

The Vertical Garden

A scientific and artistic approach by Patrick Blanc. Patrick is a French botanist, working at the French National Centre for Scientific Research, where he specialises in plants from tropical forests.

Do plants really need soil? No, they don't. The soil is merely nothing more than a mechanic support. Only water and the many minerals dissolved in it are essential to plants, together with light and carbon dioxide to conduct photosynthesis.

As a teenager, in the late sixties, Patrick Blanc conceived the Vertical Garden as a biological filter for his tropical aquarium. During his university years, he visited the Southeast Asian rainforests to observe his beloved aquatic *Cryptocoryne* species growing in the shaded forest streams and then he decided to study tropical botany. His Ph D, in 1978, concerned the growth habits of the plants of the Aroid family (*Anthurium*, *Philodendron*, *Monstera*, *Aglaonema*, *Cryptocoryne*). In 1982, he joined the National Center of Scientific Research (CNRS) and his research topic since that time concerns the adaptive strategies of the tropical rainforest understory species. This was the subject of his State Thesis (Doctorat ès Sciences) and he won the Botany prize from the French Academy of Sciences in 1993.



Patrick Blanc on a bench at the new Shinkansen station walkway, Yamaguchi, Japan in October 2015. Photo: © Pascal Héni

During these years he was also developing his Vertical Garden concept and finally patented it in 1988 and 1996. Consecutive to his first realisations in the late eighties (especially at the Museum of Science and Technology in Paris in 1986), he has been invited for the Chaumont International Garden Festival in 1994. The success of his work was immediate and then the Contemporary Art institutions considered he was an artist and then they commissioned different permanent installations. In 2001, Andrée Putman invited Patrick for a huge installation on a blind wall at the Pershing Hall hotel in Paris and suddenly many famous architects have been interested by Patrick's work. Now, the closest collaborations are with Jean Nouvel and Herzog and De Meuron. Besides these collaborations, Patrick Blanc now designs many projects by himself.



Amandolier, Genève, Entrance Vertical Garden in October 2013. Photo: © Patrick Blanc

Plants in the wild are growing on vertical surfaces

Wherever water is available all year long, as in tropical forests or in temperate mountain forests, plants can grow on tree trunks and branches (epiphytic habit) as well as on soil-less habitats: sandstone or granitic outcrops, limestone cliffs, caves, waterfalls as well as natural or man-made slopes. These situations provide perfect habitats for many species, most of them having a very narrow range of distribution. The most important plant families are *Gesneriaceae*, *Rubiaceae*, *Melastomataceae*, *Begoniaceae*, *Balsaminaceae*, *Urticaceae* among the *Dicotyledons* as well as *Orchidaceae*, *Bromeliaceae*, *Araceae* among the *Monocotyledons*, not forgetting the so many Ferns species. In Peninsular Malaysia, for instance, out of the 8,000 known plant species, about 2,500 are growing on these steep habitats, without any soil.

Even in the temperate parts of the world, many plants are growing on cliffs, cave entrances, waterfalls or fallen rocks. On such very steep places are growing many common shrubby species among the *Berberis*, *Spiraea*, *Stachyurus* or *Cotoneaster* genera. Their naturally curved branches indicate that they originate from naturally steep biotopes and not from flat areas like the gardens where they are usually grown. The situation is the same for many herbaceous species: for instance, all the *Hosta*, *Heuchera*, *Tricyrtis* as well as most Fern species that Patrick Blanc did observe in North America or temperate East Asia were growing on steep slopes.

Thus, as seen from nature, it is possible for plants to grow on nearly soil-less vertical / surfaces as long as there is no permanent water shortage.

Walls and Plants, a surprising, though long-lasting combination

Whenever roots are allowed to grow deep inside a man-made wall, they can easily damage the wall and cause its destruction. That is precisely what happened to the Angkor temples. This root-related damage can be excluded if the Vertical Garden is totally insulated from the existing wall. The Vertical garden becomes a second skin of the building and this is a living skin. The plant roots are then only spreading on the surface of the Vertical Garden structure, leaving the inner wall unaffected. Plants and architecture can thus cope with harmony.

The core innovation is to use the root ability of the plants to grow not only in a volume of soil but also on a surface; this is just what they do in their natural environment when their roots are growing on tree barks or among the mosses covering the rocks. Without any heavy soil, the plant-supporting system is very light and thus can be implemented on any wall, whatever its size. The Vertical Garden can be set up both outdoor and indoor. Of course, the plant species selection is set according to the prevailing climatic conditions.

The Vertical Garden is composed of three parts: a metal frame, a PVC layer and a layer of felt. The metal frame is hung on a wall or can be self-standing. It provides an air layer acting as a very efficient thermic and phonic insulation system. A 1 cm thick PVC sheet is riveted to the metal frame. This layer brings rigidity to the whole structure and makes it waterproof. A felt layer, made of polyamide, is stapled on the PVC. This felt is rot-proof and its high capillarity allows a homogeneous water distribution. Now, the oldest parts of felt, together with the "invited" plants, are 30 years old in Patrick Blanc home.



Global view of Rain Forest Chandelier at the EmQuartier in Bangkok.
Photo: © Patrick Blanc



The Rain Forest Chandelier as seen above. Photo: © Patrick Blanc

The roots grow on and inside this felt. Plants are installed on this felt layer as seeds, cuttings or already grown plants. The watering is provided from the top. If tap water is used, it must be supplemented with low concentrated nutrients. Of course, the best solution is to recycle used water, such as grey waters and also to collect the rain from the adjacent roofs as well as water issued from air conditioning. The whole weight of the Vertical Garden, including plants and metal frame, is lower than 30 kg per square metre. Thus, the Vertical Garden can be implemented on any wall, without any size or height limitation.

The Vertical Garden on concrete walls: a shelter for biodiversity and a cleaning system for cities

Thanks to its thermic insulation effect, the Vertical Garden is very efficient and aids in lowering energy consumption, both in winter (by protecting the building from the cold) and in summer (by providing a natural cooling system). The Vertical Garden is also an efficient way to clean up the air. In addition to leaves and their well-known air-improving effect, the roots and all the microorganisms related to them are acting as a wide air-cleaning ecosystem. On the felt, polluting particles are taken in from the air and are slowly decomposed and mineralised before ending up as plant fertiliser. The Vertical Garden is thus an efficient tool for air and water remediation wherever flat surfaces are already extensively used by human activities.

The Vertical Garden allows human beings to re-create a living system very similar to natural environments. It is a way to add Nature to places where people once removed it. Thanks to this botanical knowledge and long lasting experience, it is now possible to display natural-looking plant landscapes even though they are man-made. In any city, all over the world, a naked wall can be turned into a Vertical Garden and thus become a valuable shelter for biodiversity. It's also a way to add nature to the daily life of city inhabitants.