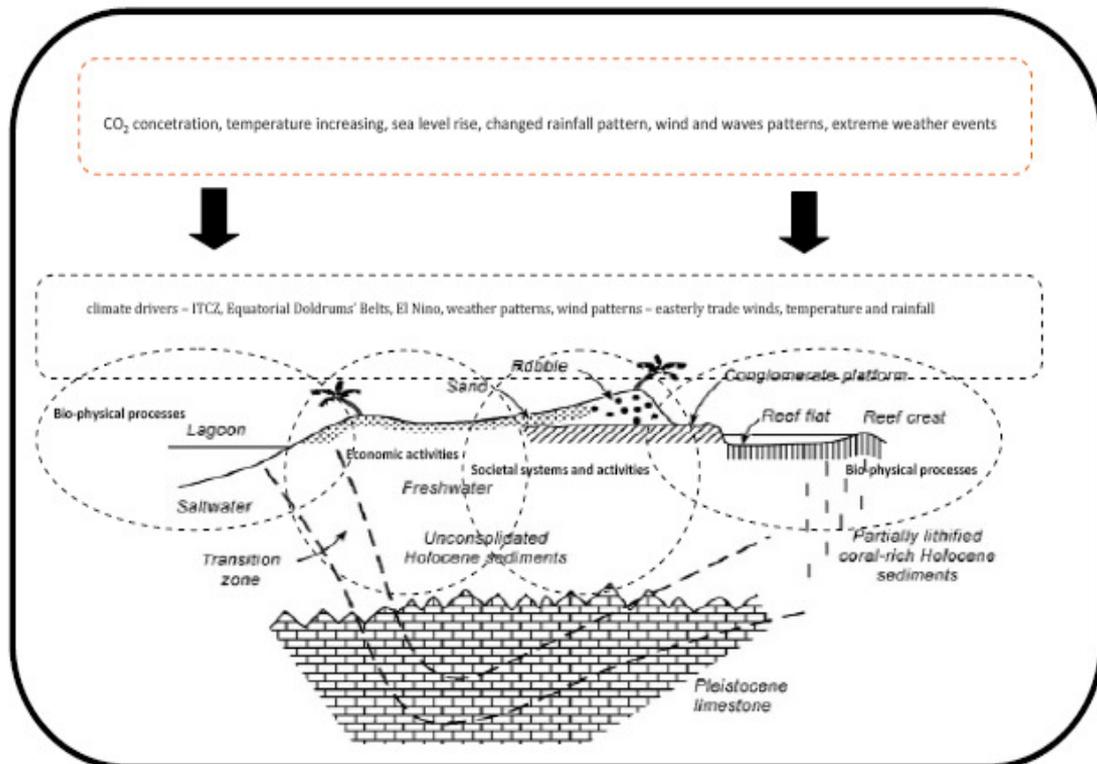
From Step 2 as modified by Step 3 (supposing there is socioeconomic development factor to modify results of Step 2), the natural systems as so characterized are considered as related to the condition of baseline climate and where the characterization extends to future years it is then related to baseline climate scenarios.

With the natural systems so characterized, we will want to know more specifically, how these characterizations will change in future years or at some future year intervals. Changes can be possible under two different sets of future climate conditions. The first set is future condition of the “no climate change” scenarios, that is, climate baseline scenarios. The second set is of “climate change scenarios”. This second conditions is already defined in step 1. The characterization and assessment of the natural systems under the two distinct conditions should be made clear.

The natural systems characterized under the *baseline climate scenarios* affect the human systems that would have been described (under Step 2 as modified by Step 3). Similarly the natural systems characterized under the *climate scenarios* (climate change scenarios now taken into account) affect the human systems. The human

systems so affected and so described under two different conditions: natural systems under the baseline climate scenarios; and natural systems under climate change scenarios provide two sets of information. The information on the human systems under the two conditions must be made distinctive.

Figure 3 Climate change and its implications on an atoll system



Source: adapted from Woodroffe, 2007

Step 5. Formulate response strategies addressing impacts of Climate Change on natural and Socio-economic conditions.

From Step 4 we have a description of baseline climate scenarios, from Step 1 a description of climate change scenarios and corresponding to each are information on natural systems as modified by each of the scenarios. It may be useful to conceive these processes as the mapping of baseline climate scenarios and climate change scenarios separately on the same natural systems. Ideally these images should not overlap but show clearly the relevant difference.

Both images and assessments of the baseline climate scenarios on the natural systems will affect the socio economic conditions of the study site. . There should be analysis of how the socio economic conditions are affected by, and their responses to the natural systems so impacted separately by baseline climate scenarios and climate change scenarios. The difference between the two is most important to highlight.

The difference in the conditions of the natural systems (natural systems under baseline climate scenarios minus natural systems under climate change scenarios), and the corresponding difference in the socioeconomic conditions can prompt a revisit of the whole process once again. An interactive process can be started when the latter suggests extremes on notional scale of vulnerability and should therefore be taken as a further driver of the second round impacts on the former, and so on. This should also provide opportunity to incorporate any additional development factors that may have been overlooked in Step 2.

The differences between the conditions of the natural systems under the two separate scenarios, and/or the differences between the corresponding socio economic conditions, without or after the second round of iterative steps of KVAAM process should indicate what must be done in the respective areas of socioeconomic conditions and for natural systems.

Step 6. Assess vulnerability profile and interpret results

The Vulnerability and Adaptation Assessment is premised on the assumption that climate change scenarios adversely affect the natural systems. The differences explained in Step 5 in terms of overall effect on the livelihood of the people are expected to be negative.

Positive differences may be encountered and if this is the case, there is good reason for iteration as noted in step 5 that is the need to refine further the assessment or to question the assumption as it relates to the particular site and elements of the natural systems so studied.

As noted under Step 5 this information can enable us to identify adaptation strategies.

Formulation of adaptation framework and mainstreaming

The KVAAM should also assist in providing information that may be useful for the formulation or review of the adaptation framework from time to time.

The KVAAM should intend further to lead to actual adaptation activities to be implemented. For this to happen, it is a prior requirement that any such activities should be integrated into national development policy and plans. Mainstreaming of adaptation activities is also an important aim that the KVAAM should facilitate.

5.0 Operationalising the Kiribati Vulnerability and Adaptation Assessment Methodology.

One of the reasons that lead to the design of the methodology was to assess and better understand the findings of study reports on climate change. This section was intended to assist the application of the methodology. The KVAAM is flexible and a combination of tools can be used to run through the various steps. The following are few examples of the tools among others that can be used when one applies this framework.

Step 1 – Delineating the problem on the study area

It is fundamental to carefully understand key elements within this step which include the purpose & scope of the study, climate change scenarios and the time-frame which the study uses for the purpose of assessing the projected impacts.

Step 2 – Understanding systems and interactions on the study area

Two main key systems that should be assessed in this step and they are i) natural systems and ii) human systems. A form of a chart can be constructed and used to record and assess areas mentioned in the study report, or, a matrix of each system category and sub-activity can also be used to document areas identified in the report. However, there are other innovative tools that can be used in this particular process to better understand each system outlined in a report.

Figure 4 Example of Gap analysis tool that can be used for this purpose

Study (author, year and site)	emphasis of the study						issues raised
	Coastal processes and changes	Geology/morphology	Biological aspects	Socio-economics	Institutional arrangements and governance	Integrated coastal planning	
Howarth, 1982, selected sites in Tarawa	Observed sediment movements patterns, i.e. erosion and accretion and other coastal processes						Human and natural disturbances contribute to sediment accretion and erosion

Step 3 – Identify relevant socio-economic development factors

Again, the tools above can be integrated with this step to see their inter-linkages

Step 4 – Assess responses of natural systems

The tools in step 2 and 3 can be integrated to capture this step as well.

Step 5 – Formulate response strategies addressing CC impacts

A sheet corresponding to the analysis and outputs in step 2, 3, 4, or a separate spreadsheet can be developed to capture strategies related to issues and problems evidenced in the above steps.

Step 6 – Assess vulnerability Profile and interpret/evaluate results

Similarly with Step 2, 3, 4, the tool can be applied also in this step. However, this does not preclude any other application tools relevant for this step.

The Annex 1 contained checklist for each of the steps. This information is a relevant input into a tool that can be employed in each of the steps of this methodology.

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Annex 1

CHECK LIST OF QUESTIONS FOR STEPS IN THE V&A THAT ARE USED IN VARIOUS CLIMATE VULNERABILITY STUDIES.

STEP 1. - Define the Problem on the study area

1. Are climate change scenarios stated?
2. Are time frames stated, and do information clearly identified with different time frames?
3. Is the purpose or objective of the study stated?
4. Is the scope of the study defined?
5. Who are involved in the scoping of the study?

STEP 2. - Understanding the (inventory) study area

1. Are natural systems and socio economic systems distinguishable from each other in the study?
2. Are selected aspects of natural systems that are included in the study fully described in relation to the selected time frames?
3. Are selected aspects of socio economic systems fully described in relation to the selected time frames?

STEP 3. - Identify socio-economic factors that interact with assessment

1. Are there development factors, either currently relevant or to be relevant at some future date, stated?

STEP 4. - Assess responses of natural systems

1. Any of the development factors taken into account to modify selected aspects, described under Step 2, of the natural systems?
2. Are assessments undertaken of the impacts of climate change scenarios on the selected aspects, described under Step 2, of the natural systems?
3. Are there assessments as in 2 above but relate to the impacts of baseline climate scenarios?
4. Are there assessments of impacts of natural systems under condition in 2 above on human systems?
5. Are there assessments of impacts of natural systems under condition in 3 above on human systems?
6. Does the study provide indications of the differences between 4 and 5?

STEP 5. - Formulate response strategies

1. Do the differences cause the assessments in the study to revisit Step 4?
2. Do we think the study provide *climate scenarios* impacts on the natural systems, and then the natural systems impacts on the human systems of interests?
3. Do we think the study provide *baseline climate scenarios* impacts on the natural systems and then the natural systems impacts on the human systems?

STEP 6. - Assess vulnerability profile and interpret results

1. Does the study gives some vulnerability indicators of either the natural systems, or the human systems, or both?

2. In what forms does the study give the vulnerability indicators – qualitatively or quantitatively or both?
3. Does the study indicate approaches to reduce vulnerability indicators?