

VETIVERIM

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Editorial

Unique Property of Vetiver: Fire Tolerance

This is the second part of a series of the Editorial on the unique property of vetiver. Although there is no such thing as “fire tolerance”, if the word is interpreted literally, as everything burns down by fire. However, the word ‘fire tolerance’ can be used in case of the unique property of the vetiver plant, as it refuses to die after being burnt down by fire.

It is more obvious when vetiver is planted for soil and water conservation. It is almost impossible to destroy a mature vetiver plant by fire due to the following properties:

❖ **Stay green in the summer:** If it is not too severe and lengthy, vetiver remains wet and green throughout the summer.

❖ **The growing points are underground:** Well protected by the thick crown, vetiver's tightly-packed growing points are not affected by above-ground fire.

❖ **Sprouting new flush soon after fire:** Vetiver is the only plant that sprouts its new flush of leaves after fire, as in the African savannah or in agricultural area subjected to controlled fire - an effective approach to rejuvenate vetiver plant.

❖ **The shoots are relatively high in silica content:** The present of silica in the shoot makes it difficult to be burnt.

In practice, there are three approaches to make use of vetiver's fire tolerant property:

➤ **Fire prevention:** With its deep root system, vetiver plant continues to grow with lush green flush throughout the dry period, thus would not catch fire easily. Moreover, its thick clumps contain larger stems than other grasses, like cogon grass, thus difficult to burn. Growing a vetiver strip as a firebreak in the forest would stop approaching forest fire.

➤ **As a means to induce new growth of vetiver hedgerow:** New sprout of vetiver are induced to grow after mature plants are burned down.

➤ **As a management tool:** Fire could be used as a tool for enhancing the vigor of older vetiver plants and to remove old and dead material. If a fire is set to the old vetiver clumps just prior to rain and new growth, a much invigorated and healthy looking vetiver plants would be obtained while old dead stems removed to allow room for regeneration of new tillers of vetiver from the center of the clump.

Vetiver System Application in the USA and Mexico*

Phytoremediation in the USA

Although vetiver grass was introduced to the USA more than 150 years ago for essential oil production and more recently for erosion control in California and the states bordering the Gulf of Mexico (from Texas to Florida), its application has been limited to small scale projects.

Leggette, Brashears & Graham Inc. (LBG), is the oldest groundwater consulting firm in the US and is a consistent leader in innovation as shown by a rich history of not only developing industry- changing ideas, but applying them with success in the field to solve real problems for clients. One of LBG specialties is phytoremediation to treat/dispose landfill leachate. LBG has successfully used hybrid poplar trees in several projects for US waste disposal industry. Hybrid poplar is suitable for cold climate of the northern states of the US.

In search for an equally environmentally friendly and cost effective plant for phytoremediation in the warmer southern states around the Gulf of Mexico, LBG identified vetiver as a potentially suitable plant for this application. In cooperation with Paul Truong, (TVNI Technical Director), Brad Granley, (Senior Associate of LBG) developed a phytoremediation approach to treat leachate from an old landfill near Biloxi, Mississippi operated by Republics Services.

The Biloxi project, which was started early in 2011, was highly successful and the American Academy of Environmental Engineers subsequently awarded LBG the **2012 National Grand Prize for Excellence in Environmental Engineering - Small Projects Category**.

The followings are some excerpts from the Academy's citation for the Award:

"Leggette, Brashears & Graham, Inc. has successfully implemented a first-of-its kind project in the western hemisphere that is likely to change sustainability practices in the \$50 billion US solid waste industry. Through the innovative application of sustainable phytoremediation technology, landfill leachate can actually be utilized on-site as a resource in lieu of disposal as a waste. The approach provides an excellent option to address one of the most persistent and expensive long-term problems associated with landfills. LBG was retained by Republic Services. (the second largest solid waste company in the US) to implement this cutting-edge technology at one of their Gulf Coast Area landfills (GCAL), located near Biloxi, Mississippi. The role of LBG in this innovative environmental project was to develop and implement the entire phytoremediation concept from start to finish.

LBG evaluated numerous traditional and non-traditional options and recommended that phytoremediation should be implemented as a 'new way' to handle leachate. This cost-cutting approach allows leachate to be handled on site. By definition, phytoremediation is a plant-based system used to remove pollutants from groundwater, surface water, soil, or air. Specifically, LBG recommended phytoremediation using a unique grass called vetiver. Vetiver has been in the US for decades, but has never been used to address leachate problems, making the project a first-of-its kind for the US solid waste industry. Vetiver is ideally suited for leachate utilization due to its tremendous water and nutrient demand, fast growth, and extraordinary tolerance to extreme environmental conditions (contaminants, pH, soil, moisture, insects, and disease). Vetiver is also a USDA non-invasive plant. Coincidentally, leachate's main components are water and contaminants (micro- and macro-nutrients to the plants), exactly what vetiver needs."

The use of phytoremediation at landfills represents an integrated approach having a profound environmental impact.

- **Groundwater** is protected through minimization of surface water infiltration and better

* By Paul Truong, TVNI Coordinator Asia and Oceania; and Brad Granley, Senior Associate Leggette, Brashears & Graham Inc. See photographs in the central pages

control of leachate within the landfill, which can otherwise result in contamination of aquifers,

especially at old facilities like GCAL, which has no bottom liner.

- **Surface water**, vetiver reduces infiltration which helps prevent leachate seeps (leachate that flows out the side of a landfill and to surface water), and can dry up existing seeps. Vetiver also removes sediment and nutrients from surface water runoff.
- **Subsurface “biological treatment reactor”** develops in the rhizosphere (root zone) which effectively breaks down and mineralizes a wide range of compounds.
- **Great reduction of adverse impacts to air quality.** Using phytoremediation at GCAL instead of hauling 3.5 million gallons of leachate per year to a distant, out of state disposal facility, results in the following:
 - 1 year: 232,000 miles not driven; 38,000 gallons of diesel not burned (6 mpg); 380,000 kg CO₂ emissions (10 kgCO₂/gal diesel burned)
 - 30 years: 7 million miles not driven; 1.14 million gallons diesel not burned; 11,400,000 kg CO₂ (25 million pounds CO₂)
- **Carbon sequestration.** Fast growing vetiver will sequester 113,000 kg CO₂/year through carbon fixation.

Achievement

The Biloxi project has exceeded Republic’s expectations. The system has performed as designed and 100% of leachate generated has been utilized on site, well ahead of anticipated results. Republic is also thrilled with the cost savings.

- Phytoremediation system low-cost O&M has cut annual costs by 60%, saving millions over a standard 30-year post-closure care period. Per Republic, “the approach is a game changer for leachate management.”
- The work has also attracted the serious interest of other multi- billion dollar US solid waste companies.
- Internationally, the first three vetiver system installations in Latin America are underway forPASA, the largest solid waste company in Mexico.

Original and Innovative

- The GCAL phytoremediation effort represents the first-ever use of vetiver for landfill leachate utilization in North America. The standard for leachate disposal (load, haul and dump) was essentially an accepted, ‘necessary evil’ and the concept of utilizing leachate as a resource is changing the industry.
- The use of an amazing plant like vetiver has greatly expanded the scope of phytoremediation. Further, by incorporating a specialized, sub-surface drip-irrigation system to distribute leachate year-round, the process is further advanced.

Complexity

- After overcoming justifiable scepticism by regulatory authorities, the success at Biloxi still required overcoming technical limitations, logistical obstacles, budget restraints, and difficult site conditions all within a compressed timeline.
- From a technical standpoint, the approach blended numerous disciplines including engineering, hydrology, microbiology, plant physiology/morphology, soil science, agronomy, chemistry, hydrology, and computer science (PLC programming and evapotranspiration modelling).
- Further, the actual phytoremediation approach includes a number of sub-processes: phytostabilization, rhizofiltration, rhizodegradation, phytodegradation, phytovolatilization, and biodegradation.
- In addition, the coordination of 15 subcontractors and specialty suppliers from nine states was completed seamlessly. The end result was a highly innovative, successful project

completed on time and under budget.

Contribution to Social or Economic Advancement

The new, vetiver-based phytoremediation approach offers numerous direct and ancillary benefits to the end-user and community at large:

- Leachate treatment costs reduced > 60%, millions of dollars saved
- Initial capital investment offset in only two years
- Direct reduction in GHG emissions, additional carbon fixation.
- Millions fewer miles driven.
- Carbon footprint reductions (diesel emissions eliminated, and carbon fixation).
- Habitat for wildlife.
- New technology for landfill owners and engineers to consider.
- Advancement of regulatory acceptance.
- Protection of groundwater, surface water and air.
- Reduced loading to WWTPs.
- Sustainable, green approach.

Waste Expo – Las Vegas, NV, May 2012

At the Waste Expo Conference in Las Vegas (largest solid waste trade show in the US), Brad Granley provided a platform presentation entitled, “Phytoremediation Applications For the Solid Waste Industry Using Hybrid Poplar and Vetiver Grass – Slope Stabilization and Erosion / Sediment Control, Leachate Seep Control, and On-Site Leachate Utilization”. The presentation was given during a technical educational portion of the conference and attended by landfill owners and regulators.

Global Waste Management Symposium – Phoenix, Arizona, October 2012

At the Global Waste Management Symposium in Phoenix, Paul Truong and Brad Granley presented a paper entitled: “A Changing Industry: On-site Phytoremediation of Landfill Leachate Using Trees and Grasses – Case Studies”, in which the details of the Biloxi and Mexican projects were outlined. In addition, a poster entitled, “Leachate Treatment with Phytoremediation: Case Studies”, provided case study information for landfill leachate treatment projects in Australia, China, Mexico, Singapore and USA.

Future Projects

As a result of the successful Biloxi project, the Academy of Environmental Engineering Award and the presentations at the national conferences, LBG has since begun planning and working on additional vetiver phytoremediation projects in Mississippi, Alabama and Texas for other multiple waste management companies.

Phytoremediation in Mexico

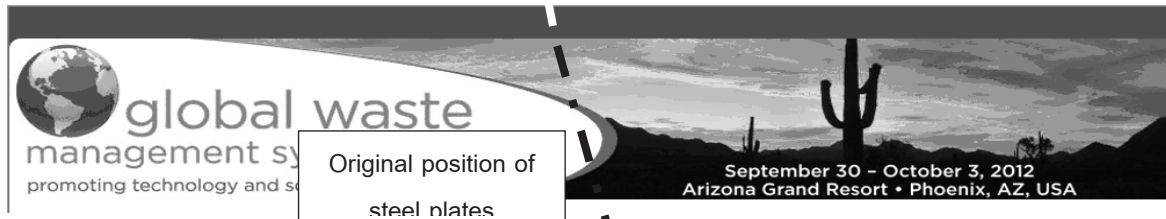
Concurrent to the Biloxi project, LBG was commissioned by PASA, the biggest solid waste company in Mexico, to implement vetiver phytoremediation projects in Leon, Poza Rica and Villahermosa. Three additional projects are expected to be completed in 2013.

Land Slip Control in the USA

While travelling in the Mississippi Delta, Paul Truong came across an extraordinary sight at Daphne, a small coastal town in Alabama, where vetiver out performed interlocking steel plates in preventing landslip.

This restaurant is perched on the edge of a salt water wetland. Due to erosion, a cliff of at least 10m high was formed between the edge of the restaurant and the wetland. To stop further erosion and possible landslide, the owner installed a wall of solid interlocking steel plates about 12m high.

As an extra measure, two thick rows of vetiver were planted right next the restaurant veranda. Surprisingly, after about two years, the section of the steel wall in front of the restaurant that is protected by vetiver rows remained upright. However, the section of the wall on the car park which was not protected by the vetiver rows slid down 2-3m, bending the steel plates at least 10°. Instead of planting a few rows of vetiver on the affected area, the owner installed anchors to hold up the steel wall to preserve the scenic ocean view. Similarly, on the other side of the restaurant, instead of planting a few rows of vetiver on the affected area, the owner installed anchors to hold up the steel wall to preserve the scenic ocean view.



Tweeds Shire Landfill, Australia



Guangzhou Landfill, China



Poza Rica Landfill, Mexico



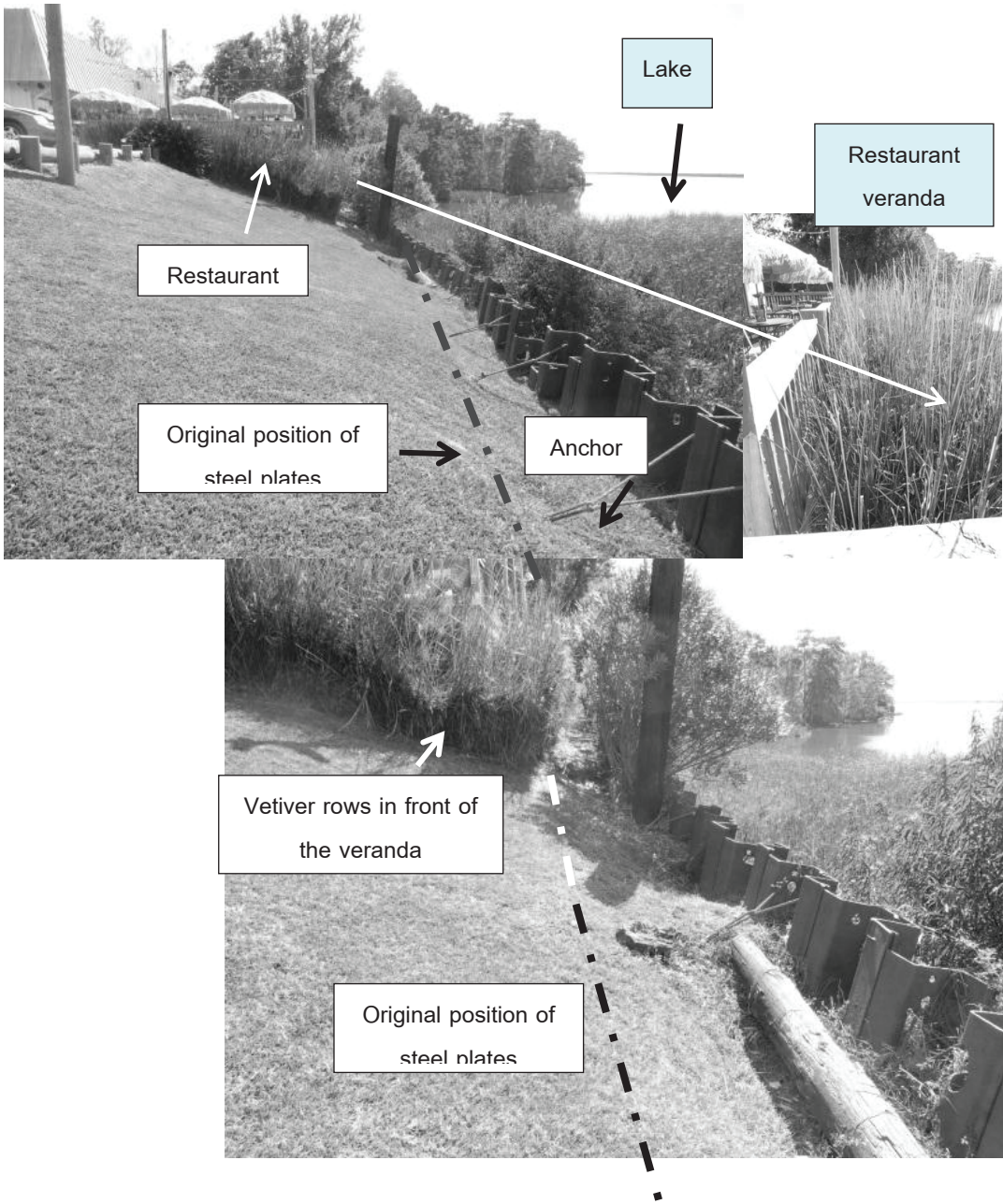
Lorong Halus Constructed Wetlands, Singapore



Biloxi Landfill, Mississippi, USA

Two months after planting

One year after planting





First Announcement: The Sixth International Conference on Vetiver (ICV-6)

The International Conference on Vetiver (ICV) is a scientific event focusing on various applications of the Vetiver System. Such an event was first held in 1996 in Thailand and extended to other countries under the supervision of The Vetiver Network International (TVNI) and the Chaipattana Foundation. In 2015, Vietnam will be the host for ICV-6 with the theme, “Vetiver System: Empowering Sustainable Development”, to be held in Danang, central Vietnam in May 2015.

The Fifth International Conference on Vetiver (ICV-5) in India in 2011 was a great success. It attracted nearly 250 registrants, representing 20 countries from around the world, and provided significant opportunities for networking, professional growth and education, as well as business opportunities. Following the success of ICV-5, ICV-6 is expected to have equal or even more participants, as “sustainable development” based on the Vetiver System is seriously considered than ever before in many countries. This conference will be attended by decision makers, researchers and specialists representing the government and private organizations undertaking the global task of “sustainable development”.

The main goal of ICV-6 is to provide an opportunity for academicians and professionals from various disciplines to come together and learn from each other. Supporting organizations include TVNI, the Chaipattana Foundation, Vietnam Vetiver Network, Da Nang People’s Committee, Da Nang University and many others from the private sectors and NGOs.

The program of ICV-6 reflect those of the past ICVs, which consist of the Keynote Address, Presentation of Invited Speakers and Contributed Paper, Poster Papers, and the Study Tour. Social activities such as Welcoming Toast, Reception Party and Farewell Dinner will be organized. In addition, it is hope that the Organizer will organize an international training course on “Vetiver Handicraft Making” for those who want to have “hands-on” practicum on vetiver handicraft making” from the most experienced guru from Thailand. We would also hope to have the awards be given to the outstanding papers and posters, as had been done in the previous ICVs. Further information about ICV-6 will be updated in the Second Announcement, to be published in October 2013.

**The Meeting of the Executive Committee on
the Development and Promotion of the Utilization of the Vetiver Grass Project According to
the Royal Initiatives in Thailand on 10 June 2013**



**The Progress of “We Love Vetiver Network” of the Lower Part of the Northern Region
in Phitsanulok Province, Thailand on 21 June 2013**



**The “1st Thailand’s We Love Vetiver Network Festival 2013”
At Naresuan University, Phitsanulok Province, Thailand, between 22 – 24 June 2013**



Privy Counselor Visits “We Love Vetiver Network” in Phitsanulok, Thailand

On 21 June 2013, H.E. Mr. Ampol Senanarong, Privy Counselor, as the chairman of the Committee on the Development and Promotion of the Utilization of the Vetiver Grass According to the Royal Initiative, together with Mrs. Suwanna Pasiri, Deputy Secretary-General of the Office of the Royal Development Projects Board, members of the said Committee, the executives of the PTT Co.Ltd. and officials from concerned agencies, visited Mr. Chalao Badirath, who is a member of “We Love Vetiver Network” at his house in Bang Rakam District, Phitsanulok Province.

On this occasion, the group was welcomed by Mr. Preecha Ruengcham, Governor of Phitsanulok Province, and the members of “We Love Vetiver Network” of the lower part of the Northern Region. Then, the group observed activities on vetiver in Mr. Chalao’s plots such as growing of vetiver with perennial trees and vegetables, growing of vetiver for soil and water conservation and using of organic fertilizer in agriculture.

The First Thailand’s We Love Vetiver Network Festival 2013

PTT Co.Ltd., in cooperation with the Chaipattana Foundation, the Office of the Royal Development Projects Board (ORDPB) and the Land Development Department, organized the First Thailand’s We Love Vetiver Network Festival 2013 between 22-24 June 2013 at the Building Commemorating Her Majesty the Queen 72nd Birthday Anniversary, Naresuan University, Phitsanulok Province. The activities included the panel discussion on “Vetiver, the Miracle Grass Under the Royal Aegis” workshops, knowledge market on “Vetiver: Holding Water, Embracing Soil” by the members of the “We Love Vetiver Networks” in all the six regions, and the exhibitions of the concerned agencies. The ORDPB organized an exhibition on “His Majesty the King and Vetiver Grass” which was visited by a number of students and the general public.

Pollution of Planet Earth’s Food Supply Source*

Did you see the recent article in The Washington Post, “Chinese official: Soil pollution hurts farming”, claiming that at least 8 million acres of Chinese farmland will be closed to production due to contamination by heavy metals and other contaminants, including the over use of agricultural chemicals? This problem is not just confined to China. In India ground water is not only being depleted at an alarming rate, but it is also being polluted by overuse of agricultural chemicals and by toxic effluent from industry. “A recent Punjab state water department survey found that 1,166 of its nearly 7,000 projects were contaminated with heavy metals, including arsenic, uranium and arsenic beyond permissible limits”. Additionally the overuse of nitrogenous fertilizer has in places seriously contaminated groundwater – the consequence - contaminated food and drinking water, and an increased incidences of cancer and other ailments. This problem also occurs in the USA. The Salinas Valley in California has serious nitrate contaminated groundwater due to years of fertilizer use for intensive agricultural cropping.

These are just a few examples of water pollution, there are many more, at various scale on all continents. There is an awful lot of discussion and planning in an attempt to mitigate the problems; and in a few specific cases, normally associated with industrial wastewater, there are positive actions with good results. However little is done on a wide scale because of lack of political will, cost, lack of suitable technology, and the inability of communities, landowners and businesses to address the problems collectively.

The Vetiver System can provide the technology to address some of the

problems. Vetiver Phytoremediation Technology (VPT) has the distinct advantage of relative low cost, low design complexity, and application over a wide range of conditions. VPT can be used for cleaning up and stabilizing mine dumps and landfills, and treating the leachate from such sites. It can be used to remove agricultural chemicals from the runoff from farmland and, preventing these chemicals from entering groundwater and surface water drains and streams. One major strength of VPT is that not only has it been proven extremely efficient in doing its job, but unlike most phytoremedial systems that are based on constructed wetlands, VPT works effectively under non wetland conditions thus allowing much wider application. VPT takes up, at high levels of concentration, most heavy metals, nitrates and phosphates and agricultural chemicals including atrazine and endosulphan.

The Vetiver System has also been proven as a technology that is liked by and is understandable to poorer communities. Thus we have examples of community use for erosion control (in many countries including Indonesia), urban ravine rehabilitation (Congo DR), wetland rehabilitation (Ethiopia), coffee coop wastewater treatment (Ethiopia), slope stabilization (Madagascar), and coastal infrastructure protection (Vietnam). Wherever used, the applications have positive bi-products that include: carbon sequestering, biofuels, mulch, and materials for handicrafts and industry - real opportunity for a WIN WIN remedial program.

The contamination of soil and water can only get worse as population increases and the demands on our land and water resources increase. It needs action by civil society as a whole and especially by communities associated with the most contaminated areas to act. There are many actions needed involving many agencies, and that action is needed now. Vetiver Phytoremediation Technology is one such technology that could be quite easily introduced on a wide scale, at minimum cost, to mitigate some of these problems.

*Richard Grimshaw
TVNI Founder and Director*

Latin America International Conference on Vetiver System

Venue: Medellin, Colombia, October 2013

Vetiver System: Green Consciousness for Sustainable Development

“Vetiver is a plant to develop a sustainable future”. Meet “Culture Vetiver”, the latest research and development in the use and application of Vetiver Systems and its environment, economic and social benefits, which have been recognized worldwide for sustainable development.

The use and importance of these systems is rapidly increasing during the significant development of Latin America, either as a bioengineering tool for erosion control and environmental protection or as a phytoremediation techniques. These systems provide a viable, simple and low cost solution to promote true sustainable development in areas as diverse as agriculture, mining, construction and landscaping, tourism and handicrafts.

Theme: Vetiver System for Sustainable Development

Erosion and Sediment Control: Bio-engineering / Research

Environment Management (Phytoremediation / Nursery management

Socio-economic and Alternative Uses / Emerging Applications

Registration

Registration opens until September 1, 2013.

Organizing Institution

J. Daniel Longono G. Meceta Sas
Colombia Vetiver Network

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The Participants

With the participation of VS leaders representing Australia, USA, Africa, and Latin America, these lectures on these systems have emerged as an important forum for politicians, academics, business and communities leaders to gather and exchange ideas and experiences and their Environmental, Economic and Social benefits worldwide.

Aim:

The conference aim to provide current trends and the latest studies and research, primarily in Latin America. Entitled "Green Awareness for Sustainable Development", the conference intends to focus on sustainable resource and Environmental uses and practices.

We sincerely hope to grace us with his presence, accepting our invitation to join us in October in the city of Medellin, Colombia.

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To

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