The Role Vetiver System can play in helping to Achieve PNG Vision 2050

A green Solution for Sustainable Development in Papua New Guinea

Brief Facts about Papua New Guinea

Papua New Guinea is located in the south-west region of the Pacific Basin and lies to the north of Australia. It shares a border with Indonesia, through the island of New Guinea. Papua New Guinea's total land area is 461,690 square kilometres with a mixture of tropical forests, savannah grass plains, big rivers and deltas, swamps and lagoons and numerous islands and atolls to the east and north-east of the country. Other main islands in the country are New Britain, Bougainville, New Ireland, Manus and Milne Bay islands. The country has a population of approximately 6.5 million people who speak a total of over 800 languages.

The isolation of the island of New Guinea from the Western world and its formidable terrain were obstacles to urbanisation the development of commerce, trade and industry until after the Second World War. When the country became self-governing in 1973, it was a prime example of a dual economy, with a small, industrialised sector that included enclave mining development and a dominant traditional agricultural sector.

A Brief History of Development Planning

Serious thinking about development planning in the then Territory of Papua and New Guinea first evolved from the recommendations of the Foot Mission which was sent from the United Nations in 1962. The Foot Mission bemoaned the lack of development of the indigenes and called for a development plan to be implemented sooner, rather than later. In response, the World Bank designed a five-year development plan in 1964 for implementation by the Australian colonial administration. This plan was not implemented until the latter part of the 1960s. The development strategy focused on key economic growth sectors, including plantation agriculture, forestry and livestock development. Mining at that time was negligible.

Before self-government in 1973, the Chief Minister, Michael Somare, commissioned the development of what became known as the Eight Aims. The Eight Aims were to procure the equitable distribution of benefits and power in order to allay potential political upheaval. This was based on the view that the indigenes were increasingly being marginalised in terms of political and inclusive economic participation. Economic growth was assumed, but not emphasised. The Eight Aims later became popularly known as the Eight Point Plan.

The *Eight Point Plan* was a statement of intent by the founding fathers of our nation who wanted to build a peaceful and harmonious society, as well as to prosper and empower our people. The *Eight Point Plan's* intents are timeless. They were very relevant then and remain relevant now in our endeavour to grow and advance this nation.

The overall objectives under the *Eight Point Plan* are:

- *Increased indigenous participation in the economy;*
- *Equality amongst ethnic groups, gender, and areas;*
- *Greater attention* to *rural and village development; and*
- *Self-reliance.*

Papua New Guinea Vision 2050

PNG Vision 2050 is the new country's development blueprint covering the period 2010 to 2050. It aims at making PNG a newly industrializing, "middle income country providing high quality life for all its citizens by the year 2050".The Vision has been developed through an all-inclusive stakeholder consultative process, involving Papua New Guineans from all parts of the country.

The vision 2050 is underpinned by seven Strategic Focus Areas, which are referred to as **PILLARS**:

- Human Capital Development, Gender, Youth and People Empowerment;
- Wealth Creation;
- Institutional Development and Service Delivery;
- Security and International Relations;
- Environmental Sustainability and Climate Change;
- Spiritual, Cultural and Community Development; and
- Strategic Planning, Integration and Control

Papua New Guinea has great potential through its natural resources - land, cash crops, forests and fisheries - to improve its socioeconomic development status. Equally important are other areas that can contribute to economic growth and better living standards for the people, including human capital development, an improved infrastructure networks and an efficient service delivery mechanism for public goods and services. These areas underscore the underlying theme that drives Vision 2050 and the development agenda for Papua New Guinea.

Based on the deterioration of the provision of public goods and services and lack of meaningful participation of the rural people in income-earning activities and their aspirations to do better, Vision 2050 incorporates the National Government's Strategic Directional Statements that will drive development initiatives over the next 40 years.

The Vetiver System (VS)

The Vetiver System is based on the application of Vetiver grass, *Chrysopogon zizanioides* (formerly - *Vetiveria zizanioides*) which has extraordinary and unique morphological and physiological characteristics, including a deep rooting system with a strong soil-binding capacity and stiff stems.

Vetiver grass is both economically and ecologically important and is one of the few plants that have emerged from obscurity to prominence in a very short time. Since the mid-1980s its application has been widely extended as an important plant for erosion control, land stabilization, water quality improvement, slope stabilization, pollution control, handicrafts, and other important applications associated with natural resources management and protection.

About the Vetiver System

The Vetiver System is an innovative, green technology used to solve environmental problems based on the use of inexpensive Vetiver Grass plants (Chrysopogon zizanioides). A truly incredible plant species, Vetiver is a fast growing, seedless, perennial bunch grass that is native to southern India. The roots, shoots, reproductive biology and metabolism of Vetiver Grass plants are truly remarkable. Properly applied, we can capitalize on these special botanical properties to solve erosion, pollution, and other environmental issues. If we rely on plants to provide us with food crops, clothing textiles, building

materials and medicines then why not employ them to help us with our environmental engineering needs?

Role of the Vetiver System

Vetiver System is a technology that has been tested and proven and is currently being used in several countries throughout the world.

It impacts positively on a wide range of environmental problems and will work fast in dealing with problems and sustainability issues that PNG is currently facing as it strives to achieve the vision 2050. The Vetiver Systems is appropriate for use in the sectors involved in rural and community development in PNG and it can be easily incorporated, into the PNG Vision 2050. If all the sectors use it, there is then an opportunity for vetiver grass producers, to get involved with VS as an income generating enterprise, either by producing planting material, contracting as landscapers for slope stabilization and other needs, or selling vetiver by-products such as handicrafts, mulch, thatch, forage and other material.

To help the Government of PNG achieve its Vision 2050, Eagle Vetiver Systems Limited is:

Embarking on promoting the widespread use of Vetiver Grass in the following sectors to enable the Government to achieve its Vision 2050. These projects are done in order to gorge the support of the Government to invest in Green Sustainable solutions such as the Vetiver System. To get policy makers and decision makers in the Government hierarchy is a mammoth task; therefore Eagle Vetiver Systems Ltd is embarking on demonstrating the actual applications at project sites to convince them.

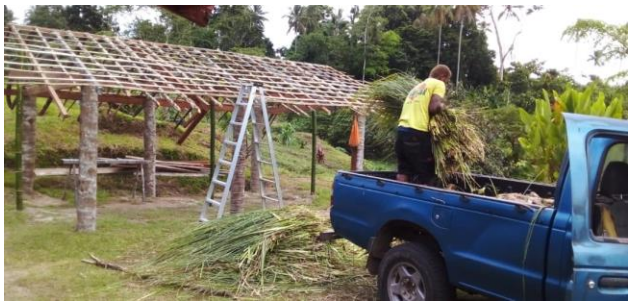
The vetiver system can play a crucial role in their implementation. The application of vetiver grass in the vision best fits in the following areas of Economic and Social pillars of the vision:

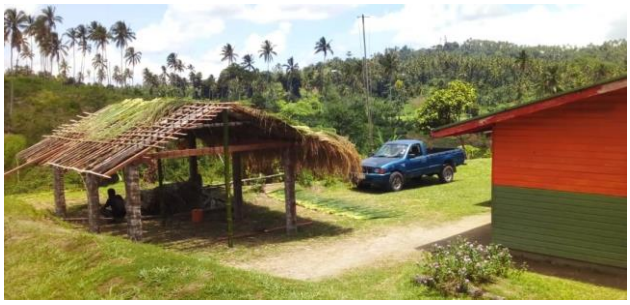
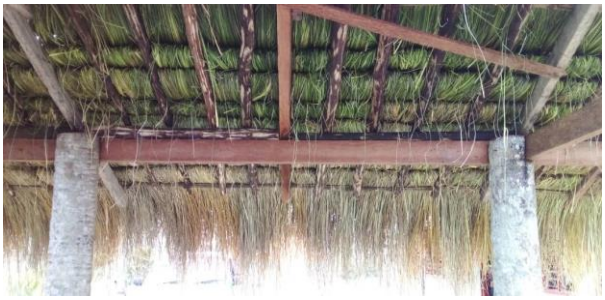
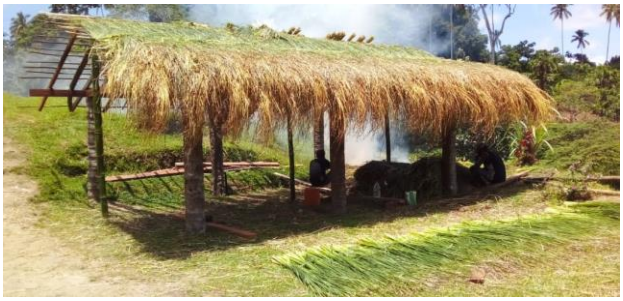
1. **Tourism**

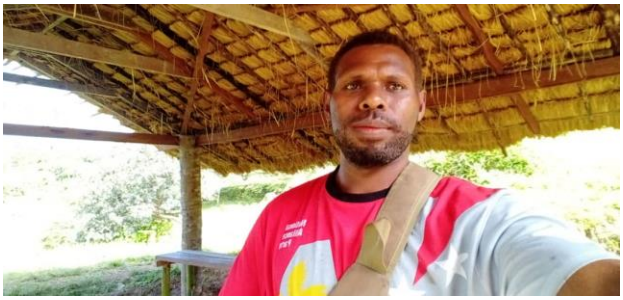
Vetiver handicraft business can be developed to produce products that would be appealing to the tourists. This would be an important means of income generation and job creation as seen in Thailand, Indonesia, Philippines, Latin America, and some countries in Africa. Developing some more resort villages and towns in PNG, vetiver grass can be used in construction of cottages in the hotels using the thatching material and vetiver bricks. Most hotels in the rural settings are faced with the problem of waste water disposal and the vetiver system would be most appropriate is solving this problem.

We have recently started using vetiver leaves in roof thatching on village huts as demonstration huts. We plan to promote its use to tourism resorts in the remote areas that have no access to modern materials. Following are some pictures of the huts with roof thatching in Lae and Rabaul.

The following pictures below are thatched building done by Mr Hubert Enman, who has been actively involved in promoting Vetiver applications in East New Britain Province. He thatched the building using freshly harvested vetiver leaves installed without the drying process. This was done to evaluate the durability of vetiver grass in roof thatching.



Roof thatching in Kokopo, East New Britain Province

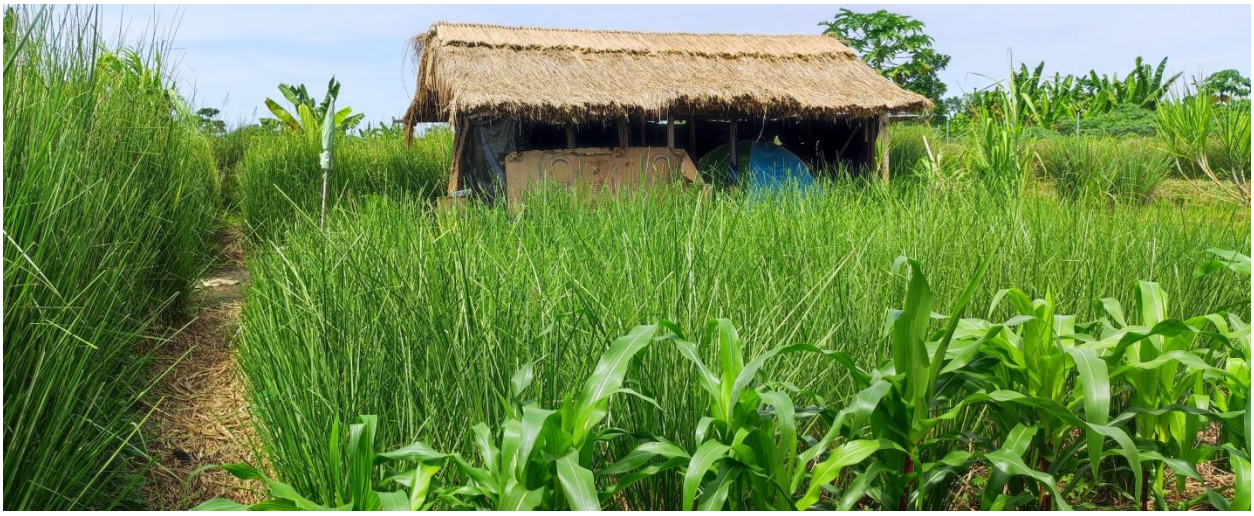
Pictures below are thatched building done by Mr Robinson Vanoh, in Lae, Morobe Province. This hut is thatched with vetiver leaves that were harvested, cured using boiling water and salt mixture. The leaves were then wind dried under shade for two days and installed. This is the similar method used by the Thais in handicraft making.











Roof thatching in Lae, Morobe Province

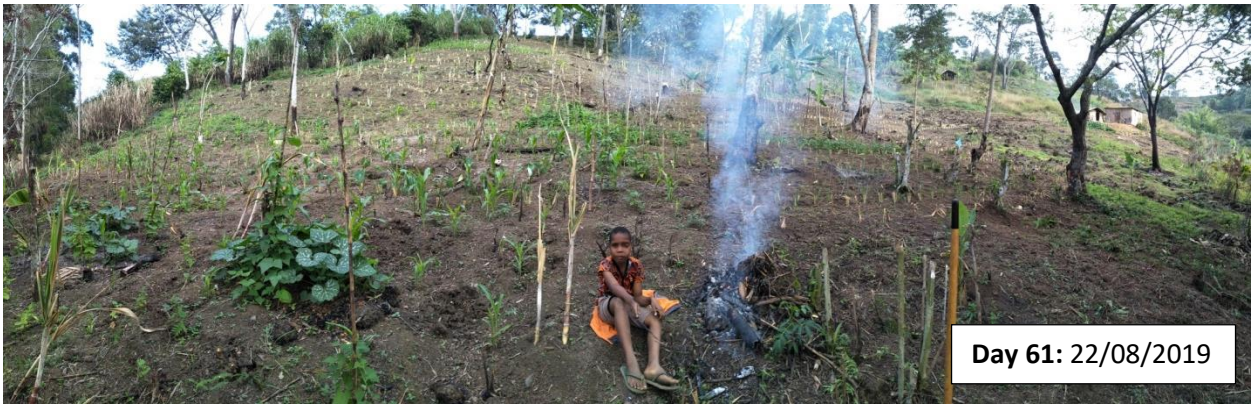
2. Agriculture, livestock and fishing

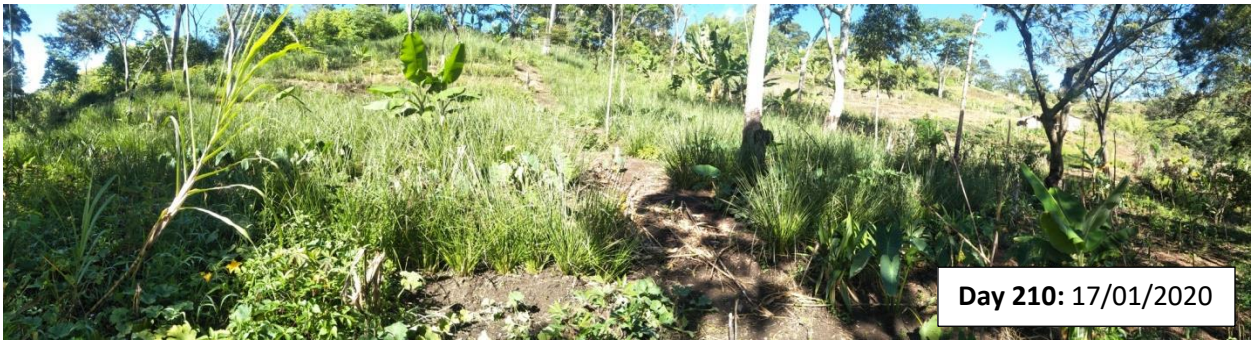
One of the major problems in Papua New Guinea and other smaller Island Nations in the South Pacific is soil erosion which is affecting agricultural productivity. In PNG, subsistence agriculture is still the largest single economic activity undertaken. It remains the backbone of the nation's economy with the involvement of over 80 percent of the population. Increasingly subsistence farmers are entering the cash economy through the sales of surplus produce, and by combining subsistence food production with cash cropping. This is achieved by using the same piece of land; however this trend is changing due to soil loss. In general, agriculture is and will continue to be the mainstay of the PNG economy but, with unsustainable agricultural land use practices; this is and will continue to severely affect food and cash crop production.

Vetiver system can help increase crop production through soil and water conservation. Vetiver hedges along the contour results in terrace formation. Vetiver mulch is very effective in moisture conservation and weed control. Vetiver grass is also quite effective in pest control e.g. stem borer in maize. Vetiver grass can be used as fodder to increase livestock production. Young vetiver grass is quite nutritious and is comparable to mature Rhodes and Kikuyu grass. It can be used to stabilize fish ponds in aquaculture systems.

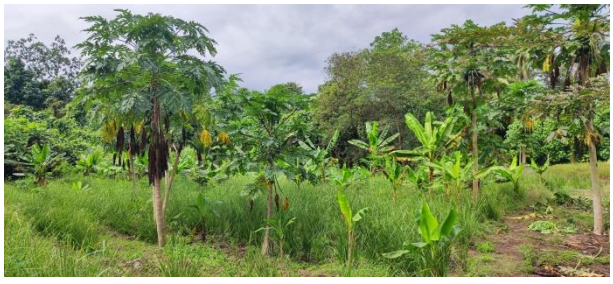
Agricultural Applications

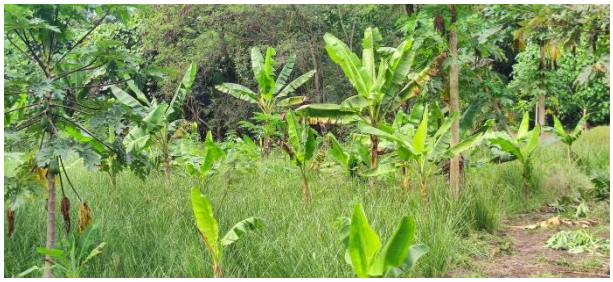
In line with the Governments vision, Eagle Vetiver Systems Limited is also promoting the use of Vetiver in Soil and Water Conservation in village agricultural farms at own cost. Some selected village farms were planted with hedgerows of vetiver grass by the farmers for visual observation to evaluate the difference. Very good results were noted with areas planted with vetiver grass. Following pictures shows a highland hillside village farm in Goroka where the land was cleared of vegetation and vetiver contour hedgerows planted across the slope. In between the vetiver rows, food crop were planted. Traditionally, the cleared land is normally planted with food crops only without conservation methods. This was proven to be a success with very good crop yield and minimal soil loss.





Vetiver applications were also done for the lowland farms in Lae, Morobe Province. This farm will be used as demonstrations farm to promote its use in the coastal lowlands. Following are some pictures of the application on the lowland farm. Despite the city going through dry season a few months back, the farm remained green all through with excellent crop growth.



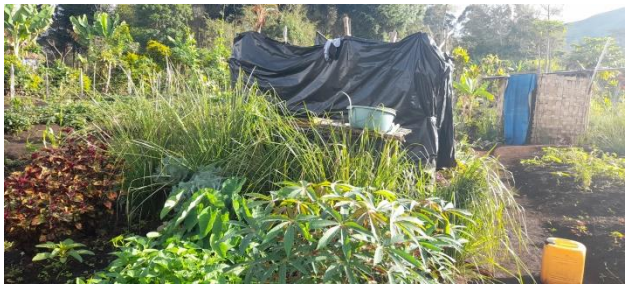
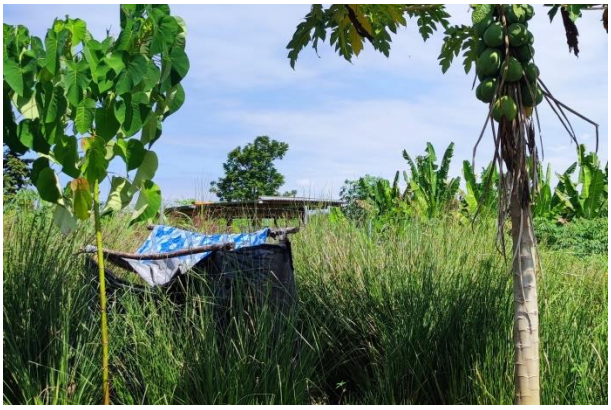
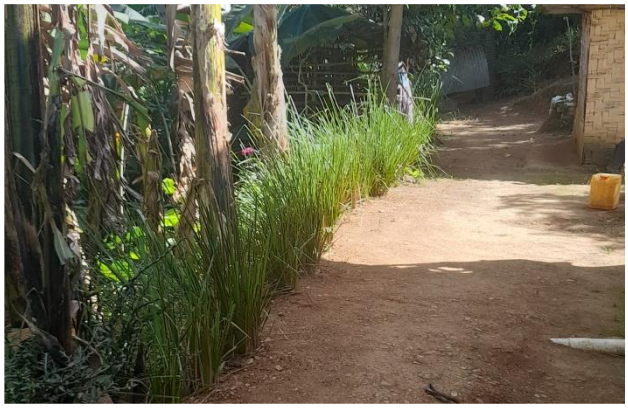
3. Education and training

Introduction of the vetiver system into the curriculum at all levels (primary, secondary and tertiary) of education in PNG will help in promoting the vetiver system. This approach was successfully used in East Bali, Indonesia where school children were able to disseminate the vetiver technology successfully.

This sector is an important sector which requires the support of the Government to enable us to introduce into educational institutions. We have done some awareness and awaiting response from the Government. We have done presentations at the PNG University of Technology and a few community colleges, however chances of introducing into the education system remains low.

4. The Health Sector

The vetiver system can be used to improve the overall livelihoods of Papua New Guineans, especially through improved water quality and application of vetiver for herbal medicinal use. Waterborne diseases are very high in urban settlements and rural villages therefore we are also introducing Vetiver latrines to help minimise these diseases. We are planting vetiver grass near and around vetiver latrines and shower blocks to uptake waste discharged from them before going into the waterways and creeks. Following pictures in Goroka and Lae shows vetiver planted near and around these facilities.

5. Environment, Water and Sanitation

The major challenges under this sector include environmental degradation; deterioration of water quality and quantity; pollution and waste management; impacts of Climate change and Global Warming; inadequate adoption of Bio-Technology. The vetiver system would be most appropriate in dealing with these challenges. Apart from its extraordinary attributes to soil and water conservation, vetiver also possesses unique physiological and morphological characteristics particularly well suited to environmental protection, particularly in the prevention and treatment of contaminated water and land. These remarkable characteristics include a high level of tolerance to elevated and even toxic levels of salinity, acidity, alkalinity, sodicity, and a whole range of heavy metals and agrochemicals, as well as exceptional ability to absorb and tolerate elevated levels of nutrients.

Infrastructure Protection Applications

One of the major environmental challenges in Road works is soil erosion. Eagle Vetiver System aims to focus exclusively on the prevention and control of soil erosion within road servitude as well as in areas adjacent to it.

As a consequence of road improvement and maintenance done by road contractors:

- The natural drainage pattern may be interfered with. For instance, opening up a culvert might lead to concentration of large quantities of water to the outlets often resulting in erosion damages on the land bordering a given road.
- A properly shaped and compacted road surface itself contributes to an increased run-off. Increases in the speed of runoff in turn will intensify the erosion of top soil and deny a chance for the water to soak into the soil.

Traditionally, engineers are mainly concerned about:

- The provision of adequate drainage structures to protect the road servitude with little/no consideration for the damages caused outside the road by erosion induced by these structures.
- It is, therefore, necessary to include soil and water conservation as a way of protecting the road itself and the area surrounding it.
- This calls for adequate provision of longitudinal and cross drainage structures on the road to reduce the concentration of water and for the construction of suitable soil and water conservation structures to protect the lower-catchment areas in the vicinity of the roads to be improved.

The current situation nationwide can be characterized as follows:

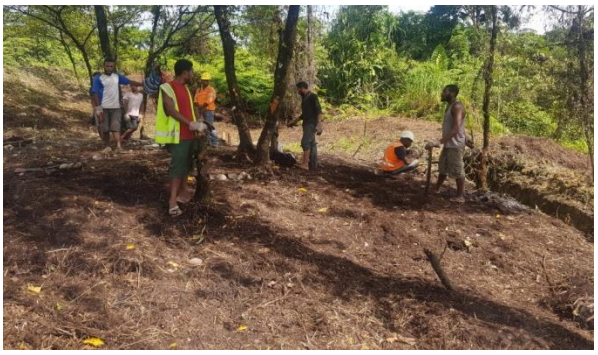
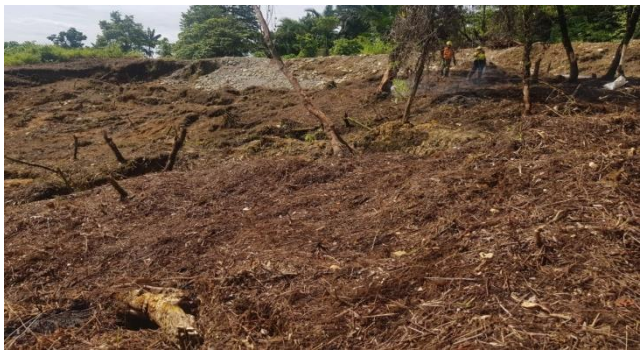
- Many large gullies are being caused by inadequate road drainage, too much water and high flow velocity over unprotected soils.
- Problems often caused by developments outside the road reserve, i.e., poor farming practices on slopes, deforestation, etc., are resulting in siltation and erosion damages to roads and land downstream (lower catchment).
- Frequent conflicts with the land owners who are refusing to allow drainage of water over their land

- In the context of soil and water conservation activities along roads, the roles and responsibilities of stakeholders such as the Road Authorities, Ministry of Agriculture, land owners and the community are not clearly defined and known to all.

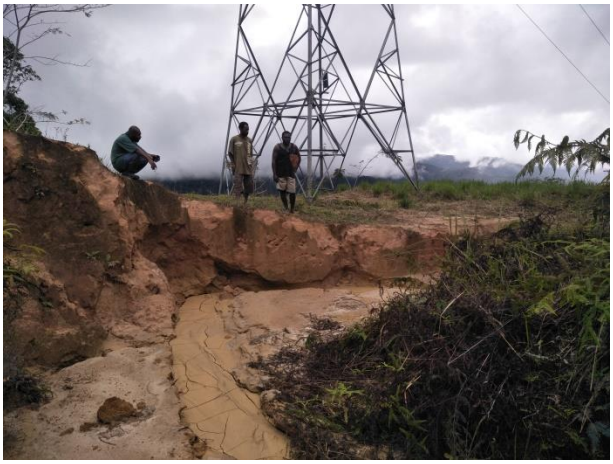
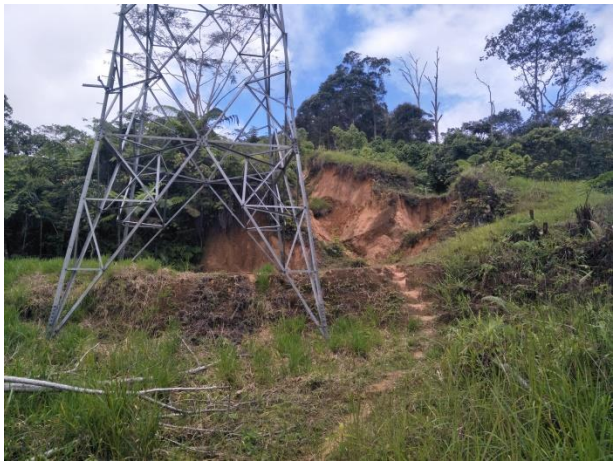
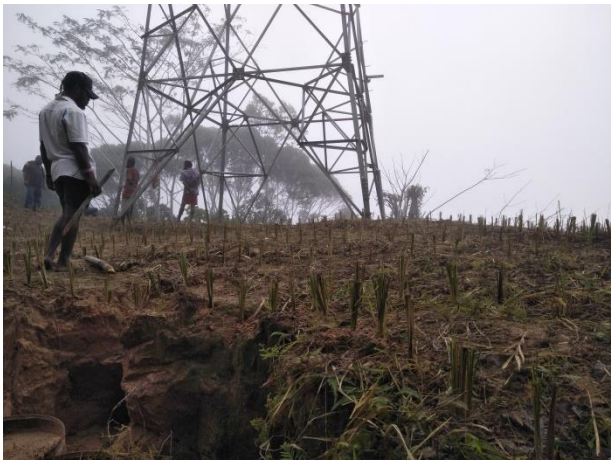
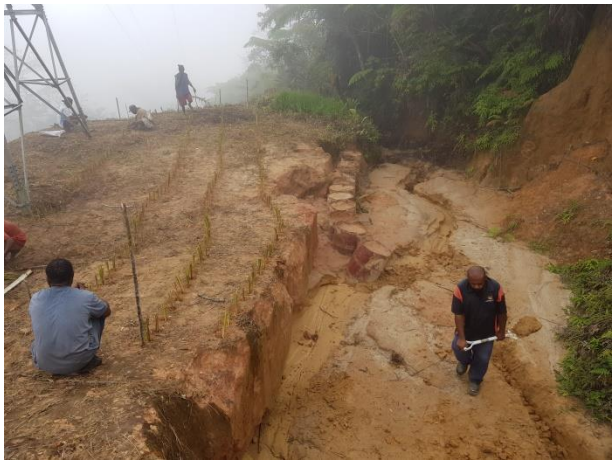
Eagle Vetiver Systems Ltd is embarking on and promoting, including carrying out awareness on the use of vetiver grass in environmental protection services such as infrastructure protection and slope stabilization. We have and are undertaking major projects with major resources players like PNG LNG project, Ok Tedi Mining and the main supplier of power in PNG, the PNG Power Ltd. We have been overtime trying to get the support of the Ministry of Works and Highways to accept the VST and use it on the National Roads Nationwide in the Connect PNG program to link up all the provinces by building new roads.

Few of the major projects successfully undertaken by Eagle Vetiver Systems Limited include:

- Failed slope remediation and stabilisation works with the OK Tedi Mine. Following are some pictures of the successful projects.


- High tension power pylon protection for PNG Power Ltd

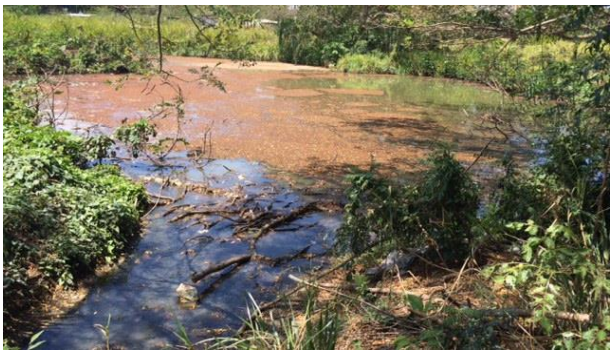
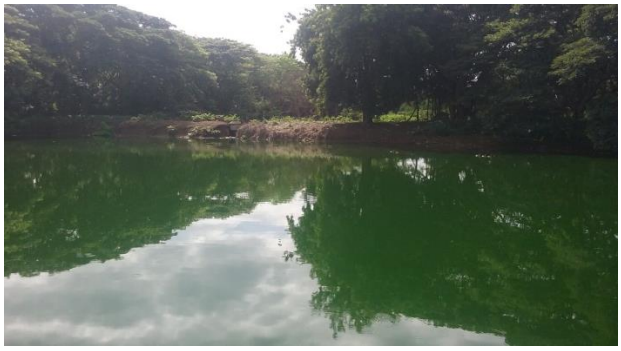
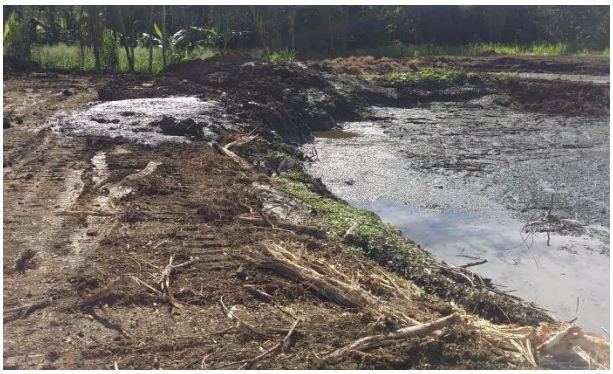
Wastewater Treatment Applications

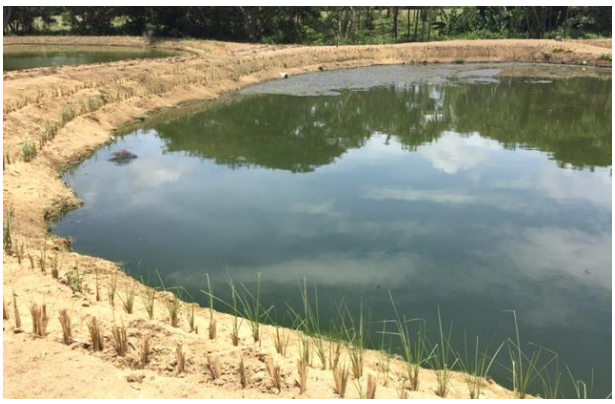
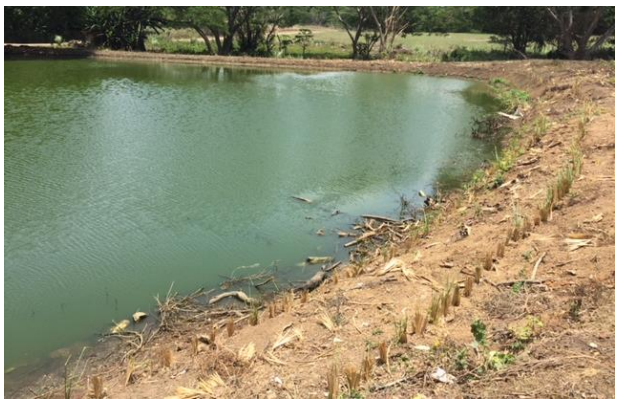
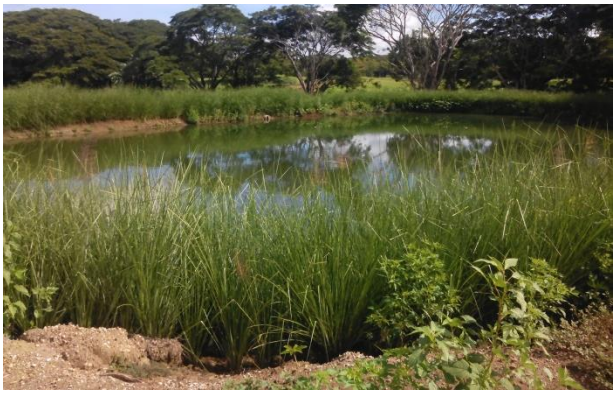
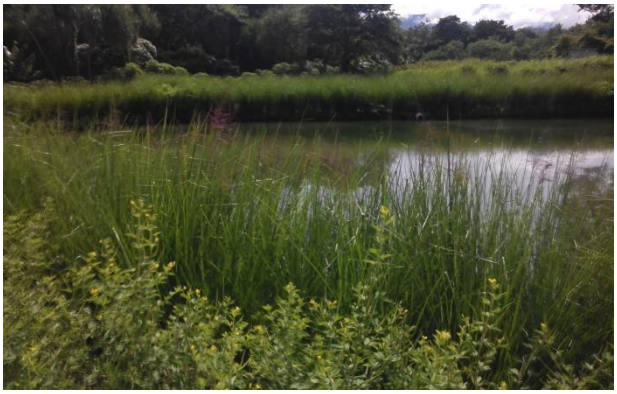
Two major wastewater (sewer) treatment projects (1) Pacific Adventist University (PAU), 2016 (Port Moresby) and (2) Goroka Town Urban Sewerage Ponds, 2018 (Goroka) were undertaken by Eagle Vetiver Systems Limited here in Papua New Guinea. These projects were basically defunct sewerage ponds remediated and planted with vetiver grass around the pond edges for primary treatment. Due to lack of funding by both institutions, secondary treatment applications in the pond on floating Vetiver Islands and wetland were dot done, which also includes water sampling. These samplings would have shown the effectiveness of vetiver in treating waste.

PAU has a water-based wastewater system with water from the flush toilets, water-based urinals, and grey water (shower, sink and laundry water) all entering the sewer system. The sewer system conveys sewage from campus buildings, including dormitories, and staff and student houses to the first of the three effluent treatment ponds (Pond 1) located roughly in the center of the PAU campus, and lower than any of the buildings. It is anticipated with expected growth of the campus, population is also expected to increase by the year 2024.

Surface flow of effluent flows consecutively through each of the three ponds, and discharges from the final pond (Pond 3) into the adjacent tributary. There is currently a channel approximately 1.5m wide between Pond 1 & Pond 2, which is thought to have been widened at some stage to improve flow

between the two ponds. The water level in Ponds 1 & 2 is the same. There is a pipe between Pond 2 and Pond 3, which has broken, however effluent continues to flow from Pond 2 to Pond 3. There is a drop of approximately 1m from Pond 2 to Pond 3.

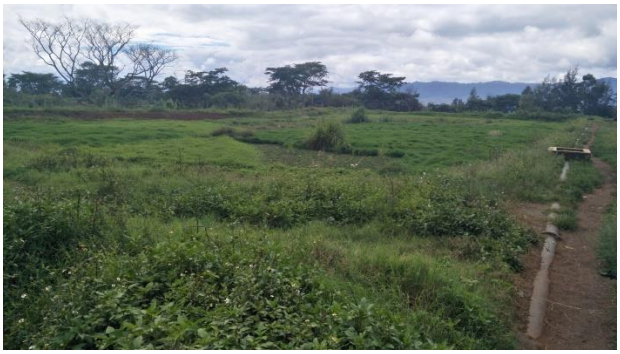




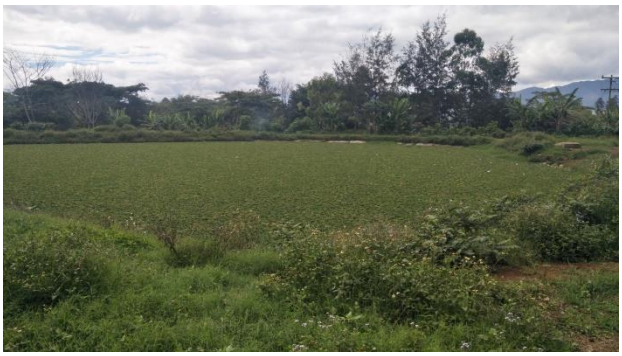





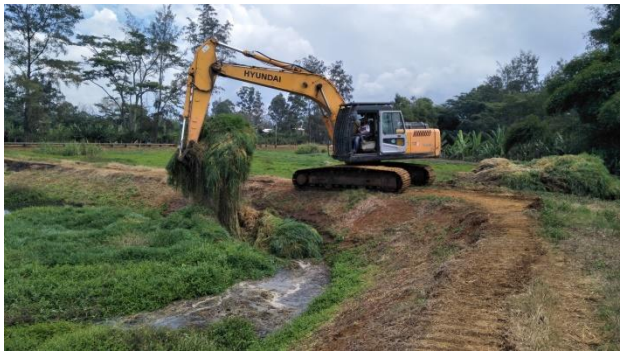
The Goroka municipality's current sewerage system was designed for a population of 8,000 people in the 1960's. With recent population growth, it was identified to be posing hazard to people and the environment both within and downstream from the sewerage pond. The municipality has a water-based wastewater system with water from the flush toilets, water-based urinals, and grey water (shower, sink and laundry water) all entering the sewer system. The sewer system conveys sewage from town buildings, including residential houses, institutions and commercial houses to the four effluent treatment ponds located on the sketches (Western end) of the town. It is anticipated with expected growth of the town, population is also expected to increase by the year 2024, and hence the ability of the ponds to hold the waste will be insufficient.

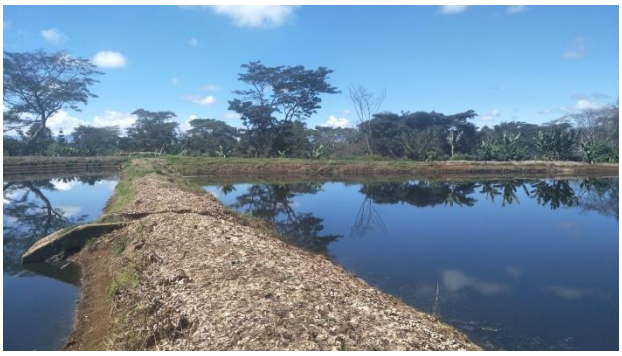
Surface flow of effluent flows consecutively through each of the three ponds, and discharges from pond 4 into the treatment chamber and into the adjacent tributary. Currently sewer flows through the four ponds through PVC pipes laid underground. Pond 1 & Pond 2, sits on an elevation of about 2 meters from pond 3 and 4.

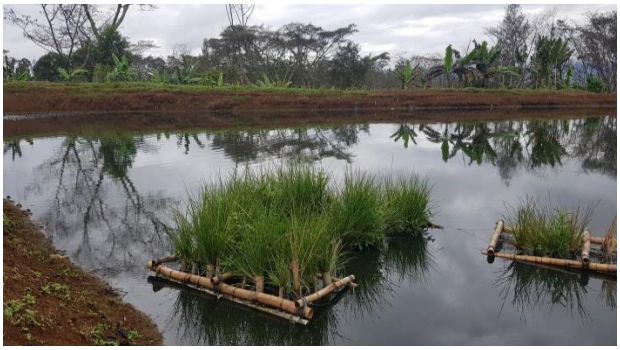
Goroka Urban LLG and Eagle Vetiver Systems Limited entered into a contractual agreement to carry out upgrade and rehabilitation works on the current defunct Apoga sewerage ponds. Following works were carried out, Site clearing, ground preparation, Vetiver grass planting around the ponds and construct and launching of pontoons in the discharge pond. Following pictures shows the scope of works done to the final results.

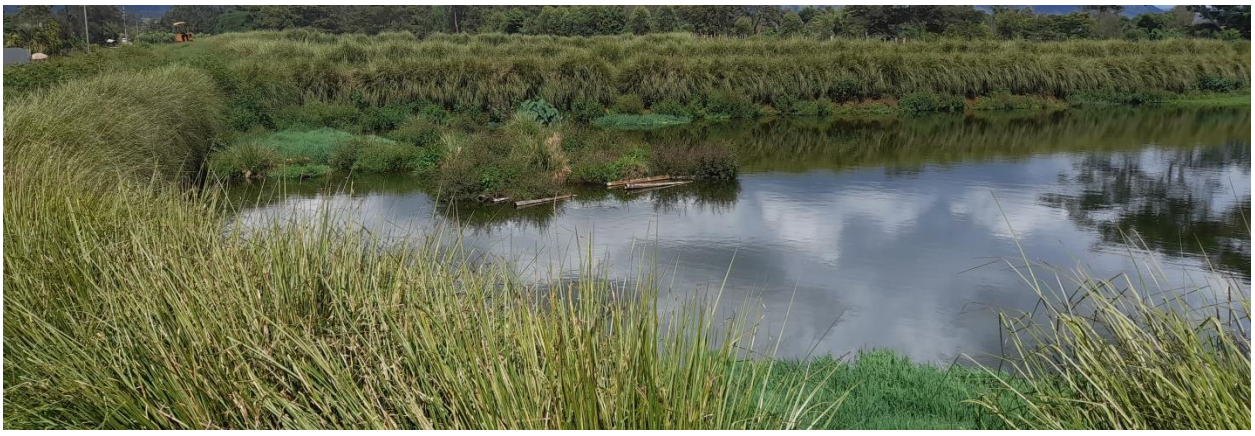


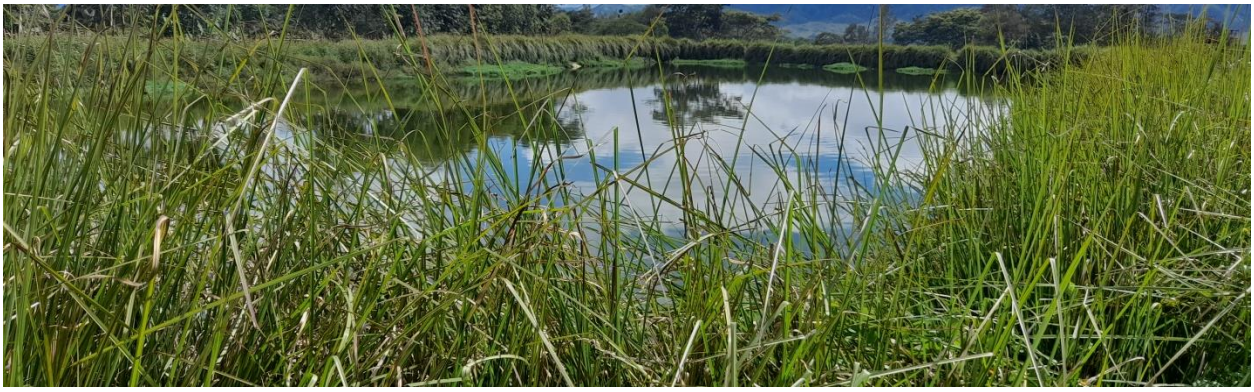






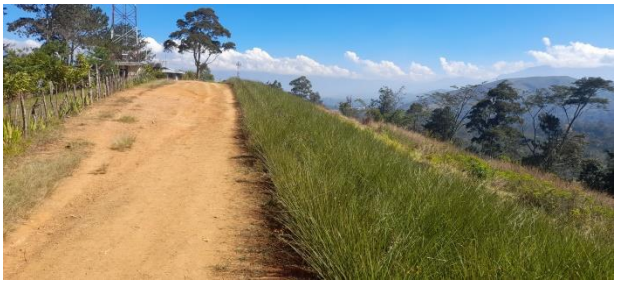






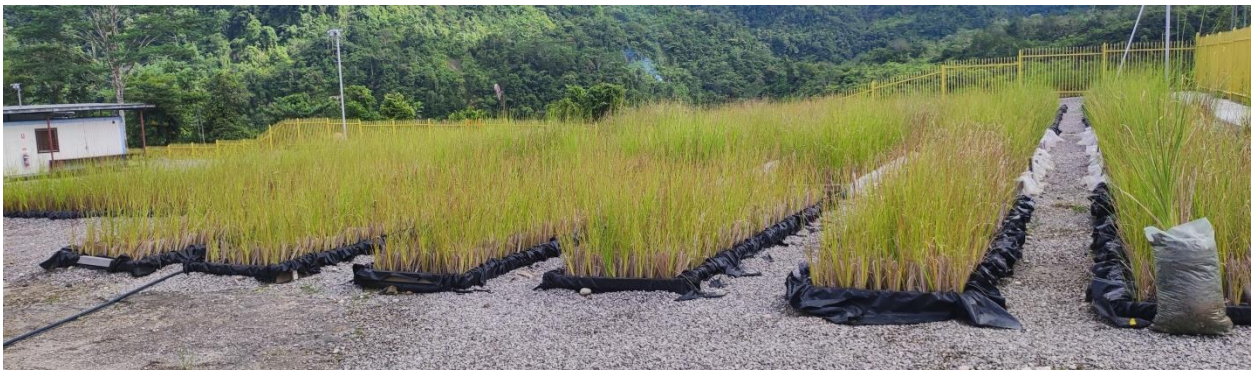
Agroforestry Applications

Eagle Vetiver Systems Ltd is also helping to revegetate barren land that has lost all its trees through over harvesting due to demand for fuel. Villagers have over harvested their trees without replanting trees to replace the ones harvested. Vetiver hedgerows were planted across the contour and in between the rows, trees were planted as the following pictures show. We target to get these over logged areas to be planted up with trees in between hedges to vetiver.



Vetiver Nursery Propagation

Quality planting material is essential for the success of these projects. Therefore, Eagle Vetiver Systems Limited has established nurseries where it holds its supplies for commercial use to support its activities. Most or nearly all our community based activities are self-funded from the funds we make through our consultancy services and sell of planting materials to interested companies and organizations from our nurseries. Following are pictures of our nurseries where we supply to interested users.



Current Needs for expansion

Papua New Guinea, including Small Island Developing Nations in the South Pacific needs a solution that is cost effective, self-sustainable and easy to use technology, that is in near or most of its environmental degradation problems currently being faced. One such technology is the use of Vetiver grass which is a proven technology and readily available in most Island Nations that needs expansion. Conventional methods are too costly for the Island communities to get and use, hence the problems are accelerating at an alarming rate. The use of nature-based solutions such as the Vetiver System is a need in mitigating these myriad of problems.

The need to accelerate the application of Vetiver System.

Farmers are relating well and accepting the use of Vetiver System despite the technology being new in PNG. Vetiver grass was however introduced into the country back in the late 1980's. In line with the current need, the need to accelerate the application of Vetiver System and other nature-based solutions

is a necessity. These impact projects need a driver, that is funding, to upscale and accelerate its use across the region. With poor policy and decision making by policy makers and the Government's inability to fund such important projects, it is and has certainly been a setback.

Currently most of our activities in the application of Vetiver System here in PNG are self-funded from funds raised from the commercial activities of Eagle Vetiver Systems Limited which is the only legally registered company here in Papua New Guinea which promotes the use of Vetiver Grass.

Farmers Perceptions

Accelerated soil erosion problems, wastewater problems and generally the environmental degradation problems are primarily caused by farmers land use practices and human activities. Likewise, the success of any soil and water conservation intervention depends on the extent to which the introduced conservation measures and mitigating practices are accepted and adopted by the farming community and the users.

The economic impacts of soil erosion and as well as soil conservation measures are important discussions that are discussed during implementation. Farmers and users have generally developed experience about the effects of erosion and have understanding of these problems, however needs ongoing awareness and training to further equip them.

The farmers have a good perception on the problem of soil erosion and other related problems but not sufficient for the farmers to adopt modern conservation measures. The farmers and users perception on the use of Vetiver grass was very encouraging. Farmers are encouraged to establish small household nurseries where Eagle Vetiver Systems Limited purchases Vetiver slips from them to use in some its project sites. This then is motivating them to cultivate more, not only in nurseries, but on their farms for soil and water conservation as well.

Conclusion

The accelerated use of the Vetiver system in the above sectors can be a medium to long-term solution in enabling the Government to achieve its vision 2050 going forward. If the Government can integrate Vetiver system in the various farming systems, rural road protection works, wastewater treatment systems and many other uses, it will surely help to achieve its vision.

The Vetiver grass is an environmental defender which should be considered as a first choice technology in mitigating all its environmental degradation problems currently faced in Papua New Guinea, and even across all Small Island Developing Nations in the South Pacific. Wide spread adaptation program throughout Papua New Guinea will be practically ideal going forward.

A TVNI initiative for Fiji and the Solomon Islands which started in 2018 and being funded by the Amberstone Trust fund in enabling a Visiting Agent (Robinson Vanoh) from PNG has proven a success, therefore continuity of such initiative across the Islands Nations will accelerate the knowledge base for the Vetiver System and its applications.