

Basel, Switzerland: Building regulations for green roofs

Climate change impacts addressed	High temperatures
Spatial scale	Town or city
Response type	Regulations
Themes driving the initiative	Mitigation of climate change Biodiversity conservation
Factors of success	Leadership or championship Outsourcing research Public engagement Cohesive delivery of multiple benefits

Summary

The city of Basel in Switzerland has the highest area of green roofs per capita in the world. The use of green roofs has been stimulated by a combination of financial incentives and building regulations. Building regulations have required the use of vegetation on roofs since their implementation in 2002. Initiatives aiming to increase the provision of green roofs in Basel were initially driven by energy-saving programmes, and subsequently by biodiversity conservation. The focus on green roofs was promoted by the researchers from the Zurich University of Applied Sciences (ZHAW) in Wädenswil, Switzerland, who worked to influence decision-makers in Basel to amend the building regulations and offer financial incentives to increase green roof coverage.

Case study location

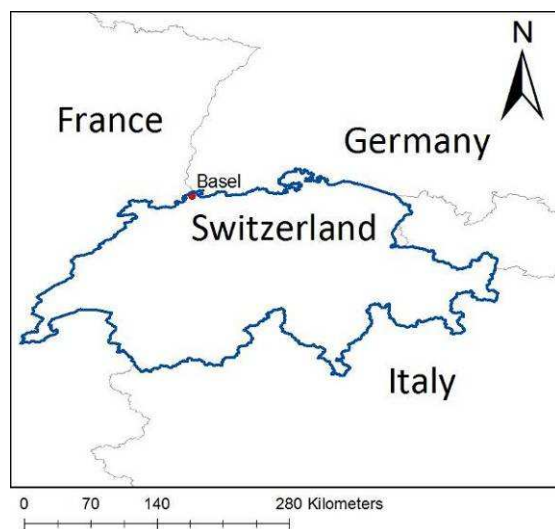


Figure 1. Location of Basel

Located in northwestern Switzerland on the Rhine River and bordering Germany and France, Basel has a population of around 187,000. It is located in the most successful economic region of Switzerland, with the pharmaceutical and chemical industries forming the backbone of its economy. Many major Swiss banks have central offices in Basel, giving finance a pivotal role in the local economy. The City of Basel is one of 26 cantons (states) of Switzerland with its own constitution, legislature and government ⁽¹⁾.

Basel has a mild climate due to its location in the Rhine valley at an elevation of 277m. It receives Mediterranean air currents and lots of sunshine throughout the year. Winters are characterized by short cold periods, with temperatures between 0 and 5°C. Basel typically has light snow cover for about 25–30 days, which usually does not stay on the ground for more than two weeks at a time ⁽¹⁾.

There has been a 1.5°C temperature increase observed in Switzerland between 1970 and 2007. In comparison to the beginning of the 20th century, the frequency of intense rainstorms north of the Alps has increased by between 15 to 70% depending on location. Future climate projections suggest that by 2050s the temperature in Switzerland north of the Alps could increase by 2°C in winter and 2.5°C in summer. By 2100, under the high greenhouse emissions scenario, the temperature is projected to increase by about 4.5 °C in comparison to the 1990s. This means that every second summer will be as hot or even hotter than the temperatures reached during the

2003 heat wave which caused severe loss of life across Europe. Extreme precipitation events are likely to increase in frequency and severity ⁽²⁾.

Development of the initiative

Key aims

The main aim of this initiative is to increase the coverage of green roofs in the city of Basel through the use of a combination of financial incentives and building regulations.

Themes driving the initiative

In many cities of Switzerland, green roofs became popular in the 1970's as an element of ecological construction. Numerous green roofs were created in the 1980s, mainly as pilot projects, which provided a foundation of knowledge and experience for later initiatives. In addition, 1995 was the **EU year of Nature Conservation**. This provided the impetus for Basel's first green roof campaign, which started in 1996 ⁽³⁾.

In the early 1990's the City of Basel implemented a law to support energy saving measures. According to this law, which was the only one of its type in Switzerland, 5% of all customers' energy bills are put into an **Energy Saving Fund**, which is then used to fund energy saving campaigns and measures. The national Department of Environment and Energy decided to pursue and promote green roofs using this source of funds.

Reducing energy consumption of buildings and **protection of biodiversity** have been the key motivators behind expanding green roof coverage in Basel. Initially, the municipality explored green roofs as an energy-saving measure for buildings. Green roofs were funded by the City of Basel for a two-year period in the mid-1990s to stimulate interest and awareness. Encouraged by the success of this project, funds were allocated for a study documenting the biodiversity benefits of green roofs ⁽¹⁾. It is now recognised that green roofs also provide a climate change adaptation function through limiting surface water runoff and reducing temperature in urban areas.

Details of the initiative

The City of Basel has promoted green roofs via a number of funding streams and policies:

- Investment in **incentive programmes**, which provided subsidies for green roof installation. The first incentive programme ran between 1996 and 1997, and was funded from the Energy Saving Fund. This focused on the insulating characteristics of green roofs and their capacity to reduce energy consumption. This was followed by another incentive programme ran between 2005 and 2006, which incorporated design specifications into the green roof guidelines ⁽¹⁾.
- The incentive programme spurred interest in research on the biodiversity protection benefits of green roofs ⁽¹⁾. A **grant for research** on the biodiversity protection benefits of green roofs was awarded to researchers at the University of Applied Sciences (ZHAW) in Wädenswil. The research was led by Dr Stephan Brenneisen. The results of this study shaped design specifications for green roofs in Basel.
- In 2002, following the first incentive programme, and incorporating the outcomes of the research into biodiversity value of green roofs, an amendment to the City of Basel's **Building and Construction Law**, was passed (paragraph 72). It reads that all new and renovated flat roofs must be greened ⁽⁵⁾ and also stipulates associated design guidelines (Box 1).

- **Best looking green roof contest** was held by the city in 1996-1997 and 2005-06 to help promote the green roof incentive programme ⁽³⁾.

Box 1. The green roof regulations ⁽¹⁾

- The growing medium should be native regional soils — the regulation recommends consulting a horticulturalist;
- The growing medium should be at least 10 cm deep;
- Mounds 30cm high and 3m wide should be provided as habitat for invertebrates;
- Vegetation should be a mix of native plant species, characteristic to Basel.
- Green roofs on flat roofs over 1,000 m² must involve consultation with the city's green roof expert during design and construction

Implementing the initiative

The two green roof incentive programmes operated for specified two year long periods (1996-1997 and 2005-06). However, the building regulations implemented in 2002 are now an established element of the planning system, and have an ongoing impact (Figure 1).

The incentive programmes were administered by the Canton of Basel ⁽⁷⁾ and supported by the national Department of Environment and Energy ⁽¹⁾. Due to the semi-independent character of the Swiss cantons in legislative terms, it was possible for Basel's building regulations to be changed at the City level. The development of the regulations was led by the Department of Building and Transport, and included the academic expert in green roofs (Dr Brenneisen) and a group of contractors working in the field of green roofs from the trade association ⁽⁷⁾. The installation of green roofs and their maintenance are carried out by the owners of the buildings ⁽⁷⁾.



Figure 1. Examples of green roofs in Basel
Photographs by John Handley

Sources of funding

Between 1996 and 1997, the City of Basel invested 1 million Swiss Francs (CHF) in a green roof incentive programme. A further 1 million CHF funded the green roof incentive programme that ran between 2005 and 2006. Finance for these programmes came from the Energy Saving Fund.

The Zurich University of Applied Sciences received funding for a PhD research into the potential of different designs of green roofs to provide valuable habitat for invertebrate species and birds. The outputs of this research supported the development of the evidence base for the amendment of the building regulations ⁽⁴⁾.

Stakeholder engagement

Prior to the first incentive programme (1996-1997), the Department of Environment and Energy conducted a poll with the Swiss public to determine the level of support for an electricity tax to pay for energy-saving measures. The results of the poll favoured a tax, and the City of Basel then explored energy-saving ideas, including green roofs. In 1996, a variety of stakeholders, including business associations and environmental organizations, were engaged by the City of Basel in the process of developing the green roof incentive programmes ⁽¹⁾.

The City led on the incentive programme, and the commitment of individuals from the Department of Building and Transport secured the political buy-in for the initiative ⁽⁷⁾. Various stakeholders were consulted when developing the green roof concept, and in establishing the first incentive programme. They included ⁽¹⁾:

- the local business association,
- the horticultural association,
- the green roof association,
- the Pro Natura Basel environmental organization,
- the Department of Parks and Cemeteries in the City of Basel,
- the National Department of Environment, Forest and Landscapes.

Dr Brenneisen's research on green roof approaches to maximise biodiversity played a key role in setting green roof design specifications for the building regulations. Dr Stephan Brenneisen is the head of the Green Roof Centre of Competence at the Zurich University of Applied Sciences Wädenswil, where he conducts research and advises on green roof policies and design⁽¹⁾. Dr Brenneisen has acted as a champion for Basel's green roof programmes.

Basel's green roof regulations did not meet with any significant resistance because all stakeholders were involved in the process from the beginning, and due to the success of the incentive programmes. For developers, installing green roofs is now considered to be a routine practice, and developers make no objections to installing them ⁽⁵⁾.

The incentive programmes were targeted at businesses as well as the residents of Basel. During the incentives programme in 1996-97, the media interest in was high, and newspapers and posters were used to inform residents of Basel about the subsidies ⁽⁷⁾. This played an important role in its success through increasing awareness of green roofs across a range of stakeholders.

Can it make an impact?

Scope of adaptation

During the first incentive programme (1996-97) 135 people applied for a green roof subsidy, which led to 85,000 m² of roofscape being greened. The Building and Construction Law has since provided a major impetus for the development of more green roofs in Basel. In 2006, 1711 extensive green roof projects and 218 intensive green roofs were recorded across the City of Basel in total. Approximately 23% of Basel's flat roof area is now green ⁽⁵⁾. In 2007, Dr Brenneisen estimated the surface of green roofs in Basel as around 700,000 m² ⁽⁶⁾. It is estimated that through the green roof building regulation, 30 per cent of all flat roofs in Basel will be greened within the next 10 years (Lawler et al., 2006). As Basel now has the highest per-capita area of green roof in the world, the initiatives promoting green roofs can be seen as very successful.

The implementation of the regulations is not considered as problematic. However, the quality of green roofs was not sufficient to provide biodiversity benefits, and this prompted the second campaign and inclusion of the specific requirements relating to quality of green roofs (see Box 1) in the regulations ⁽⁷⁾.

Current work includes awareness raising among the architects, planners, builders, gardeners, and representatives of other professions on the benefits of green roofs ⁽⁴⁾.

Additional benefits

The biodiversity research conducted in Basel has produced convincing evidence that green roofs can protect endangered invertebrate species ⁽¹⁾. An ongoing study is being carried out to investigate in more detail the ecological benefits of greening the roofs, and the use of roofs as a form of ecological compensation where developments lead to the loss of habitats ⁽⁴⁾.

Energy savings during the first incentive programme aiming at promotion of green roofs totalled 4 giga watt-hours per year across the City. The amount of energy savings through this second campaign were estimated as 3.1 giga watt-hours per year for the City of Basel ⁽⁵⁾.

Thanks to the incentive programmes, local business profited from sales of materials and supplies relating to the installation of green roofs, building owners realized energy savings and Basel gained a nationwide and worldwide recognition for its green roof programmes ⁽¹⁾.

Key messages

- Green roofs are a type of green and blue space adaptation to climate change that brings multifunctional benefits: while the original entry point was energy-saving, the focus shifted to biodiversity, and then to the role of green roofs in adapting Basel to climate change.
- It is important to involve all stakeholders from the beginning of the initiative to address questions and concerns and ensure that everyone's goals are being met ⁽¹⁾.
- Leadership of the project by a committed individual dedicated to the initiative's success.
- A comprehensive suite of mechanisms, from incentives to statutory regulations, has ensured a wide uptake of green roofs in Basel.

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Acknowledgements

Thanks go to Dr Stephan Brenneisen and Natalie Baumann for their help in developing this case study.