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International Waters: Learning Exchange and  
Resource Network (IW:LEARN)

## GEF IW Experience Notes Format

(Please submit to [fonongam@spc.int](mailto:fonongam@spc.int))

The GEF's *International Waters Experience Notes* help the IW community share its practical experiences to promote better resource management. **Experiences** include successful practices, approaches, strategies, lessons, methodologies, etc., that emerge in the context of your projects. Completed forms may be 3-7 pages long and serve as the basis for *Notes*.

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**1. TITLE** - *In the Experience Note title, please identify the key issue(s) addressed by the experience described in this brief.*

Application of integrated and Innovative approaches to reduce municipal waste pollution in atoll environments.

**2. PROJECT TITLE** - *What is the title of the project from which the experience is derived? (Include the project's unique Implementing Agency code and/or GEF ID, if applicable.)*

- Ridge to Reef - Testing the Integration of Water, Land, Forest & Coastal Management to Preserve Ecosystem Services, Store Carbon, Improve Climate Resilience and Sustain Livelihoods in Pacific Island Countries
- Project ID# 00092601
- Implementing Entity/Responsible Partners: SPC's Applied Geoscience and Technology Division (SOPAC)

**3. PROJECT DESCRIPTION** - *Briefly summarize the project's objectives, expected outcomes and timeframe (from Project Document or elsewhere). If experience pertains to a specific project activity, please describe that activity as well.*

"Ridge to Reef" concept was coined by the GEF Council to reflect the paradigm in Pacific Island Countries where the integrated approaches to freshwater and coastal area management emphasise the inter-connections between the natural and social systems from the mountain 'ridges' of volcanic islands, through coastal watersheds and habitats, and across coastal lagoons to the fringing 'reef' environments associated with most Pacific Island Countries. Similarly, the

integration of communities, stakeholders, and national governments through a cross-sectoral planning framework promotes the R2R principle of 'Community to Cabinet' approach.

The 5-years project is implemented by the United Nations Development Program through the Applied Geoscience and Technology Division of the Pacific Community in partnership with the 14 Pacific Island Countries namely: Cook Islands, Federated States of Micronesia, Fiji, Kiribati, Republic of Marshall Islands, Nauru, Niue, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Tuvalu, and Vanuatu. The project aims to improve the integration of water, land, forest, and coastal management required to fashion sustainable futures for island communities.

Importantly, the project will build on nascent national processes built in the previous GEF IWRM project to foster sustainability and resilience for each participating island nation through:

1. Reforms in policy, institutions, and coordination;
2. Building capacity of local institutions to integrate land, water, and coastal management;
3. Establishing evidence-based approaches to ICM planning;
4. Improved consolidation of information and data required to inform cross-sector R2R planning approaches.

It is envisaged that this project will also focus much attention on harnessing support of traditional community leadership and governance structures to improve the relevance of investment in integrated land, water, forest, and coastal management. This project will also provide coordination functions and linkages with the national GEF STAR multifocal projects and LDCF project and will facilitate dialogue and action planning through national Inter-Ministry Committees on responses to emerging issues and threats in environment and natural resource management.

The project's objective is to test the mainstreaming of 'ridge-to-reef' (R2R), climate resilient approaches to integrated land, water, forest, and coastal management in the PICs through strategic planning, capacity building and piloted local actions to sustain livelihoods and preserve ecosystem services.

The objective is a stepwise approach to catalysing transformational change for the sustainable development of Pacific Islands countries including Tuvalu with structured principles and strategic considerations which were outlined into five components.

- (i) national demonstrations to support R2R ICM/IWRM approaches for island resilience and sustainability.
- (ii) island-based investments in human capital and knowledge,
- (iii) mainstreaming of R2R ICM/IWRM approaches into national development planning.
- (iv) development of regional and national 'Ridge to Reef' indicators for reporting, monitoring, and adaptive management, and knowledge management.
- (v) overarching coordination of the ridge to reef programme at both regional and national levels.

The project at a national level has a budget of \$200,000 with the total funding for all the 14 countries composed of USD \$10,317,454. *The Projects* commenced on April 24, 2016, and expected to end on September 31, 2021.

**4. DESCRIPTION OF ISSUE(S), CHALLENGE(S), AND EXPERIENCE** - *Provide a concise description of (a) the transboundary waters management issue[s] this experience addressed and (b) how the issue(s) were addressed through specific actions by the project.*

The key environmental threats in Tuvalu are well documented, and in this project, the focus was to test innovative technology such as DLT to reduce and minimize levels of waste pollution land-based impacting on the underground aquifers, and service waters in close by coastal and marine areas. On the capital of Funafuti, access and use of underground water is no longer allowed by law because of high levels of contamination and coliforms exceeding safe threshold standards.

There are also frequent occurrences of algae bloom in coastal waters and fishing poisoning all pointing to possible pollution leakage from land-based septic and piggery waste systems. The problem is exacerbated by increasing population and rural-urban drifts, as well the impact climate change, which may lead to increasing levels of nutrient overloads and discharges into the receiving environment. Critical species and habitats exposed to several forms of land-based pollution. Nutrients derived from sewage, soil erosion and fertilizers due to changing land-use practices and urbanization (contributing to the pollution). Nutrient overloads particularly affect coral reef ecosystems, weakening the reef carbonate skeleton and smothering it;

Threat from land-based sources of pollution. These derive in particular from sewage and poor sanitation practices, sediments (soil erosion, agriculture, forestry, poor land-use practices), urban run-off, agro-chemicals, and solid waste.

The challenge to overcome by the IW Regional R2R project is to generate evidence-based results and support successful delivery of stress reduction targets thereby influencing transformational change in the local population. The project primarily demonstrated low-cost suitable technologies that could, if supported by upscaling future R2R investments, alleviate contamination of underground and surface waters, as well, the impact of pollution upon the habitats and biodiversity of atolls and islands in the country. Moreover, the experiences from this project, which include effective participation of stakeholders, and community engagement and support of relevant government agencies, provides a strong strategic platform useful for replication by others.

The GEF Pacific IWRM Project was built on achievements of previous investments via a focus on national IWRM demonstration projects aimed at providing an opportunity for participating countries to implement, and experiment with, new management models and methods. For Tuvalu the practical on-the-ground solutions to water and sanitation issues demonstrated by the previous national IWRM project acted to stimulate support at both community and national government levels for policy reform and the mainstreaming of integrated approaches as part of

national sustainable development planning. The Sustainable and Integrated Water and Sanitation Policy 2012-2021 emerged together with the introduction of compost toilets and are parts of the success stories of the previous IWRM project.

### The Dry Litter Piggery

Most small piggeries in the Pacific islands including Tuvalu are small and dependent upon the use of clean water for pen washing where polluted run-off (nutrients and pathogens) is often directly discharged into streams, mangroves, the ocean or left to flow uncontrolled and unmanaged over the landscape. The Modified Dry Litter System virtually eliminates the use of water for pen clean up resulting in water cost saving and protection of the surface, ground, and coastal water resources.

The system promotes the collection, processing, and beneficial use of the nutrients through a managed composting system. In the composting process, odors are reduced, pathogens are destroyed and carbon resources, once destined for municipal landfills, are recycled in the production of a highly valuable organic soil amendment. Success stories emerged from countries in the Pacific particularly the northern Pacific such as the Hawaii, the Marianas, the Federated States of Micronesia, and Samoa from the Southern Pacific. All of these piggeries are small holders and family-owned small businesses.

### ***Tuvalu Case study***

From the last decades, farming of pigs in Tuvalu has evolved and the evidence showed that the traditional way is still practiced on outer islands. In the capital, the improvement seen practiced by some families is the application of the biogas concept, yet the majority are using the wash down system which has a detrimental impact to the environment, causing algae blooms and 'fish kills' in coastal waters if anaerobic conditions build up and exceed threshold levels. In the introduction of the new innovative pig waste management system, the demonstration was carried out in the capital to showcase the importance and the benefits of the Dry Litter Piggery.



Insert Figures for these photos

According to the agriculture department, different types of pig farming including a dry litter system has been introduced back in the nineties hence the demonstration and the trialing was done on the agriculture station on outer islands. For the IW's R2R demonstration, the Town

Council supports the initiative with their designated area as the demonstration site. The Public Works Department comes with the pig pen design that reflects the Dry Litter system while the continuous supply of mulch comes from the Department of Waste Management to fully meet the standards of the Dry Litter Piggery.

### *The Strategy*

To fully replicate the Dry Litter Piggery by the farmers, the plan was to develop a strategic plan that will encourage fifty (50) farmers to practice the dry litter technology. In achieving the target, research was carried out selecting a sample of 200 households in the capital. This sample size served to determine what the population knows about the current wash down pig pen system as well as the needed information of their current knowledge of sustainable waste management systems. That said, it is uncertain what are the contributing factors that might hinder the introduction of the Dry Litter Piggery?

The results from the survey suggested that very little of the population understand the impacts the current wash down piggery system have on the environment. While there have been awareness programs by similar projects with pig waste such as biogas, the full participation is limited to land issues which is a critical factor considered. Apart from land, regulation relating to animal waste management is not available or is not well constructed. Moreover, the engagement with all stakeholders was a success story since information was readily available together with their support to establish a firm ground on constructing a way forward to fulfill the main goal.

These important information and facts collected were enough to plan a strategy that could restructure the setups of how people manage their livestock in the capital. Having a good partnership with the Town Council and the formulation of a new by law that would enforce the new strategy was passed by the authorities and is now ready to be implemented and enforced.

Moreover, the detrimental environmental status of the capital prompted the support from the Environment Department and all the relevant authorities paved the way forward to enable the formulation of the strategy to a proposed municipal piggery. The enabling environment with the Funafuti Island Council the project named the Saugaavaka Piggery Project with an estimated value of Australian \$6.2 million was formulated, was presented, and submitted to the government for funding and implementation.

Interestingly, through the post graduate degree course in Ridge to Reef Sustainable Development at James Cook University, the strategy for the proposed Municipal Piggery was achieved with tools cultured from the implementation of the national and local capacity for waste management built to enable best practice in coastal waters, land, and public health protection.

Moreover, targeted scientific approaches to optimize on-site waste management systems and to identify causal links between land-based contaminants and the degradation of coastal waters has been implemented. This includes the implementation of coastal monitoring and the proving of impacts from land-based activities.



Suggest replacing one photo with that of farmers building the DLT pig pen or farmers meeting etc.

## **5. RESULTS AND LEARNING FROM EXPERIENCE** - *Summarize the impacts of this experience on the issues, the project, and its partners. What was learned from this experience?*

In the discourse of this trajectory, building partnership and harnessing support of traditional community leadership and governance structures was a good experience that proved to improve the relevance of investment in integrated land, water, forest, and coastal management. The Proposed Municipal initiative has elevated the undertaking to a platform that raises the fundamental interest of the IW R2R Project at the national level in which the streamlining of the idea and the concept of the Ridge to Reef in national development. At the local context, the community institutions such as the Funafuti Town Council have profiled their Island strategic plans parallel to the national sustainable strategies.

The Funafuti Island Strategic Plan (ISP) underpins a thematic area which focuses on the infrastructure development. Behind this thematic area, is the goal that anticipates the creation of an infrastructure policy and development framework that will facilitate sustainable green urban development. While there are specific strategies which were identified and drawn to achieve the above goal such as to improve quality of ground water lens; to provide sustainable & quality services to the people of Funafuti & the public; to provide a secure and a safe environment and to protect and support the people of Funafuti including all communities living on the capital. This is where the point of entry of the IW Ridge to Reef entered to join and connect the Malefatuga III Island Strategic Plan to the National Strategy for Sustainable Development 2016 to 2020

### **Anticipated outcomes**

For the targets of the International Regional Ridge to Reef Project it has to convert 50 washdown Pig Pens to Dry Litter Pig pens with an anticipated impact on the following:

1. Municipal Waste Pollution Reduction: 919 kg/yr TN and 503 kg/yr P reduction through conversion of 50 wash-down pigpens to dry-litter systems in Tuvalu
2. Pollution Reduction to Aquifer: 7.6 kg/ha/yr TN pollution reduction to groundwater system from conversion of 50 piggeries to dry-litter system in Tuvalu

In the capital there are 560 pig pens on the island. In this event the proposed Municipal Pig Pen catering 1000 pig pens, 500 pens using Dry Litter Technology, 500 using biogas with the roof of the building having solar panels. The impact will be huge not only to the communities but also a great improvement to the physical environment. It is also envisaged that the social aspects of the community in the capital will also change not forgetting the economic factors derived from the undertaking. Therefore, the experience shares the projected benefits of the project as a success for the Tuvalu IW Ridge to Reef Project.

**6. REPLICATION** - *What implementation challenges should others expect to encounter when replicating this experience? Highlight specific conditions needed for others to replicate or benefit from this experience.*

- Identify areas under current policies and legislations that support and encourage implementation of future R2R projects
- Identify influential persons and champions in targeted communities, groups and govt to assist and facilitate stakeholder consultations etc
- Participation starts throughout the project life not just when you need help
- Technology testing must be monitored, and data collected, analysed and results presented back to stakeholders
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The setting of Pacific countries in terms of the type of governance in place and the settings of local institutions may differ compared to other countries. It is important to engage with government agencies as they are crucial to engage with when considering the proper authorities and the provisioning of advice. With the support of all the stakeholders, particularly the private sector has also the potential to establish a network that will support the project. Moreover, the solution of the approach lies in a mixture of legislative action and enforcement, and development of improved technologies to deal with solid and liquid wastes.

**7. SIGNIFICANCE** - *Why is this experience significant to GEF and to transboundary water resources management?*

The significance of this experience emphasizes the importance of initiating capital investment that not also captures coastal infrastructure within an integrated management framework but also formulates co-financed activities on water resource and wastewater management, coastal systems, and climate adaptation.

**8. REFERENCES** - *How can someone interested in using or adapting this experience get more information? Please provide relevant Web site(s), documentation and contact information.*  
Contact information

**9. KEYWORDS** - *What 2-5 keywords could be used to help others search and find this experience note?*

Dry Litter Piggery , Municipal waste water management

## Examples of IW Experiences

### Process

- Development and tracking of indicators
- Knowledge management database and IT
- Financing mechanisms
- Public/private partnerships

### Participation

- National/regional/local participation
- Leveraging of local funds (public and private)
- NGO participation
- Workshops, training, and education programs
- Public relations/communications/outreach/visibility

### Performance

- TDA/SAP approval
- NAP development and approval
- Regulatory development and enforcement
- Engineering/investment project completion
- Measurable environmental improvement
- Public private partnerships & market-based mechanisms
- Applied scientific research
- Water quality monitoring program implementation
- Species, habitat, and ecosystem protection/rehabilitation
- Sustainability issues (post-GEF investment)

### Technical

- Wetland restoration practices
- Optimization of wetlands as nutrient sinks
- Primary and secondary wastewater treatment
- Tertiary wastewater treatment
- Cleaner industrial production
- Nutrient management in Agricultural practices

### M&E Process Indicators

- Establishment of country-specific inter-ministerial committees
- Completion of a country endorsed TDA
- Documentation of stakeholder involvement in stakeholder involvement plan
- Completion of a country-endorsed SAP
- High-level political commitment to follow up joint actions
- Adoption of a science advisory panel
- Adoption of an M&E plan

### M&E Stress Reduction Indicators

- Point source pollution reduction
- Non-point source pollution programs implemented
- Coastal zone or wetlands placed into protection
- Reduced releases of pollution to groundwater recharge zones

### M&E Environmental Status Indicators

- Improved (measurable) ecological or biological indices
- Improved (measurable) chemical, physical (including flow regimes), or biological parameters
- Demonstrable reduction of persistent organic pollutants (POPs) in the food chain

### Other Areas

- Pollution and water use tariffs
- Economic instruments for water resources management (taxes, tradeable permits, etc.)
- Economic valuation of water-related environmental assets
- Sustainable fisheries management
- Structuring and operation of transboundary waters institutions