

Case Study 26

Maximising the Role of Trees in Flood Control



Across Scotland 1 in 20 homes and 1 in 14 businesses are at risk of flooding. EnviroScience was commissioned to undertake a study to measure the potential of trees and forests to contribute to effective flood management controls. The research explores effective infiltration rates of sustainable drainage schemes and assesses installation costs in comparison with other approaches. Early findings highlights the importance of urban trees and suggests that tree and forest enhanced flood control can save up to 99% of flood control costs.

Context

Increasing urbanisation has amplified the risk of flash flooding. As areas of vegetation are replaced by impermeable concrete and tarmac they lose their ability to absorb rainwater. This rain is then directed into surface water drainage systems, often overloading them and causing floods. The cost of flooding to Scotland is approximately £350 million per annum and the costs of flood controls are escalating.

There is evidence that the use of trees as part of Sustainable Drainage Systems (SUDS) can double the soil moisture deficit as compared to grass cover and that rain interception by the canopy and soil leaf litter can also help to reduce the risk of flooding.

However, there is some question as to the effectiveness of trees in flood control as the infiltration of rain water into natural soil is often too slow to control floods.

"...very sound, both technically and practically"

**Ron Melville, Region Director,
Forestry Commission.**

"Councils should be falling over themselves for this."

**Alan Lascelles, Principle Adviser,
Business Link.**

Project Background

EnviroScience sought to enhance the role of trees in flood control through the installation of specially engineered boreholes. Their study demonstrates that during storm events these facilitate deep infiltration, enabling storage of water and minimising run off. The boreholes also increase soil surface area, soil air and encourage deep rooting, with further benefits to tree stability, structural damage control and drought resilience.

Key Points

- Tree cover can double the capacity for an area of land to hold water compared to grass cover and that rain interception by the canopy and soil leaf litter can also help to reduce the risk of flooding.
- This study delivers key information for SUDS development by quantifying the many benefits of woodland cover over traditional methods (including financial savings) - particularly in an urban setting.
- Additional advantages include carbon sequestration by trees, the production of biomass fuel, recycling of landfill plastics, increasing property values and can stimulate employment in the civil engineering and arboricultural sectors.



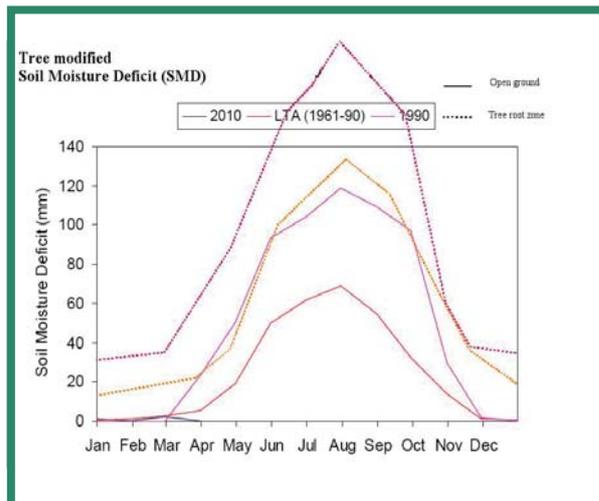
What it did

With the support of the Forestry Commission Scotland, Scottish Environmental Protection Agency and Stirling Local Authority, experimental boreholes were installed in both urban and forest environments in Stirling, Falkirk and Aberfoyle.

It is believed that the trees in these selected areas will begin to root towards the boreholes and that, in time, fibrous roots will emerge through the borehole perforations.

The success of the boreholes depends on design detail and lessons have been learned about limitations of glacial soils, drilling techniques and road infrastructure constraints. The pilot project has shown that the storm water capacity of each engineered tree is approximately 7m³. It has also found that a network of boreholes can typically take 50mm of storm rainfall from street surfaces, protecting sewers from overflow and river pollution.

The project has the added benefit of increasing carbon capture, thus reducing the levels of CO₂ in the atmosphere. Furthermore, the excess wood produced in the project can be used as wood fuel, reducing the consumption of fossil fuels and helping to reduce energy costs



The pilot project has shown that enhancing the role of trees as part of a SUDS scheme is cost effective as a flood solution, thus adding real economic value to urban trees against the escalating cost of flood control. Furthermore, urban tree installation work is estimated to take two days per borehole and could be expected to stimulate employment in a civil engineering/ arboricultural subsector.

UK studies also show that trees can add value to the property values of the homes which overlook them by up to 7%.





CSGN Learning & Support

This project received a CSGN Development Fund grant in 2010. It highlights the potential and cost effectiveness of tree enhanced flood control in urban spaces where there is little space to sacrifice to flood waters. It encourages woodland creation, the creation of habitats for wildlife, urban greening and the use of biomass energy in the heart of urban communities, thus helping to create urban sustainability.

Future

Building on the success of the CSGN funded pilot study, EnviroScience conducted further research focussing on Forestry Commission roads in the River Forth catchment. This study shows that Forest Enhanced Flood Control has the potential to control millions of cubic metres of flood water at a fraction of the cost of conventional flood controls.

With flood prevention costs increasing

each year, the proposed method of Forest Enhanced Flood Control could provide a much cheaper soft engineering solution, saving 90-99% of flood control cost as compared to conventional civil engineering solutions. It supports commercial forestry, vital for sustainable building timber into the future and has more precise flow control and repeat storm performance in enhancing natural forest flood management.

The Forest Enhanced Flood Control method also includes a new drainage product from recycled plastic. This product is proposed for manufacture in Scotland and will take up to 10,000m³ low grade plastic waste from landfill. The massive savings demonstrated in this research greatly enhances the economics of existing forest and reforestation, for which Scotland has a world leading reputation. Several Local Authorities have also expressed interest in applying the model.



Outcomes

Reduced Costs: The research provides firm evidence that planting trees can be a more effective and cheaper approach to mainstream flood prevention mechanisms.

Improved Sustainability: Planting trees captures CO₂, biomass energy production in the heart of urban communities, recycle plastics from landfill.

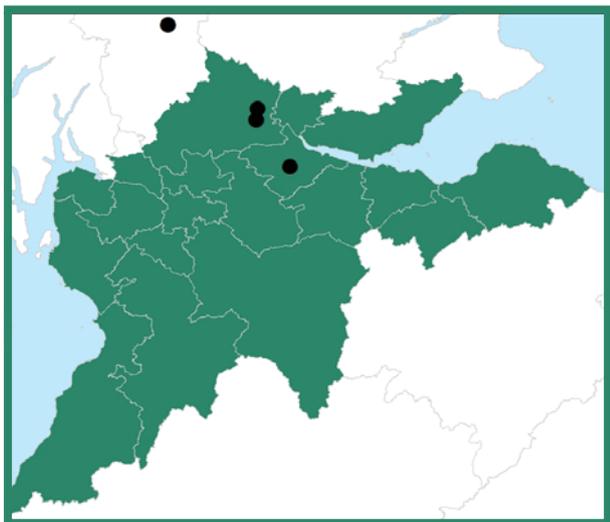
Better Biodiversity: Creating woodland and urban trees creates habitats for wildlife and increases the potential of urban areas to contribute towards habitat networks.

Improves Wellbeing and Health: Research shows that neighbourhoods with good tree cover are, statistically speaking, significantly healthier than less green neighbourhoods.

Boosts Local Economies: Urban trees can typically enhance values of properties in close proximity by between 5% and 7%, larger trees and parkland may add even greater value.

Location

The location of the four test area sites are shown the map below within the context of the CSGN area.



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Project Partners

Forestry Commission Scotland
Scottish Environmental Protection Agency
Stirling Council
Falkirk Council

What is the CSGN?

The CSGN is a national development within the National Planning Framework which aims to make 'a significant contribution to Scotland's sustainable economic development'. It involves public agencies and stakeholders (those with an interest in our work) working together to align their policies, programmes and actions to achieve a common aim. That aim is to change the face of Central Scotland by restoring and improving the rural and urban landscape of the area.

Getting in Touch

To discuss this case study please contact: Stephen Hughes, Monitoring & Evaluation Manager, Central Scotland Green Network Support Unit. E-mail: stephen.hughes@centralscotlandgreennetwork.org

For further information on other case studies please visit: www.centralscotlandgreennetwork.org

October 2013