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STAP WORKSHOP ON SMALL ISLAND DEVELOPING STATES (SIDS), GROUNDWATER AND INTERLINKAGES

6-9 NOVEMBER 2006, PORT OF SPAIN, TRINIDAD

(Prepared by the Scientific and Technical Advisory Panel)



United Nations Environment Programme

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PROGRAMME DES NATIONS UNIES POUR L'ENVIRONNEMENT • PROGRAMA DE LAS NACIONES UNIDAS PARA EL MEDIO AMBIENTE
ПРОГРАММА ОРГАНИЗАЦИИ ОБЪЕДИНЕННЫХ НАЦИЙ ПО ОКРУЖАЮЩЕЙ СРЕДЕ

Workshop Report

STAP Workshop on Small Island Developing States (SIDS), Groundwater and Interlinkages

6-9 November 2006, Port of Spain, Trinidad

*Prepared by the Scientific and Technical Advisory Panel (STAP)
of the Global Environment Facility (GEF)*

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Preface

The request to STAP by the GEF Secretariat for guidance on groundwater management led to the acknowledgement by the constituency of water management practitioners convened in three workshops on the subject, that groundwater is by far the world's largest store of accessible freshwater; but that it is not sufficiently recognized in policies or practices for integrated water management.

Groundwater is a limited resource that is subject to over-exploitation, as well as pollution from various practices relating to sanitation, waste management, and use of external inputs in land use for agriculture. Further, there are often direct linkages between quality of groundwater and wetlands and coastal resources. Groundwater resources are also sensitive to climate change, biodiversity loss, and land management.

This Report indicates that these relationships are more evident and direct, that they have clearer and shorter feedback loops, and that they take on even more significance and urgency, in the context of Small Island Developing States (SIDS). Moreover, it is apparent from much of the literature relating to SIDS that the sustained development of these countries depends heavily on the protection of ecosystem services, and on integrated management of their freshwater resources.

STAP recognizes that the GEF has been active in SIDS through all of its focal areas. However, it would appear from this workshop that the range of GEF-assisted activities may be more effective if they are better linked in concept and in project interventions, and through activities on the ground in any such State. Approaching groundwater as a cross-cutting issue may create an entry point for an ecosystem based framework for assisting SIDS, which the GEF is well-placed to do within the range of activities in which it supports SIDS.



Yolanda Kakabadse
STAP Chair

May 18 2007
Washington, DC

EXECUTIVE SUMMARY

1. Over the last five years, an increasing recognition of the significance of aquifers in ecosystems has been noted in the global environmental agenda. As aquifers hold 99% of all accessible freshwater on the planet, the need for their proper management and protection is very important for ensuring the effectiveness of strategies to address global changes, including those occurring in small island developing states (SIDS), because of their fragility. The Scientific and Technical Advisory Panel (STAP) was therefore asked by the Global Environment Facility (GEF) to provide an assessment of the global state of knowledge on aquifers in relation to the principal threats, and to advise on strategic issues.
2. To meet this request, STAP convened a series of three workshops. This Workshop Report covers the 3rd Workshop which considered the role of aquifers in environmental sustainability in SIDS, as part of the STAP-III work program. The first workshop (held in UNESCO, Paris, 2004) addressed general issues of the prevalence and the importance of aquifers, the second workshop (held with the support of UNESCO Office Delhi, 2005) addressed aquifers as subsurface space and the value of managed aquifer recharge.
3. The discussions and findings of the two previous workshops suggested among other issues, the need to focus specifically on aquifers in SIDS. Thus the subject of the third workshop was ‘SIDS, aquifers¹ and interlinkages’, held in Port of Spain, Trinidad, 6th – 9th Nov 2006, co-hosted by the Cropper Foundation and the Government of Trinidad & Tobago, represented by the Ministry of Public Utilities and the Environment and the Environment Management Authority.
4. The rationale for the workshop recognizes that owing to climatic fluctuations, the sustainable development of small island developing states will increasingly depend on two related factors: protection of ecosystem services, and management of groundwater resources. Additional drivers relate to human and climate induced alterations of the marine/freshwater interface, and to pollution of unconfined aquifers by excess nutrients and their impacts on coral reefs and other habitats. While GEF is very active in SIDS in all its Focal Areas, groundwater has not been so far been considered among the central issues. STAP was thus asked to consider providing a science based stocktaking of the groundwater related risks, and of the opportunities for action in managing groundwater in SIDS with a focus on: recharge areas; salt water intrusion from rising sea levels; interlinkages of contaminated groundwater and coral reefs.
5. The workshop was organized in plenary sessions interspersed with breakouts. It was supported by reports of the two previous STAP workshops, a Background Paper and a questionnaire circulated to practitioners in advance of the event. The participants addressed the current status, needs and obstacles to the sustainable use of aquifers in SIDS. A series of on-going GEF supported projects and activities were presented followed by a diagnosis of the key issues that might guide the way GEF might seek to create the linkages through its

¹ In this Report, “aquifer” denotes the geological rock formation *and* the water contained within it – somewhat analogous to ‘river basin’ – which denotes the soils, vegetation, urbanisations, etc *and* the water in the stream channels..

focal areas. The Workshop also included a full day field trip to water supply well field sites that are likely to be subjected to saline intrusion, potential recharge sites and production wells sited on fractured aquifers that have locally been termed ‘megawatershed’.

6. The conclusions and recommendations from the Workshop, which are primarily directed at the GEF Secretariat and to SIDS regional bodies, are intended to result in a more integrated GEF SIDS program of work that builds in sustainable management of groundwater, responding to socio-ecological drivers that are more intense in SIDS than in continental coastlines.

The Workshop concluded that:

- a) Aquifers in the SIDS are an important, but sometimes forgotten component of the SIDS ecosystems.
- b) An enhanced focal area integrated GEF approach to the needs of the SIDS would enhance the efficiency of the delivery of the technical assistance.
- c) The science of the aquifers in the SIDS is well understood but it is not integrated into the social, cultural and economic policy frameworks. As a result, innovation in exploitation of aquifers has remained generally dormant with the exception of examples of public-private partnership, e.g. through Build, Operate & Transfer (BOT) in Trinidad & Tobago.
- d) The conventional geographical grouping of SIDS (e.g. of the Caribbean, Pacific, Atlantic & Indian Oceans), though relevant in geo-political considerations, does not necessarily provide suitable classification and insight for addressing the socio-ecological needs of many SIDS, which may be better identified through their geomorphology.
- e) The diverse needs of SIDS are defined by each island’s individual ecological footprint, which can help to define specific needs to be addressed as well as to indicate relative priority.
- f) The socio-ecological drivers in the SIDS are highly amplified due to their restricted terrestrial extent and are particularly challenging in the coastal zones of SIDS.
- g) The challenges facing aquifer management, which underlie and interconnect with socio-ecological systems, can only be addressed by greater integration between the various focal areas of GEF in order to better respond to these drivers, and to provide means for innovative solutions.

The Workshop recommended that:

- h) A new and more environmentally relevant classification of the SIDS should be used to guide the Regional bodies in better focusing their technical assistance to the most fragile

& vulnerable SIDS². This classification should be based on the underlying geomorphological features coupled with the ecological footprint approach.

- i) A multi-focal GEF approach should be created under which greater integration would occur in the projects across the various focal areas, delivered through a stronger and lasting partnership between SIDS and the GEF
- j) Opportunities for engagement with the private sector should be sought out and encouraged.
- k) Coordinated action on sustainable management on groundwater should be built on the current GEF investments, such as the IW LEARN project, emphasizing more support for the sharing of experiences, lessons and technical expertise amongst SIDS.
- l) Groundwater must be considered together with surface freshwater to enable effective management of water resources, including reducing the risk of pollution by inadequate and inappropriate sanitation or by surface water contamination due to poor agricultural practices and other diffuse sources.
- m) The community co-management issues raised in this workshop should be considered in all future SIDS actions.

² Regional bodies e.g. South-Pacific Regional Environmental Program (SPREP).

SECTION I: INTRODUCTION

Background

1. There is an increasing recognition of the significance of aquifers in ecosystems generally, and in SIDS in particular. Their proper management and protection is very important for ensuring the sustainability, including climate resilience, of groundwater support to ecosystems. The Scientific and Technical Advisory Panel (STAP) was asked by the GEF to provide an assessment of the state of knowledge on aquifers in relation to the principal threats and to advise on strategic issues. To meet this request, STAP has convened a series of three workshops.
2. Reports from the previous two STAP Workshops relating to aquifer resources and their management have been made available to the GEF. The first workshop³ made recommendations linked to the development of a GEF strategy on groundwater. The second workshop⁴ recommended a number of priorities for action, including assessment of the significance of aquifer sources for small-island developing states (SIDS) and strategies for their sustainable use. As a result, a third workshop was proposed in the STAP Work Program to provide science based stock taking of the groundwater related risks due to climate change, and unsustainable management practices in SIDS. The third Workshop, the subject of this Report, was convened from 6th – 9th November 2006, in Trinidad & Tobago. Its work was supported by Reports of the previous two Workshops, a Background Paper, and a ‘practitioner’s survey’ that was conducted by the Workshop Rapporteur, as part of the Workshop preparation.

Purpose of the Workshop

3. The purpose of the workshop was to gain a better understanding of the vulnerability of groundwater as the basis for supporting livelihoods and in the preservation of coastal ecosystems in Small Island developing states. The potential for the GEF to explore integration of project efforts in GEF focal areas of biodiversity, climate change, sustainable land management and persistent organic pollutants was also explored.

Workshop Participation

4. The workshop was organized to provide for maximum information exchange and discussion among a group of groundwater management and SIDS expert-practitioners from developed and developing countries, from the different geographic regions, representing academia, research, international, government agencies and NGOs. The workshop was led by Angela Cropper and Saburo Matsui, STAP Members, and co-hosted by the Cropper Foundation, the

³ “Strategic Options and Priorities in Groundwater Resources” (GEF STAP Paris Workshop Report, April 2004)

⁴ “Managing the Sub Surface Environment”, (GEF STAP, New Delhi Workshop Report, September 2005)

Ministry of Public Utilities and Environment, and by the Environment Management Authority of Trinidad and Tobago. Representatives from the GEF Secretariat, the GEF's implementing Agencies (UNEP, UNDP and the World Bank) were invited, as well as UNESCO/IHP, and the STAP Secretariat, (see Annex 1).

Setting the scene

5. The formal opening of the Workshop was in the presence of the Honourable Minister of Public Utilities and the Environment Penelope Beckles, who gave an overview of the key issues that affect the water resources in Trinidad & Tobago, identifying over-exploitation and saline intrusions of aquifers as of increasing concern. The Minister also stressed the evolving approach of community co-management as an approach with some promise, leaving the Workshop participants with three issues that she would like guidance on: capacity building strategies, community co-management approaches, and the role of women.
6. The introductory session of the Workshop also included a presentation from Andrea Merla, GEF Secretariat, who outlined the overall aquifer issues in the GEF, and their significance in the SIDS. Three issues were raised for the participants to deliberate on:
 - How to achieve IWRM in SIDS (protection of water supply and how to implement integrated approaches, including the issue of community co-management).
 - How to enhance the existing geographic-based networks (and the best vehicle for replication of GEF investments).
 - How to strengthen GEF actions in SIDS (is there a need for an overall GEF/SIDS partnership in view of the need for significant capacity building requirements?).
7. The main discussion points were addressed sequentially by considering the baseline condition, identifying of perceived needs, obstacles and common issues, and discussion on integration strategies. These and the main findings are discussed further below.

SECTION II: MAIN FINDINGS

Summary of Conclusions and Recommendations

The Workshop concluded that:

- a) Aquifers in the SIDS are an important, but sometimes forgotten component of the SIDS ecosystems.
- b) An enhanced focal area integrated GEF approach to the needs of the SIDS would enhance the efficiency of the delivery of the technical assistance.
- c) The science of the aquifers in the SIDS is well understood but it is not integrated into the social, cultural and economic policy frameworks. As a result, innovation in exploitation

of aquifers has remained generally dormant with the exception of examples of public-private partnership, e.g. through Build, Operate & Transfer (BOT) in Trinidad & Tobago.

- d) The conventional geographical grouping of SIDS (e.g. of the Caribbean, Pacific, Atlantic & Indian Oceans), though relevant in geo-political considerations, does not necessarily provide suitable classification and insight for addressing the socio-ecological needs of many SIDS, which may be better identified through their geomorphology.
- e) The diverse needs of SIDS are defined by each island's individual ecological footprint, which can help to define specific needs to be addressed as well as to indicate relative priority.
- f) The socio-ecological drivers in the SIDS are highly amplified due to their restricted terrestrial extent and are particularly challenging in the coastal zones of SIDS.
- g) The challenges facing aquifer management, which underlie and interconnect with socio-ecological systems, can only be addressed by greater integration between the various focal areas of GEF in order to better respond to these drivers, and to provide means for innovative solutions.

The Workshop recommended that:

- h) A new and more environmentally relevant classification of the SIDS should be used to guide the Regional bodies in better focusing their technical assistance to the most fragile & vulnerable SIDS⁵. This classification should be based on the underlying geomorphological features coupled with the ecological footprint approach.
- i) A multi-focal GEF approach should be created under which greater integration would occur in the projects across the various focal areas, delivered through a stronger and lasting partnership between SIDS and the GEF
- j) Opportunities for engagement with the private sector should be sought out and encouraged.
- k) Coordinated action on sustainable management on groundwater should be built on the current GEF investments, such as the IW LEARN project, emphasizing more support for the sharing of experiences, lessons and technical expertise amongst SIDS.
- l) Groundwater must be considered together with surface freshwater to enable effective management of water resources, including reducing the risk of pollution by inadequate and inappropriate sanitation or by surface water contamination due to poor agricultural practices and other diffuse sources.
- m) The community co-management issues raised in this workshop should be considered in all future SIDS actions.

⁵ Regional bodies e.g. South-Pacific Regional Environmental Program (SPREP).

Aquifers in the SIDS: identifying the problem

8. As a result of the commitments to assist the SIDS, made through the Barbados Plan of Action and the later Mauritius Strategy, the international community and the Governments of the SIDS have embarked on an ambitious program of activities. Many of these reflect the needs of the regional groupings of SIDS and these are coordinated through the respective regional initiatives such as South Pacific Applied Geoscience Commission (SOPAC) in the Asia-Pacific and the Integrated Watershed & Coastal Area Management (IWCAM) in the Caribbean. Nevertheless there are still gaps in the sustainable management of aquifers in SIDS.
9. The issues raised by the GEF Secretariat with regard to SIDS included (i) approaches for integration of ‘water’ issues into sustainable management, (ii) a review of the ‘groupings’ used in delivery of technical assistance and (iii) the necessity to establish a partnership with GEF that would address SIDS and the sustainability of aquifer resources.
10. The concerns of the governments in the SIDS, as expressed by the Trinidad and Tobago Minister for Public Utilities and the Environment included among others, the issues of capacity building, co-management with communities, education and the role of women. In addition to the concerns raised by the GEF Secretariat, the perceptions of the ‘clients’ were also taken account of through the ‘practitioners survey’. Following the debates and the discussion among the experts, who took part in the workshop and with the results of the questionnaire, some of the main findings, responding to these concerns follow.
11. In the past GEF focal areas have to a large extent operated somewhat compartmentalized and this could have contributed to lower efficiencies. 68% of the practitioners found the cross-sectoral communication low to very low. A more integrated approach, especially in SIDS, through synergies across the focal areas could increase the efficiency of the technical assistance. Aquifers in the SIDS, as the principal source of fresh water in the ecosystems in many cases, can be treated as the linking medium through which such synergies could be enhanced.
12. Based on the presentations made by the participants from the GEF supported projects, and the observations of the participants, the IA’s would benefit from conducting a review of their ongoing portfolio’s to strengthen the aquifer relevant aspects, especially where groundwater dependent ecosystems are being addressed in their SIDS projects. 70% of the practitioners surveyed, ranked their appreciation of the issues connecting aquifers to the environmental challenges of SIDS, as low to very low. 81% of the practitioners gave the same ranking to their appreciation of the linkages between aquifers and groundwater dependent coastal ecosystems. These figures further strengthen the need for intensified capacity building efforts.
13. Although the science of aquifers and their linkage to land based activities and to the coastal environments is well understood, its conversion to policy relevant guidance is lagging behind, because of weak capacities. 75% of the practitioners ranked their understanding of

the science as high to very high, however 85% ranked the appreciation of stakeholders in aquifers in drought management policies as low to very low. The latter finding suggests that specialized agencies could enhance the linkages between aquifer management and environmental sustainability by better involvement of stakeholders.

14. GEF IA's could even more explicitly recognize that due to financial and human resource constraints the SIDS in general have very limited capacity both in terms of technical expertise as well as central governance, as noted by over 57% of the practitioners. In the design of GEF projects significantly more support to address community based self-regulation, public education and awareness raising, would clearly be needed from IA's than has been envisaged in the past. 77% of the practitioners noted that 'successful approaches in aquifer management in SIDS' are not well known and sporadically utilized.
15. The diversity of the SIDS is well recognized, and this reflected in their wide geographical distribution. However such a classification though relevant for geo-political considerations, disguises the socio-ecological needs of many individual SIDS. A new classification, one that takes account of the socio-ecology plus the environmental footprint would enable a better focus to be made on similar islands even though they might be located in separate geographical regions.
16. Given the diversity of the SIDS, there is a menu of management options that apply to aquifers in SIDS. Several of them were discussed in the presentations of the participants. Some of these could be adopted by the GEF for implementation under GEF IV, under a new partnership arrangement.
17. A GEF SIDS initiative, with support from the IW LEARN Project, should be developed to enhance and share the knowledge and experience being gained in current and proposed projects – the initiative should also involve GEF projects that are being conducted in other focal areas than IW, especially sustainable land use.

Synopsis of Workshop Presentations & Discussions

18. The workshop was organized in plenaries interspersed with breakout sessions. The first plenary session was devoted to the Background Paper by Shammy Puri, to groundwater in SIDS, followed by presentations on GEF and non GEF experiences. Vincent Sweeney (CEHI) discussed the IWCAM GEF project, identifying the approach taken and focusing on the selection of the 'hot spots' where aquifer related issues will be covered in the projects. This was followed by Leonie Crennan who described a study concerning sanitation and population growth impact on the quality of aquifers of Tonga, and the need to engage with the cultural and traditional values of the population that relies on the resource. Then Lucila Candela discussed the experience from the Canary & Balearic Islands, stressing the innovations that have been adopted in the face of rising exploitation of the aquifers.
19. The first breakout group addressed the current status, needs, and obstacles viewed from a regional perspective. The groups were divided according to the geographic locations of SIDS

– that is, the Caribbean SIDS, the Pacific & Indian Ocean SIDS and the Mediterranean and Atlantic Ocean SIDS

20. The subsequent plenary session addressed the socio-economic and the legal concerns, as well as the GEF approach to SIDS. Roger Mark De Souza presented a detailed analysis of population dynamics in relation to water management, linking this to limits to sustainability of ecosystems. The key social, institutional and legal requirements for the sustainable management of water resources were discussed by Stefano Burchi, who noted that in most SIDS aquifer resources are considered to be private property, and concluded that there remains a need to build capacity of users to better respond to government regulations.
21. A series of on-going GEF supported projects and activities were presented, forming the basis for the next breakout. The GEF project on the transboundary aquifers of the Artibonito and Massacre areas shared by Haiti & Dominican Republic was presented by Shammy Puri, highlighting the project approach on linking ecosystems to underlying aquifers. This was followed by Marc Overmars, who described the SOPAC project on implementing sustainable IWRM in the Pacific Island Countries, and outlined many of the misconceptions as they relate to island water resources management, describing ‘IWRM-island style’, which links the limited terrestrial extent of islands with the need for national focus. Kenrick Leslie described the GEF supported Caribbean Planning for Adaptation to Climate Change - explaining that the strategic planning stage aims to implement specific pilot adaptation measures addressing the impacts of climate change on biodiversity and land degradation in three of the Caribbean participating countries. The final presentation, by Kaiarake Taburuea, on the Kiribati Adaptation Programme, identified the limited financial and human resources as a constraint in IWRM, which have been addressed through closer involvement of all the main stakeholders, building on the experience of other Island States.
22. The second breakout conducted a diagnosis of how the GEF could address integrated approach to aquifer management in SIDS. The Workshop also included a full day field trip – this provided the participants with a very useful framework to take one representative sample of the real conditions under which the urbanized areas in SIDS are currently operating. Examples observed in the field trip included well field sites likely to be subject to saline intrusion, potential recharge sites, production wells sited on fractured aquifers that have locally been termed ‘megawatershed’. The final plenary session included a review of the workshop findings with considerable interactive discussion on the guidance on the next steps for the STAP’s advice to GEF.
23. Generally, the presentations highlighted the similarities and the contrasting conditions that are found in the SIDS. In the calcareous low lying islands, Kiribati & Tuvalu, the small aquifer resources and the high population pressures may have brought the sustainability of the systems close to their ‘tipping point’. In contrast, the larger volcanic islands, Balearic and Canary Islands, have a larger water resource base - although it is often found in fractured formations. The conventional wisdom has been to discard the water resources in these generally low permeability aquifers, but the case histories from the Balearic and the Canary Islands suggest otherwise.

24. The presentations also raised good examples of hydrogeological innovations. For example, Utam Maharaj discussed how aquifers may form a ‘megawatershed’ – that is, how the watershed that contributes to the aquifer could be from across the surface water divides. Utam Maharaj also discussed a public – private partnership for aquifer development in Trinidad & Tobago. The partnership was considered unusual for aquifer development because of the high investment risks to public funds. In this case, the project financing entity, BoT, undertook the risks in the exploration phase, and guaranteed the resource ownership would be transferred back to the water utility entity.

Current Situation in SIDS

25. In examining what is being undertaken in groundwater management in the geographically classified regions, the workshop members discussed and noted their findings for the Caribbean SIDS, the Pacific & Indian Ocean SIDS and the Mediterranean SIDS. The participants also referred to the interlinkages that were discussed in the Background Paper.

Caribbean SIDS

26. In this geographical region the science of the aquifer systems is generally well advanced, as evidenced by responses from the practitioners from this region. Projects such as the IWCAM are expected to provide a significant support in the region, though the role of aquifers in ecosystems and sustainable land use needs to be better understood and disseminated. The pilot projects that are planned should be better integrated into the aquifer system concept, rather than as stand alone ‘hot spots’. A series of relevant studies are being conducted using non-GEF resources and they involve most of the countries. Mathematical model studies have been developed, though there is the concern that field data is not available to match to the model needs, thus reducing the effectiveness of the studies. Participants commented on the use of policies on aquifer management, noting that there were many; the need for an apex water management agency was noted especially in connection with water scarcity and availability factors.

27. With regard to the additional or different approaches that could be mobilized, the participants stressed the need for capacity building, through education leading to higher degrees that the educational institutions provide within the region. Participants also noted the need to create better linkages with other operational networks with relevance to the aquifers, such as the climate change centre CCCCC, as well as the opportunity to look at opportunities for regional approaches now made possible by the advent of the CARICOM Single Market and Economy.

Table 1 – Summary of Caribbean SIDS Group Discussion

Current activities being undertaken in groundwater management in the region, in the context of the interlinkages discussed in the Background Paper	<ul style="list-style-type: none"> • Agencies and projects: IWCAM; Graeme Hall Nature Sanctuary; The Caroni. All have relationship to groundwater; conducting more studies – e.g. who pays for water; Landfill sites impacts; SLM Projects • All Caribbean countries are involved in projects; Pilot Studies Antigua, Jamaica, Barbados – e.g. salt water intrusion; aquifer management • There are already a multitude of Policies in place
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	<ul style="list-style-type: none"> • Aquifer distribution mapping & resource inventory • Institutional setting & capacity building
<p>Identify what additional or different things need to be done within countries and regions given those interlinkages.</p>	<p>More capacity building:</p> <ul style="list-style-type: none"> • Use the Water Institute in Trinidad & Tobago • Associate degree and BSc. and higher degrees • GEF to fund participation from SIDS <p>Create better linkages:</p> <ul style="list-style-type: none"> • Explore CSME framework • Climate Change CCCCC <p>Improve data availability:</p> <ul style="list-style-type: none"> • Decentralize data collection and data base for info sharing; improve monitoring systems; use simple models.

Pacific and Indian Ocean SIDS

28. The diversity of this region was clear from the discussions, as it spans much of the eastern hemisphere. Nevertheless in the region efforts are underway with the support from SOPAC and other agencies. With this support strategic directions have been developed, as presented at the 3rd World Water Forum and later in a Joint Caribbean and Pacific Programme for Action. Efforts have also been devoted to consultations in a wide ranging manner, through support from the GEF as well as the EU. This has led to raised public awareness of the issues that affect the SIDS. The raised awareness has produced key elements in the water strategies that should incorporate the culture and ethics dimension into the use and delivery of freshwater. There appears to be an evolving consensus of opinion to seek decentralized solutions, since those that arise from centralized functions will not apply too well in the local context.
29. The participants identified a series of issues that should be additional and different from the current actions. These stressed the need for integration across focal areas and also the integrated water resource management approach. The lack of knowledge on the linkage of aquifers to ecology-ecosystems was stressed. For example regarding ground water recharge and an Indian example, there are often very weak measures against surface water contamination due to agricultural practices and other diffused sources. There is a clear need for public education – though this education would have to be made relevant. Concern was also expressed on the declining data collections and the lack of good monitoring data.
30. Additionally, the participants discussed the impacts of sanitation and population growth on groundwater in small low-lying coral islands. In particular, the discussants noted the various chemical and biological factors (agrochemicals, animal or human waste, others) that impacted groundwater quality in Tonga, and what responses were taken by policy-makers and user-groups (women, church, school). Response measures included waterless zero-discharge toilets, experimenting with new and improved composting techniques, and installing septic flush toilets. Despite these efforts, the predominant message that emerged from the case study and at the workshop was the need for consistent support and capacity building on waste management and sanitation at the household and government level.
31. According to a Japanese case study, sludge can be collected by a vacuum truck, and then be used for soil treatments at night. This practice, in existence for about 55 years in Japan, is an example of how non-sewer pipe sanitation can be a cost effective solution to improve quickly poor sanitation, until financially affordable sewage systems are installed.

Table 2 – Summary of Pacific & Indian Ocean SIDS Group Discussion

Examine what is being undertaken in groundwater management in the region in the context of the interlinkages discussed in the Background Paper, and what can be supported through the GEF	What can be supported through GEF <ul style="list-style-type: none"> • Strategic directions required • Consultation processes enhanced • Public awareness raising underway • Key elements being considered • Culture vs. politics debate • Decentralized solutions being sought
Identify what additional or different things need to be done within countries and regions given those interlinkages.	<ul style="list-style-type: none"> • Integrated approach could be enhanced • Lack of knowledge ecology-Groundwater to be improved • Public education – more studies required • Several projects in countries needed • Water management to be enhanced • Nutrient trapping and sanitation must be improved to reduce risks of surface water and groundwater contamination • Depleting data collection – data integrity to be improved • More staff funding needed • Monitoring requirement, models - simplification • Policy- several policies to manage-Groundwater considered • Data sharing & information exchange to be enhanced

Mediterranean and Atlantic Ocean SIDS

32. While this region included islands not normally considered as SIDS, forming offshore parts of continental countries, they nevertheless did display many features that are relevant in terms of dissemination of experience and knowledge that has been gained. Developments on the Canary & Balearic Islands have matured in water resources management terms to the progression of devolution to committee's of water users. Such user associations have legal status in use and sharing, though apex agencies still provide central control. Other developments include the progression from traditional to non traditional water sources, such as the use of angle drilling in hard rocks, use of artificial recharge and desalination. Aquifer vulnerability mapping has been carried out and the use of economic instruments is underway to change behavior. Unlike the others SIDS of the world, the Canary Islands are in the exceptional situation of applying these instruments that arise from the application of the EU Water Framework Directive, which is legally binding to Member States and to those acceding to the Union.

33. In terms of the gaps, the operationalization of the legal instruments is still lagging behind. A similar situation applies to the implementation of the economic instruments and the full public participation. The anticipated response to climate variability has been addressed through scenario building, while the preparation to adapt to changes is still under formulation.

Table 3 – Summary of Mediterranean & Atlantic SIDS Group Discussion

Examine what is being undertaken in groundwater management in the region in the context of the interlinkages discussed in the Background Paper	<ul style="list-style-type: none"> • Devolution of responsibilities to Committees of Users, legally constituted • WR planning by Government manager • From conventional to non conventional sources- desalination, re use recharge) • Aquifer vulnerability mapping as a guide to LUP • Economic instruments • Technology of capturing flow in volcanic aquifers • EU WFD- driver of change in water policies
Identify what additional or different things need to be done within countries and regions given those interlinkages.	<ul style="list-style-type: none"> • Operationalizing legal instruments • Economic instruments • Public participation • Response to climate variability & scenario building • Preparation to adapt & respond to changes

Perceived Needs, Obstacles, Common Issues

34. The workshop participants regrouped according to the geologic, hydrologic and hydrogeologic classification of SIDS, broadly ‘volcanic islands’ and calcareous islands’ – a classification that was agreed as more appropriate for this discussion than the geographic grouping of the earlier sessions. This grouping of participants allowed similarities and differences to be better highlighted. The participants discussed the concerns under four broad perceived needs:

- a) Identify the obstacles or challenges that would need to be addressed (institutional, legal, policy, capacity, technology, etc.) in the country or region to enable more effective groundwater protection and management.
- b) Identify the common issues and solutions among the projects discussed earlier that may be applicable in other countries or regions.
- c) Consider the elements across the GEF portfolios (biodiversity, climate change, land degradation, and POPs), which can be applied to further strengthen groundwater protection and management in SIDS.
- d) Advise how the GEF and other agencies can more fully integrate strategic responses in their portfolios to address sustainability of groundwater resources in SIDS.

Table 4 - Summary of Volcanic Islands Group Discussion

	<i>Science</i>	<i>Institutions</i>	<i>Socio-cultural</i>
Obstacles	<p>Complexity of aquifer-data scarcity</p> <p>Inaccessibility of the science to decision makers & some stakeholders</p> <p>Knowledge base – dissemination</p>	<p>Capacity for supporting data assessment</p> <p>Making the science, policy relevant</p> <p>Sharing the available data-info across institutions</p> <p>Build understanding of international tools</p>	<p>Conservative / resistance to change</p> <p>Short term approach & view</p>
Common Issues	<p>Communicate groundwater science issues</p>	<p>Strengthen weak institutional awareness of importance of groundwater</p> <p>Share – between SIDS; with private sector</p> <p>Better intelligence gathering for sustainable IWRM frameworks</p>	<p>Requires local buy into groundwater actions</p>
GEF Portfolio Inter linkage	<p>Danger of pillars due to lots of ‘separate’ projects</p> <p>Scaling up</p> <p>Population dependent environmental sustainability</p>	<p>Pilot projects used to test strengthening approaches at regional level and reforms</p> <p>Regional cooperation showed potential</p> <p>Aquifer network through IW LEARN</p>	<p>?</p>
GEF SIDS Program strengthening	<p>Base line monitoring & assessment network, coupled to indicator development</p>	<p>Raise awareness of future “groundwater convention” among IA’s, EA’s etc</p> <p>Cross project learning</p> <p>Developing indicators of institutional system performance and best practice</p>	<p>?</p>

Table 5 – Summary of Calcareous Islands Group Discussion

	<i>Science</i>	<i>Institutions</i>	<i>Socio-cultural</i>
Obstacles	Lacking political will to take science to policy	Appropriate legislation, policies, incentives, sustainable financing	Application of legislation, Payment issues, especially remediation, population pressure
Common Issues	Integrated water mgmt in SIDS, not just groundwater but also global benefits, link with SLM	Good existing networks- Pacific, at the local level; extent water resource management outside utilities	Need for strong political will, factoring in the socio-economic issues, education
GEF Portfolio Inter linkage	Groundwater as an opportunity to integrate across focal area	IWCAM-network mechanism required;	Extension of the traditional SLM scope to fill the gaps
GEF SIDS Program strengthening	Link groundwater with coastal issues – e.g. impact on coral reefs	SID-wide network; include integration as innovation; establish links- groundwater & biodiversity & coastal mgmt	Marine ecosystems protection traditional fishing, to restrict land related pressure (zoning), model application-co-management

Integration of Strategies

35. The outcome of the discussions held by the two groups is summarized above in two matrices that portray the issues from the science, the institutions and the socio-cultural perspectives. While the principal findings of the two groups show some common trends (i.e. the need for capacity building and the taking of the science to policy, the political vacuum to address aquifers), there are several differences that can be highlighted.
36. The larger volcanic islands have several alternatives to assure water resources and water supplies, with some of them moving to alternative strategies such as exploration and development of fractured volcanic formations (angle drilling in Canaries and ‘megawatershed’ in Trinidad). Also, given the relative larger size and its economic base, these islands could move towards desalination at some time in the future. The CEHI experience from the Caribbean, related by Vincent Sweeney, indicated that desalination potential in the Caribbean is good, and there is a potential to adopt the public-private partnership, BoT approach.
37. On the other hand the small calcareous islands have few alternatives and restricted choices. While those that have access to financial capacity from the highly developed tourist or other industry, can import water (e.g. water barging in the Bahamas), the islands with a smaller economy can expect to have to make some very difficult choices in the face of increasing climate variability. This difficulty is further amplified under the situation when the population pressures are increasing due to the socio-cultural constraints, i.e. the ecological foot print of the islands is several times larger than the size of the island.
38. Another key issue that further requires consideration and factoring in, is the ‘*tyranny of distances*’ – many small, vulnerable calcareous islands are located at such great distances from the nearest mainland, that it can take up to several days to reach them, as related by the

Kiribati presentation. The impact of their isolation is thus amplified and magnified, investment opportunities through either foreign direct investment, or through overseas development aid, can be perceived to have lower internal rates of return – thus the potential for these islands to develop, and to make environmental investments, are more limited, as stressed by Marc Overmars in the SOPAC presentation where, in connection with ‘financing’ for IWRM full cost recovery and privatization options are ruled out. While the science of the hydrogeology here may be well understood and the institutional capacity might be enhanced, the socio-cultural drivers will override all other constraints, as noted in the discussions following the presentation of Roger-Mark DeSouza and Leonie Crennan. In many such islands, the main sources of income now are remittances from overseas or from offshore work, as mentioned by Basil Fernandez in the discussion of the presentation on ‘population dynamics (Roger Mark DeSouza). The question must be asked: how to make these means of income a sustainable and a viable option, including for improved waste water treatment facilities in SIDS.

39. The issues of legal and institutional frameworks were discussed in the context of available national legislation and within the framework of global agreements. The discussion from the participants noted that cultural biases should be incorporated into regulations, with the example provided by Basil Fernandez, which related to the granting of licenses for the abstraction of water. The question was also raised as to whether poor rating of national legislation (in the responses to the questionnaire) was a symptom of the poor performance of the laws, or the poor translation of hydrological science into legislation. In SIDS there are practically no transboundary water resources – the exception being Haiti-Dominican Republic, the issue of shared waters here was raised by Joaneson Lacour asking about the available rules. In response Stefano Burchi outlined the developments underway in cooperation with the International Law Commission on the preparation of draft Articles on transboundary aquifers.
40. The above diagnosis, in connection with aquifers in SIDS, carried out in the course of wider discussions, merits further detailed analysis. The outcome of the analysis would lead to a better focus of the financial and technical assistance that needs to be directed to SIDS in general and to the more vulnerable and fragile islands in particular.

GEF support to SIDS

41. The discussions held in the course of the workshops have indicated that the GEF support to the SIDS is valuable and is well intentioned. The constraints imposed through the focal area approach, while appropriate in continental land masses, will have limited efficiency in SIDS, given that the ecosystems operate in microcosm – this needs much greater integration in addressing at least the terrestrial and near coast based systems; the large marine ecosystems, under the jurisdiction of the SIDS could still operate under appropriate focal area support. There is thus a need to reconsider how the future support in the SIDS can be better organized.
42. While further detailed discussion of the options open to GEF with special regards to SIDS were beyond the scope of the workshop and this Report, some suggestions can be made for STAP consideration for their submission to the GEF Council: firstly, a SIDS specific

partnership may be worth exploring, secondly, a coordination mechanism that provided guidance on a new prioritization among the SIDS could be established and thirdly, the detailed recommendations of the previous two STAP aquifer relevant workshops could be reinforced. These three suggestions are briefly discussed below.

43. The idea behind a SIDS specific partnership is a reflection of the developments within GEF under its fourth replenishment, involving the adoption of RAF, as well as the accelerating impact of the various international initiatives, such as the Mauritius Strategy. Donor funds are being allocated for many of the requests arising from the Ministerial Statements made at international fora such as the World Water Forum. Many components of the joint commitments made by the SIDS countries are being funded. Nevertheless there would seem to be a missing element in coordination, whether real or perceived. In the case of GEF funding, such a lack of close coordination is more obvious due to the fact that financing is through focal areas. While it is a requirement of GEF that inter agency and inter focal area coordination is a condition of project development and implementation, in practice this has been difficult to achieve. One way to address this would be through a partnership that would address the inter focal area linkages and could also be extended to harmonization with the actions of other Donors.
44. Following on from the above, the Workshop has showed that the diversity of the SIDS is such that addressing their needs through a geographical grouping disguises some of the needs of some of the islands. A revised classification would help to better prioritize the needs. This new classification and the ensuing prioritization would take account of the underlying natural resources base – i.e. the geology, hydrogeology and the socio-ecology, expressed through the ecological footprint (Figure A). Such a revision of classification would help the GEF and Donors to take account of the factors considered important by the practitioners of water and natural resources management.
45. The previous two aquifer-relevant workshops organized by the STAP resulted in a series of detailed recommendations. Some progress has been made in the implementation of the recommendations. This can be shown through a series of GEF project ideas that have been developed, and a series of MSP's are to be implemented. However the majority of them are in one focal area, IW and a few with linkages to others such as LD. As the previous workshop reports indicate there are significant environmental gains to be had by further mainstreaming aquifers and their properties into other focal areas of GEF. A draft report, assessing the 'synergies' that can be gained by the consideration of hydrology, hydrogeology and the related eco-hydrology, has been circulated for discussion (see Background Paper for this Workshop). The IA's and EA's could be encouraged through STAP reports, to consider this in the development of their projects.

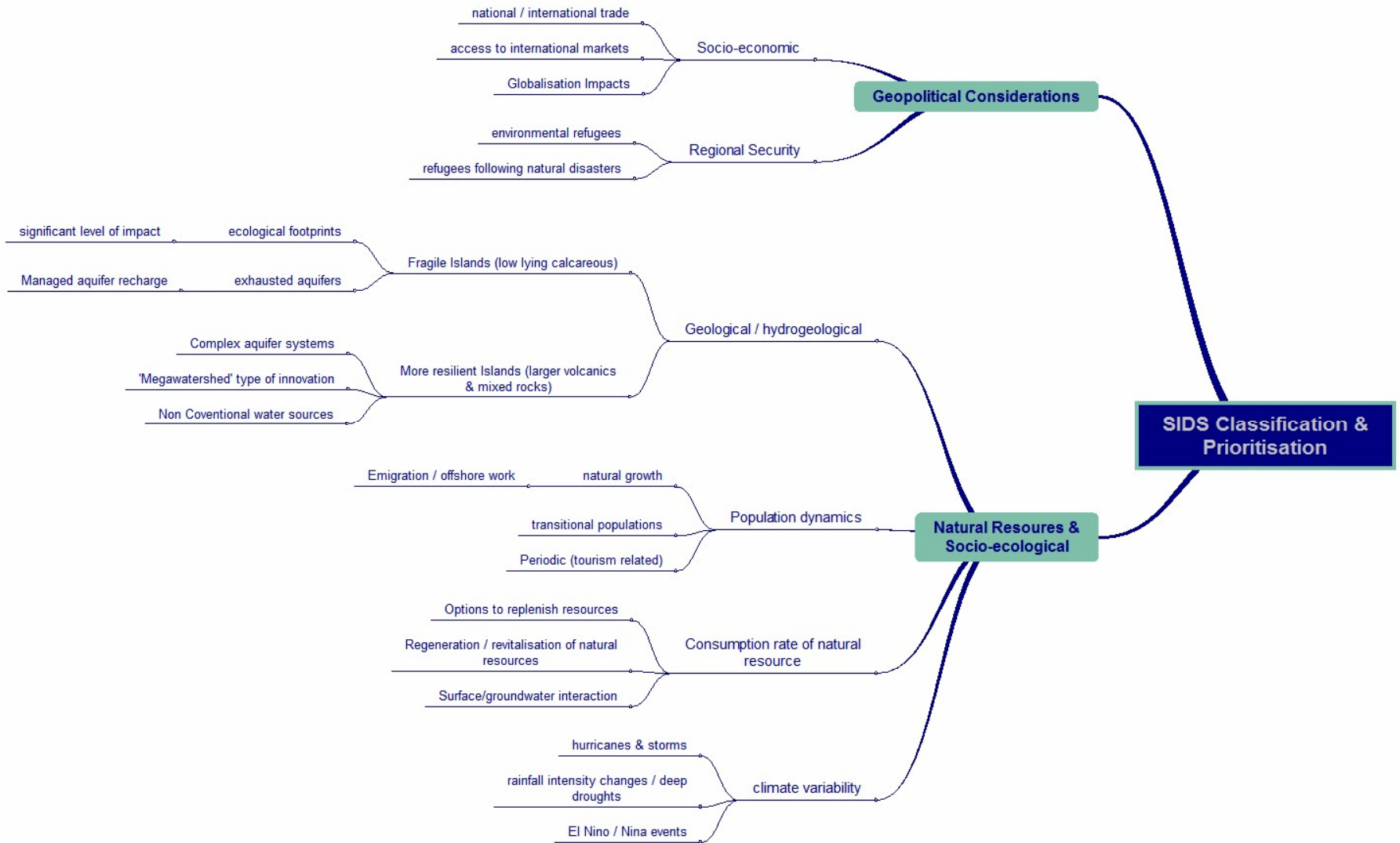


Figure A: Approaches towards classification of SIDS and prioritization as a function of environmental footprints

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