Vetiver - An Amazing Plant for the Green City

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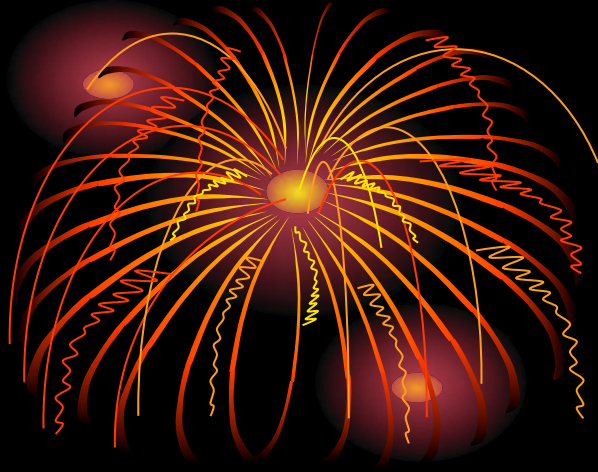
Outline



1. Introduction.
2. Vetiver: An Amazing Plant.
3. Vetiver Makes a City Greener.
4. Vetiver Makes a City Cleaner.
5. Vetiver Makes a City Cooler.
6. Vetiver Makes a City Safer.
7. Vetiver Makes a City More Beautiful.
8. Discussion.

1. Introduction

1.1 Theme of ICV-5: Vetiver and Climate Change.

1.2 The City - the Cause of Global Warming.

1.3 The Green City Philosophy.

1.4 The New Concept of A Green City.

1.5 Not Only Trees Can Make a City Green.

1.1 Theme of ICV-5: Vetiver and Climate Change

The vetiver system promises a natural solution to mitigate the effects of climate change

1.2 The City:
The Cause of Global Warming

- The city is a major contributor of the greenhouse gases.
- Automobiles, factories, people, garbage, concrete, air conditioners, etc. add greenhouse gases.

1.3 The Green City Philosophy

- Plants can bring social, economic and environmental benefits.
- Plants are keys to our sense of well being, our sense of belonging to a place, and to being at home.
- They are an antidote to our increasingly disjointed and rootless lives.

1.4 The New Concept of The Green City

- The function of the Green City is to improve liveability of urban surrounding and benefit the well being of citizen living there.
- An ideal green city is more than just being green; it has to be clean, cool, safe, and beautiful.

1.5 Not Only Trees Can Make the City Green

- Whenever an idea of Green City emerges, most people think of trees as the only group of plants that could make the city green.
- Every group of plants, through its ability to absorb CO_2 and release O_2, as well as its ability to transpire water into the air, can relief the city of the heat generated through various urban activities.
- Among the most unique plant other than trees that can make a city greener is the vetiver, a grass with exceptional properties.

2. Vetiver: An Amazing Plant

Vetiver is truly an amazing plant through its various beneficial properties, namely:

2.1 Physical Properties

2.2 Physiological Properties

2.1 Physical Properties

- Vetiver roots grow vertically to a depth of about 2-3 m, developing into a root system that is massive, can hold soil particles together, and is able to absorb ground water at such a great depth.
- It also has erect and stiff stem that resists a high velocity of runoff.

2.2 Physiological Properties

- Vetiver is tolerant to adverse edaphic conditions and a high concentration of heavy metals.
- It withstands a submerged condition as well as eutrophicated and polluted water and is able to use more water than other plants.
- It has a very high C sequestration rate

3. Vetiver Makes a City Greener

3.1 Road and Pond Boundary.

3.2 Landscaping Park and Resort.

4. Vetiver Makes a City Cleaner

4.1 Pond Embankment Filtration.

4.2 Wastewater Treatment/Purification.

4.3 Rehabilitation of Contaminated Water.

4.4 Treatment of Landfill/Garbage Dumps.

4.5 Dust Reduction.

5. Vetiver Makes a City Cooler

5.1 Carbon Sequestration Capability.

5.2 Evapo-transpiration Function.

5.3 Harvested Roots.

5.4 Harvested Leaves.

5.5 Heat Reduction.

5.1 Carbon Sequestration Capability

- Vetiver is very effective in sequestering carbon emission and encountering the effect of global warming.
- Can sequester 1 kg C annually from 1 m^2 area.
- 4 vetiver plants = 1 poplar tree in sequestration.
- 1 carbon footprint would be negated by planting 50 - 60 vetiver plants, or app. 8 m of vetiver hedgerows.

5.2 Evapo-Transpiration Function

Through its massive roots that penetrate 2-3 m deep down in the subsoil where plenty of water is available, coupled with an equally massive leaves that transpire large amount of water into the atmos-phere, vetiver is substantially contributing with its cooling effect to the environment.

5.3 Using Its Harvested Massive Roots

- The cooling property of vetiver roots could be simply judged from the observation that even birds make use of vetiver roots to prepare their nests during summer.
- Utilization of dried roots to cool the atmosphere:

  5.3.1 Making A Hut

  5.3.2 Household Usage

  5.3.3 Ventilating Panels in Electric Coolers

  5.3.4 Car Rooftops

Vetiver massive roots

Vetiver plant grown in vetiver root container

The Cooling Effects of Vetiver Roots

- In India, vetiver roots have been used since ancient times for making woven screens, mats, blinds, hand fans, etc.
- When sprinkled with water and hung at proper ventilated spaces, such materials provide cooling effect and pleasant scented air.
- They are also used on car rooftop to provide a cooling effect.

5.3.1 A Hut Made with Vetiver Roots

- In India, vetiver roots are used as a cover to prepare make-shift cabins or environmental chambers in achieving the desired cooling effect.
- Such cabins are frequently visible during summer in zoological gardens, the countryside, courtyards, parks, lawns, etc., and are used to suit specific needs and situations.
- When vetiver is sprinkled with water onto the root-screens or ‘tatti’, the air passing through it is cooler than the air outside, which may reach over 45^{o}C.
- The air also has a nice aroma of vetiver oil which is quite refreshing.

5.3.2 Household Usage

- Dried vetiver roots are employed:
  - to scent linen and clothes
  - to make sachets
  - to be burned as incense

5.3.3 As Ventilating Panels in Electric Desert Cooler

- In India, vetiver dried roots are used as a stuffing in ventilating panels used in electric desert cooler.

5.3.4 As Car Rooftops

- Dried roots are used on car rooftops to achieve a cooling effect during summer.
- In outer Delhi, India, poultry farmers kept their large poultry houses cool using desert coolers and heat exchange by forcing air through ‘wet mats’ made from woven vetiver roots.

5.4 Harvested Leaves

- Harvested vetiver leaves also provide cooling effect inside and underneath
- Used as wall of hut and roof thatch
- Low cost, durable and long-lasting

5.4.1 Hut

In Senegal, native vetiver leaves are used to make simple hut

5.4.2 Roof Thatch

- Rural people in Asia and Africa utilize vetiver as roof thatch as it provides cooling effect underneath; durable and long-lasting

5.5 Heat Reduction

- A thick and permanent hedge of vetiver can act as an excellent barrier to prevent heat from coming into the properties.

6. Vetiver Makes a City Safer

6.1 Bioengineering.

6.2 Phytoremediation.

6.3 Disaster Mitigation.

6.1 Bioengineering

A prevention mechanism through:

6.1.1 Erosion Control

6.1.2 Stabilization of slope,

embankment, shoreline,

sand dune

6.2 Phytoremediation

A curing mechanism through:

- Reclamation of naturally-occurring deteriorated land such as wastelands or deserts
- Rehabilitation of man-made deteriorated land and water such as contaminated or intoxicated soil and water through heavy metal absorption, wastewater treatment, water purification, etc.

6.3 Disaster Mitigation

6.3.1 Wind Break:

6.3.2 Slow Down Runoff:

6.3.3 Traffic Safety

6.3.4 Improve Air Quality: (i) by absorption of gaseous pollution like ozone (O_3), and sulphur dioxide (SO_2) through the surface of the leaves; (ii) by catching fine dust, ashes, pollens and smoke on the surface of the leaves; (iii) by giving up moisture to lower the temperature; (iv) by giving up O_2 through photosynthesis; and (v) by reducing hydrocarbon emissions from parked cars.

6.3.5 Stop Moving Sand Dunes: Vetiver hedgerows can stop moving sand dunes that approach the city as in the case of a city in Southwestern China.

6.3.1 Wind Break

- Vetiver hedges can act as a windbreak to slow down strong wind.
- In a field of jojoba crop in Pingtan Island, Fujian Province, China, vetiver hedgerows at 6-8 m intervals were interspersed with the jojoba rows being perpendicular to the direction of the strong wind coming from South China Sea.
- By the end of the second year, vetiver hedges were over 2 m high and could act as an effective windbreak to arrest the shifting sand and protect the jojoba field.

6.3.2 Slow Down Runoff

- Vetiver hedges planted across a slope can slow down the damaging runoff.
- Most of the water penetrates deep down and retains as aquifer in the subsoil, thus reducing the amount of water running off down the slope.

6.3.3 Traffic Safety

- Greenery can play a large role in working on road safety.
- Vetiver planted in a lane accentuates the course of the road, and the tunnel effect ensures that the road users are going to slow down.
- Vetiver hedgerows at the end of a straight, bare road warn the drivers to push on the breaks earlier and handle a bend or an intersection at low speed.
- Roundabouts have the same decelerating function.

6.3.4 Improve Air Quality

Vetiver contributes to a higher air quality by:

- absorption of gaseous pollution like ozone (O_3), and sulphur dioxide (SO_2) through the surface of the leaves;
- catching fine dust, ashes, pollens and smoke on the surface of the leaves;
- giving up moisture to lower the temperature;
- giving up O_2 through photosynthesis;
- reducing hydrocarbon emissions from parked cars.

7. Vetiver Makes a City More Beautiful

7.1 Decoration: Roadside, riverside, pond, meeting room, etc .

7.2 Beautification: Resort, hill side, etc.

8. Discussion

8.1 Simple and Low Cost Technology

8.2 Low Maintenance Costs

8.3 Sustainable

8.1 Simple and Low Cost Technology

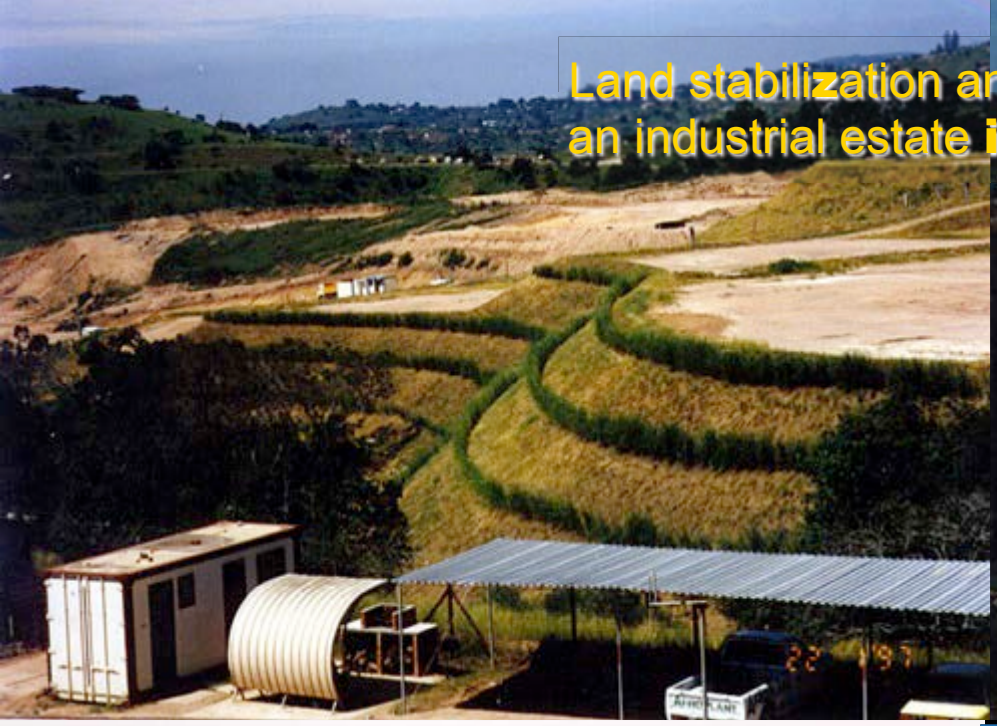
- Whenever the cost of making greenery is concerned, people always think that it costs a lot of money.
- Planting vetiver is relatively cheap as compared to other plants such as trees and ornamental plants.
- It is one of the most simple plants and employs a low-cost technology.

8.2 Low Maintenance Costs

- To make a city green with trees and other plants, particularly ornamental plants, is rather costly, especially in maintenance.
- Vetiver requires low maintenance costs
- It is only required to cut the leaves down every three months, to leave the cut leaves to cover the soil to reduce evaporation, and to add nutrients to the soil after decay.

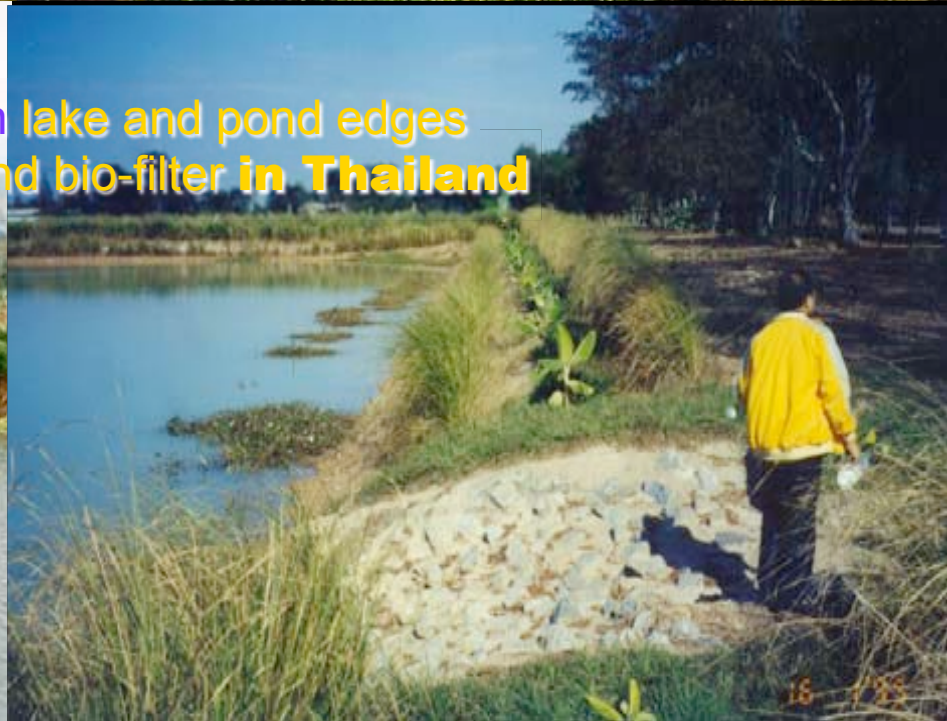
8.3 Sustainable

- Most other plants grown for greenery in the city are difficult to sustain.
- Trees, for example, require pruning, spraying with fungicides and insecticides, and sometimes, after heavy storms, can topple down and destroy houses and other structures.



Land stabilization and landscaping on an industrial estate **in South Africa**

Vetiver planted on lake and pond edges for erosion control and bio-filter **in Thailand**

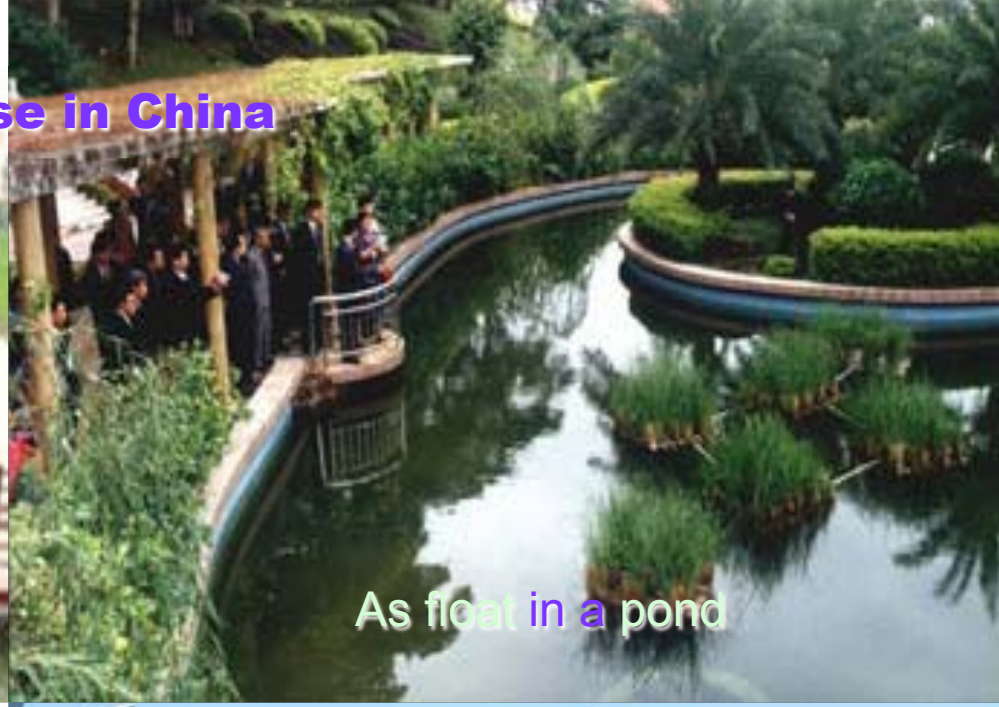


Vetiver used to stabilize sandy garden beds on a beach resort **in Senegal**

As potted plants

Around a lotus pond **in Vietnam**

Ornamental Use in China



Ornamental Use in Portugal

Erosion control and landscaping on a flood control dam wall, two years after planting **in Australia**

The road leading to Doi Tung in Chiang Rai, Thailand

Entrance of a park in Guangzhou


Planting at the entrance of a small park for ornamental purpose


Erosion control and landscaping: in Australia
After establishment


Three years later

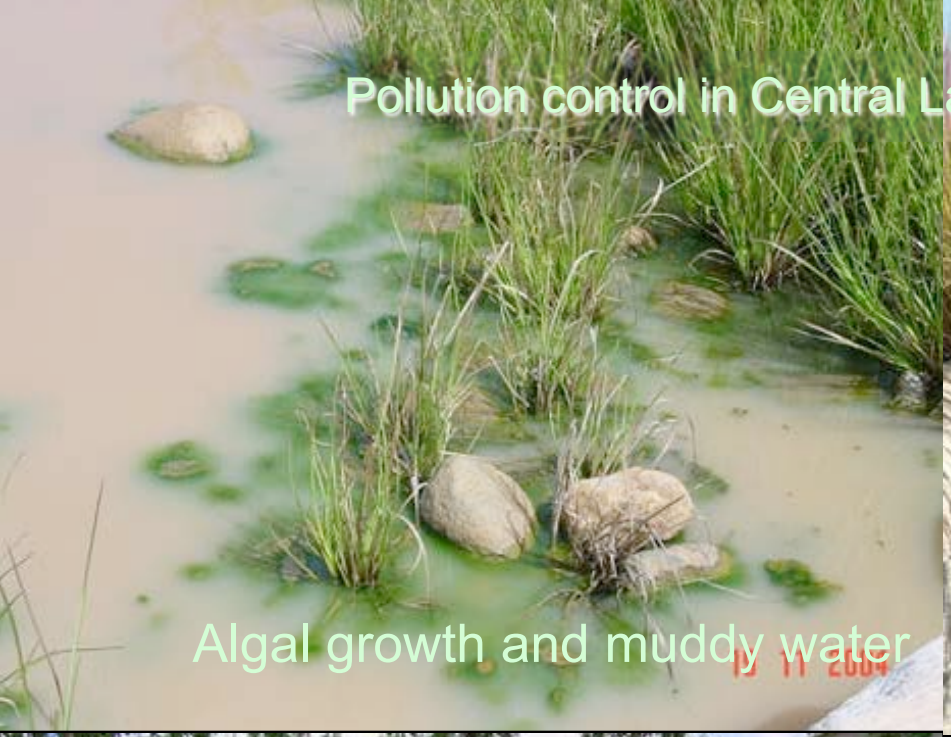

Planting on the swale floor and bio-retention pond for pollution control


Planting on the swale floor for pollution control

Planting along the swale banks
for pollution control and
ornamental purpose **in Australia**


On the rock lined shore line in Australia


Planting along the lake shore purely for ornamental purpose


Pollution control in Central Lake in Australia
Algal growth and muddy water


Mature vetiver cleaned up water and algae


Pollution control in swales
Trapping sediment


Contaminants in runoff water

A landfill leachate disposal site in Australia

Top surface of landfill dump

Two years after vetiver planting

Mature and in full flowers, two and half years after vetiver planting

Road & Pond Boundary

Vetiver hedges along roads and ponds make a nice boundary, much more pleasing to the eyes than concrete panels and other artificial objects.

Bordering a lotus pond →

Decorating building with vetiver pot plants

Decorating conference room at ICV-2, Phetchaburi, Thailand


River bank stabilization


River bank stabilization


Pond stabilization
and decoration


Sand dune stabilization

Shoreline Stabilization

❖ In Brazil, vetiver is grown on almost pure beach sand to stabilize the beach front.

❖It will stop a lot of rubbish, effluent and runoff entering the beach and the sea.

Shoreline stabilization and decoration

Vetiver Bouquet

Bundle of cut vetiver leaves and flowers can be used as material of a bouquet, or decorative plant in containers.

Vetiver plant grown in pot for decorating the room

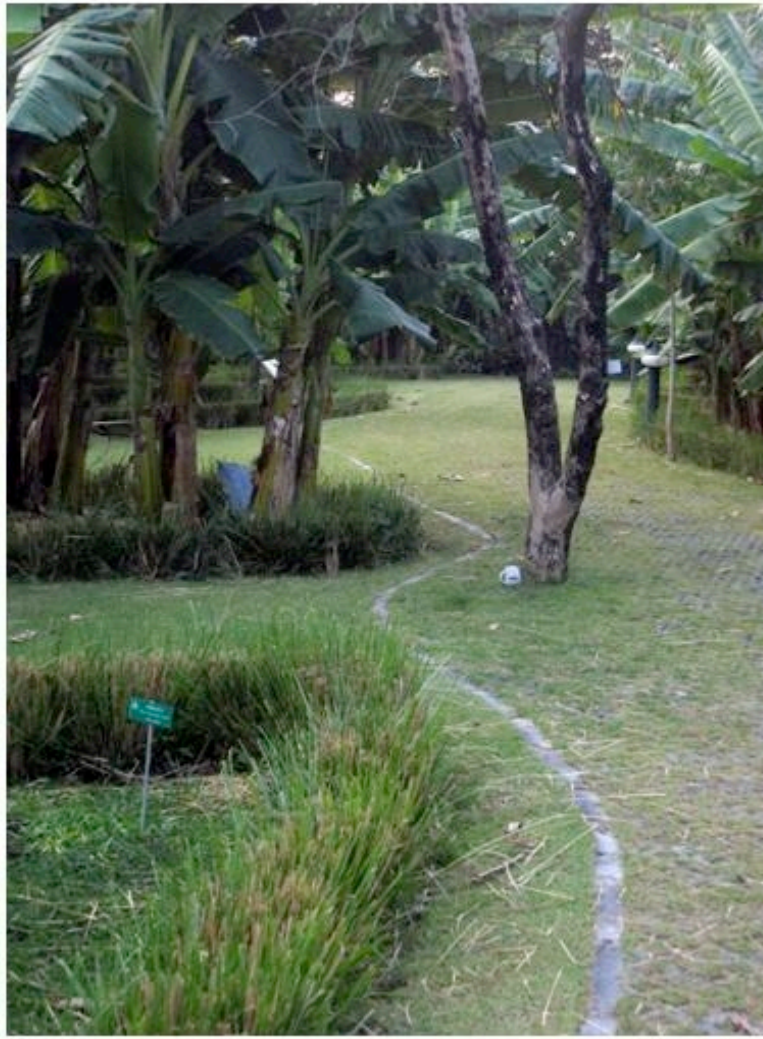
As material for flower arrangement


In a resort on Samui Island, Thailand


On the lake edges


Floating in the pool

Bordering banana collection plot at The Queen Sirikit Park in Bangkok



Nature Pronounced Garden of Musaceae Family Queen Sirikit Park ,Bangkok Thailand

Project Details: **Area** 11,200 m² **Renovation Budget** 30,000 USD **Completion** December 2008