Resource 1

Case Studies 1

New locks in Albertkanaal in Flanders, Belgium

The Albert canal in eastern Flanders is an important economic waterway but it experiences rare periods of low water flow, during which it is then less suitable for commercial shipping. As a consequence of climate change, the Meuse basin, which includes the canal, is projected to experience more frequent and longer periods of low water flow. This could have economic implications.

The Albert canal connects the industrial zones around Liège with the harbor of Antwerp. Ships can access both ends of the canal: via the River Scheldt to the Netherlands and via the River Meuse to France. It is an economically important waterway for Belgium, with a total traffic of 40 million tonnes/year. It also helps reduce the number of trucks on the highways by some 6 000 trucks/day, and results in less air pollution and congestion. In some, currently rare, cases, the discharge of the River Meuse is not enough to feed all the canals in Flanders and the Netherlands. During these periods, the low water level of the Albert canal means that the draft allowed for ships has to be reduced, making inland navigation less attractive as a mode of transport.

The solution to this challenge was to install large Archimedes screw pumps at six lock systems. In the case of a drought, water is pumped upstream to replace the water lost by the ships passing through the lock. In the case of an excess of water, mainly in winter, the pumps are used as a bypass and also generate hydroelectricity. The screws are also designed to enable fish to migrate freely. The first four screw pumps (4.3 m diameter, weighing 85 tons) were installed in the Ham lock system in 2012, and three screws were installed in Olen in 2013. Further screws will be installed in the lock systems of Hasselt, Genk, Diepenbeek and Wijnegem over the next few years.

The cost of installing the screws is about EUR 7 million for each lock system. The benefits include ensuring navigability of the canal under changing climatic conditions, reliability of the canal for shipping and electricity generation. A hydrological and economic analysis, including climate change, concluded that on an annual basis more energy will be generated than used. The exact annual amount of power generated will depend on the amount and distribution of rainfall over the year, the future shipping intensity and the amount of withdrawal by other water users. The net effect on greenhouse gas emissions over time will depend on these same elements, but is generally favourable.

Problem	**Effect**	**Solution / Adaptive measures**

Case studies 2

Barcelona trees tempering the Mediterranean city climate, Spain

Barcelona's main climate change challenges include temperature rise, a decrease in rainfall and an increase in extreme events such as droughts and heatwaves. The high urban density of Barcelona can exacerbate the heat island effect. Barcelona has committed to becoming a global model of a sustainable city in response to the urban development challenges related to climate change. For many years, Barcelona has had a focus on planting and managing trees. Trees can moderate the urban climate by cooling it in two different ways. Reflection of sunlight and transpiration by the leaves lower the air temperature, and shade reduces the surface temperature and protects people from the sun, especially during the hottest months. Furthermore, trees can prevent local flooding by helping to reduce the amount of stormwater runoff.

Besides climate-related benefits, city trees can also provide co-benefits: removing air pollutants, storing carbon, reducing noise pollution, regulating humidity and balancing the water cycle, creating ecological connectivity, providing habitat for urban biodiversity and creating a pleasant urban landscape.

Barcelona's Green Infrastructure and Biodiversity Plan 2020 (BGIBP) seeks to connect various areas of the city with green infrastructure. In line with the BGIBP goals, Barcelona’s Tree Master Plan for 2017-37 identifies a number of actions to expand tree coverage and improve the climate resilience of the urban trees. These actions include the selection of tree species that are more resilient to water and heat stresses, diversification of tree species, increased use of runoff water for watering trees, automatic irrigation and control of water leaks. While Barcelona has a relatively small amount of green space per inhabitant, it has more street trees than most European cities.

The estimated budget of the Tree Master Plan is EUR 9.6 million/year, of which EUR 8.3 million/year is already available for tree management. The difference of EUR 1.3 million/year relates to investments that will be needed for improved soil and water management.

Problem	Effect	Solution / Adaptive measures

Case studies 3

Green roofs in Basel, Switzerland: combining mitigation and adaptation measures

The city of Basel in Switzerland has implemented an incentive programme to promote green roofs as both a mitigation measure to save energy and hence reduce emissions, and an adaptation measure, lowering indoor temperatures and absorbing rainwater, thus reducing flood risk. There are also biodiversity and social aesthetic benefits. Climate projections suggest that by the 2050s, the temperature in the Basel region could increase by 2 °C in winter and 2.5 °C in summer. Extreme rainfall events are also likely to increase in frequency and severity.

The green roof initiative aimed to improve the coverage of green roofs in the city of Basel through the use of a combination of financial incentives and building regulations. In the early 1990s, the city of Basel implemented a law supporting energy-saving measures. The green roofs were promoted via incentive programmes, funded through the Energy Saving Fund, which is made up of a 5 % levy on energy bills for all customers in the canton of Basel-Stadt. In 2002, an amendment to the city of Basel’s building and construction law was passed, stating that all new and renovated flat roofs must be greened and designed to improve biodiversity. The city of Basel now has one of the world’s largest areas of green roofs per capita. For developers, installing green roofs is now considered routine and they make no objections to installing them.

Green roofs tend to be 10-14 % more expensive than traditional roofs over their lifespan because of their initial costs (the cost of maintaining a green roof is similar to that for a traditional roof). Thus, a 20 % reduction in green-roof construction cost (such as that achieved through the subsidy scheme) is considered sufficient to equalise the costs of green and traditional roofs for investors. This means that green roofs are not only a sustainable solution but also a financially feasible option. Green roofs have multiple direct benefits and cobenefits, including lowering indoor temperatures (by as much as 5 °C) resulting in energy savings; absorbing rainwater and delaying runoff, thus reducing flood risk due to intense rain events; reducing the temperature in densely built-up areas, providing habitat for urban wildlife and 'stepping stones' for migratory species; and providing a more aesthetically pleasing urban landscape.

Problem	Effect	Solution / Adaptive measures