

# *Bio-Drainage: A Green and Innovative Approach*

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## **ABSTRACT**

Efficient wastewater management is essential for environmental sustainability, particularly in water-scarce areas. Bio-drainage trees, also referred to as wastewater treatment trees, offer a viable solution to this challenge. Through phytoremediation, these trees can effectively treat and purify wastewater by eliminating pollutants and excess nutrients. This article provides a comprehensive insight into bio-drainage trees' potential advantages and various applications.

## **INTRODUCTION**

**W**astewater management is a growing concern in many parts of the world, and conventional wastewater treatment methods are often costly and require significant energy inputs. Bio-drainage trees offer a sustainable and cost-effective alternative to conventional wastewater treatment methods. These trees are capable of treating wastewater through a process known as phytoremediation, which involves the use of plants to remove pollutants and excess nutrients. Biodrainage is an innovative approach to managing excess soil water in agricultural and forestry lands. It involves the use of fast-growing tree species, such as Eucalyptus, that can absorb water from the capillary fringe above the groundwater table. This absorbed water is then translocated

throughout the plant and eventually transpired into the atmosphere through stomata. This combined process of absorption, translocation, and transpiration is what characterizes biodrainage.

Fast-growing Eucalyptus species are particularly suitable for biodrainage, as they consume large amounts of water under excess soil moisture conditions. These species can be planted in blocks as part of farm forestry or along field boundaries in the form of agroforestry. Other suitable species for biodrainage include Casuarina glauca, Terminalia arjuna, Pongamia pinnata, and Syzygiumcumini.

By utilizing biodrainage, excess soil water can be effectively removed and transpired into the

atmosphere, reducing the risk of waterlogging and salinity in agricultural and forestry lands. Biodrainage is a sustainable and eco-friendly solution that can contribute to environmental conservation and promote long-term sustainability in these important areas.

**Bio-drainage trees have several benefits, including:**

1. **Cost-effectiveness:** Bio-drainage trees are a cost-effective solution to wastewater treatment, as they require minimal maintenance and energy inputs.
2. **Environmental Sustainability:** Bio-drainage trees help to reduce the impact of wastewater on the environment, as they remove pollutants and excess nutrients from wastewater.
3. **Aesthetic Value:** Bio-drainage trees can enhance the aesthetic value of public spaces by providing greenery and improving air quality.
4. **Carbon Sequestration:** Bio-drainage trees are effective at sequestering carbon, helping to mitigate the effects of climate change.

**Examples of Bio-Drainage Trees:**

1. **Willow Trees:** Willow trees are effective at treating wastewater, as they have a high water uptake rate and can remove pollutants such as nitrogen and phosphorus.
2. **Poplar Trees:** Poplar trees are also effective at treating wastewater, as they have a high biomass production rate and can remove pollutants such as heavy metals.
3. **Mangrove Trees:** Mangrove trees are commonly used to treat wastewater in coastal regions, as they are adapted to saline environments and can remove pollutants such as nitrogen and phosphorus.

**Case Studies**

Waterlogging and its associated soil salinity are a major impediment to the sustainability of irrigated agriculture. Although conventional engineering drainage technologies such as subsurface or vertical drainage combat the problem, they are costly and generate huge quantities of effluent which is difficult to dispose of.

Biodrainage, which removes excess soil water by deep-rooted fast-growing trees through evapotranspiration using bioenergy, is an appropriate alternative. Plant consumptive water use varies between 6500 and 28 000 m<sup>3</sup> ha<sup>-1</sup> yr<sup>-1</sup> and an ideal tree plantation lowers groundwater tables by 1–2 m over a time period of 3–5 years. Trees such as Eucalyptus, Populus, Casuarina, Dalbergia, Syzgium, Acacia, Prosopis, Leucaena, etc. are found to be effective in lowering shallow groundwater tables and reversing salinity trends. Integration of trees such as Eucalyptus and Populus along with crops in a unified agroforestry system, on approach roads, field bunds or on dykes of ponds in an integrated farming system, is another viable proposition. Irrigation of highly transpiring trees has also been proposed for reuse of wastewater and conservation of nutrient energy into biomass, leading to carbon sequestration, environmental sanitation and eco-restoration.

1. **Vila Nova de Gaia, Portugal:** In this project, willow trees were used to treat wastewater from a residential area. The project was successful in reducing the levels of nitrogen and phosphorus in the wastewater, and the treated water was used for irrigation.
2. **Rotorua, New Zealand:** In this project, a constructed wetland system was created using poplar trees to treat wastewater from a dairy factory. The system was effective in removing pollutants such as nitrogen and phosphorus, and the treated water was used for irrigation.

**CONCLUSION**

Bio-drainage trees offer a sustainable and cost-effective solution to wastewater treatment.

These trees provide several benefits, including environmental sustainability, aesthetic value, and carbon sequestration. Examples of bio-drainage trees include willow trees, poplar trees, and mangrove trees. Case studies have shown that bio-drainage trees can effectively treat wastewater, reducing the levels of pollutants and excess nutrients. Overall, bio-drainage trees are a promising solution to the challenges of wastewater management.

## REFERENCES

- Prabakaran.C 2023. Environmental studies and disaster management. RK Publishers.Vettaikaranpudur, Pollachi.P.237
- MeditPanda, P. K. and Mishra, I. O. P. 2021. Bio-drainage in Waterlogged Areas. Vigyan Varta 2(9): 26-30