my building is green
A LIFE PROJECT

LIFE my building is green

LIFE17 ENV/EN/000088

Application of Nature-Based Solutions for local adaptation of educational and social buildings to Climate Change

Action: Integration and transferability at local, national and European level

Deliverable: Replicability plan of the LIFEmyBUILDINGisGREEN experience

Date: 08/31/2023

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1. SUMMARY EN ESPAÑOL

This document is part of Action C5, "Integration and Transferability at the Local, National, and European Levels. It presents a replicability plan for the myBUILDINGisGREEN project, aiming to provide guidance to key stakeholders interested in implementing Nature-based Solutions (NbS) and supporting decision-making processes. The document outlines the necessary steps and key processes to consider when implementing NbS in different contexts based on the project's experience.

The document is structured according to the various implementation phases of NbS, which include context analysis, bioclimatic study, NbS selection, financial planning, establishing an appropriate assessment framework, project preparation and tendering, and finally, en-gaging key stakeholders.

Developing a replication plan allows for the sharing of the project's experience in NbS selection so that other cities, public administrations, private entities, etc., can replicate it.

2. ENGLISH SUMMARY

This document is part of action C5. "Integration and transferability at local, national and European level". It presents a replicability plan of the LIFE-myBUILDINGisGREEN project to provide guidance to key actors who want to implement B&W and support decision making. In this document the necessary steps and key processes to be taken into account to implement B&W in different contexts are collected based on the experience of the project.

This document is structured according to the different phases of BMS implementation, ranging from the context study, the bioclimatic study, the selection of BMS, the definition of a financial plan, the establishment of an appropriate evaluation framework, project preparation and tendering, and finally the involvement of key stakeholders.

The development of a replication plan makes it possible to share the experience acquired throughout the project in terms of BMS selection so that other cities, public administrations, private entities, etc. can replicate it.

3. RESUMO EM PORTUGUÊS

This document is part of Action C5, "Integration and Transferability at Local, National and European Level". It presents a replicability plan of the myBUILDINGisGREEN project to provide guidance to key actors wishing to implement Nature-Based Solutions (NBS) and support decision making. In this document, the necessary stages and key processes to be considered when implementing NBS in different contexts are presented, based on the experience of the project.

The document is structured according to the different phases of BNS implementation, which include context analysis, bioclimatic study, selection of BNS, definition of a financial plan, establishment of an adequate evaluation structure, preparation of the project and launching of the bidding process, and finally, the involvement of key stakeholders.

The development of a replication plan allows sharing the experience acquired throughout the project in relation to the selection of BDS, so that other cities, public administrations, private entities, etc., can replicate it.

4. INTRODUCTION

A **replicability plan for** *Nature-Based* **Solutions** (**SbN**, although SBN is also frequently used) refers to a document that describes the steps necessary to adapt and replicate a Nature-Based Solution.

successful nature in different geographical and socioeconomic contexts.

In order to create this replicability plan, the steps carried out for the development of deliverable *C5.7* have been followed. *Design of 15 BDS projects*, in which BDS projects have been designed for 15 schools in 9 European countries.

This plan aims to define a methodology and/or working system to guide the implementation of BMS in different education and social services centers in the rest of the EU. As mentioned above, putting this plan into practice implies following a series of phases, which will be described below, and which have been defined on the basis of the experience developed during the execution of the LIFE myBUILDINGisGREEN project.

It is very important that decision-makers, directors and managers of these buildings, AMPAS, students and social services associations in Europe are aware of the project and participate in its development. In order to achieve an adequate replication of the solutions proposed by the project, it is necessary to analyze and evaluate the impact of BMS in the buildings they manage and use from a technical, environmental, economic, social and climatic point of view. For this, in addition to an evaluation framework with appropriate indicators, it is necessary that the groups listed above participate in the whole process.

The phases included in the implementation of a **replicability plan** for the solutions proposed and studied during the Project are as follows:

1. **Context study**. Study of the physical space and the building itself, the climatic characteristics of the area, the changes expected or already being experienced due to climate change and the use of the building by the educational community.
   In addition, it is important to identify and involve all stakeholders in the process: authorities responsible for the building (city council, county council, private entity, etc.), school management (including teaching staff), students, AMPA, technical management of the project, etc.
2. **Bioclimatic study**. A bioclimatic study for the adaptation of buildings to climate change seeks to understand and take advantage of local climatic conditions to design sustainable and resilient buildings capable of meeting the challenges of climate change and improving the quality of life of their occupants. This replicability plan includes the incorporation of SBN as a way to modify and take advantage of the climatic conditions of the area.

3. **Selection of Nature-Based Solutions**. The most appropriate solutions will be chosen according to the challenges, possibilities, the previous diagnosis, the technical definition including the type of vegetation, the necessary infrastructure, the applicable regulations, the resources needed in terms of investment, how to finance and the costs associated with their maintenance.
4. **Define a financial plan for the interventions**. Establish the level of investment required, study the sources of financing and draw up an appropriate amortization plan.
5. **Establish an appropriate evaluation framework**. For this purpose, appropriate indicators adapted to each project must be selected to allow us to adequately assess the expected impact of the action. It must be avoided that only the direct economic aspects derived from the foreseen investments are considered and that the impacts on thermal comfort for students and teachers are not forgotten.
6. **Prepare the project and put it out to tender.** Each developer, whether public or private, will follow its own procedures to launch the selection process of the entity in charge of carrying out the interventions.
7. **Stakeholder involvement.** Involving key stakeholders in the different phases of the project ensures acceptance and identification with the implemented solutions.

5. REPLICABILITY PLAN

4.1 Context study

Analysis process based on that followed in deliverable *C5.7. Design of 15 BMS projects*. First, an analysis of the building characteristics and climatic situation is carried out in order to determine the most appropriate BMS to address the main challenges and needs of the site.

For this purpose, the main characteristics of the building are analyzed, including the following parameters:

1. Climatic risk region in which the building to be studied is located;
2. The geographic location of the building, including coordinates;
3. The different heights and levels of the building;
4. Year of construction;
5. Main orientations, describing each facade of the building;
6. Types of roofs (flat or pitched roof), determining the materials that form it
7. Type of surface area (m^2), determine the built-up area, non-built-up area, green area and permeable area.
8. Photographs of the school in order to visualize what has been described above.

To determine these characteristics, the cadastre, Google Maps and information provided by the school itself can be used as a source of information.

4.2 Bioclimatic study

A bioclimatic study is a detailed evaluation of the climatic conditions of a specific location and their interaction with the design and operation of a building. Its main objective is to optimize the energy performance and thermal comfort of the building, taking into account climatic changes and variations over time.

Adapting buildings to climate change involves considering aspects such as rising temperatures, variations in rainfall patterns, extreme weather events and other phenomena related to climate change. The bioclimatic study focuses on understanding how these changes will affect the thermal behavior of the building and how it can be designed more efficiently to reduce energy consumption and improve indoor comfort.

During a bioclimatic study, various climatic factors are analyzed, such as solar radiation, temperature, humidity, wind and rainfall, among others. Aspects of the environment are also considered, such as the orientation of the building, the shape and arrangement of the windows, the construction materials, and the ventilation and air conditioning systems.

Based on this assessment, specific design strategies and retrofit measures can be proposed to maximize the energy efficiency and thermal comfort of the building. These measures may include the use of appropriate building materials, the incorporation of shading systems, the implementation of passive climate control systems such as natural ventilation, and the use of renewable energy sources.

In order to carry out the implementation projects in the three pilot schools, the corresponding bioclimatic studies were carried out to guide the selection of the BMS to be proposed. Deliverable *C2.2 Annex 2: Bioclimatic Strategies* contains the studies carried out in the framework of the projects for each school.

In order to carry out this study, a climate analysis is carried out to determine the school's thermal comfort situation and what strategies can be applied to improve it. First of all, the climatic data of the area are analyzed, taking the nearest weather station as a reference. Data on average, maximum and minimum temperatures and radiation for each month are included as basic climate indicators. The psychrometric diagram is used to determine the percentage of hours of current comfort and the bioclimatic measures that can be implemented to improve thermal comfort.

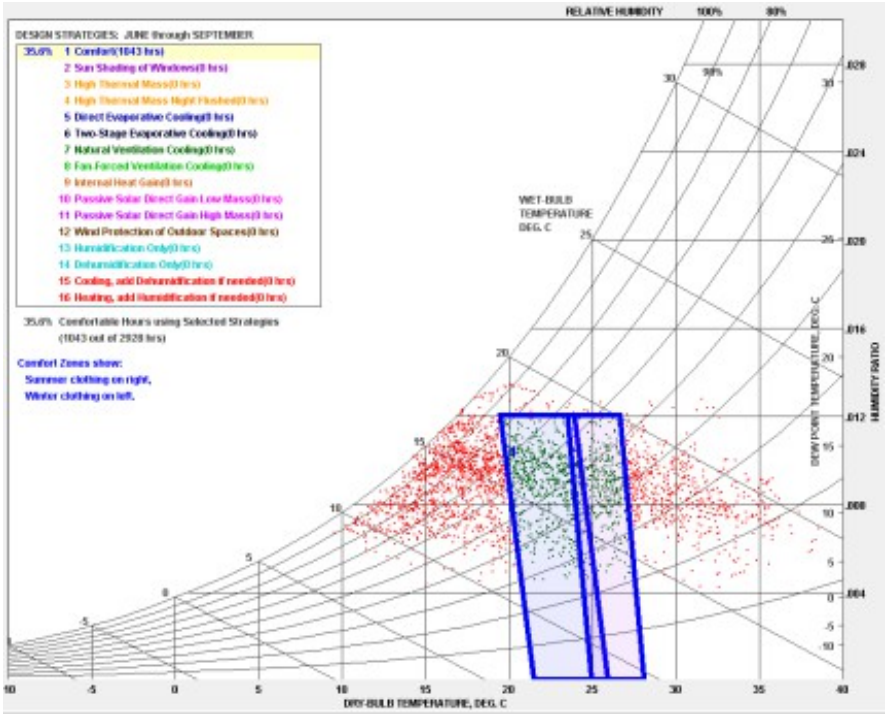


Illustration 1. Example of a psychrometric abacus. Defined comfort zones (blue) and comfort (green) and discomfort (red) time points.

The various strategies are related to:

1- *Comfort zone;*
2- *shading of gaps;*
3- *thermal mass increase;*
4- *thermal mass discharge at night;*
5- *direct evaporative cooling;*
6- *two-phase evaporative cooling;*
7- *cooling by natural ventilation;*
8- *cooling by forced ventilation; natural;*
9- *internal profits;*
10- *direct solar gain in low thermal mass;*
11- *direct solar gain in high thermal mass;*
12- *wind protection;*
13- *humidification;*
14- *dehumidification;*
15- *cooling (active system);*
16- *HVAC heating (active system).*

The application of these measures will depend on the location and orientation of the building, its exposure to the sun and wind and other characteristics mentioned above.

4.3 Selection of Nature-Based Solutions

The selection of the most appropriate BMS for each school will depend on the challenges and opportunities that have been previously analyzed, taking into account aspects such as the climatic and technical conditions of the building, but also the interests of the educational community and the conditions of the environment in which the school is located. Thus, it is necessary to establish the objectives to be achieved with the intervention before making the selection of the most appropriate BMS to be implemented. However, informing stakeholders about the type of solutions that can be used and the impact they provide in general terms can be a way of focusing the process.

The BSS catalog that the project has worked on is included in deliverable *A2 Development of BSS databases and work matrix + Development and drafting of 7 BSS proposals* and in deliverable *C2.4 Technical manual for BSS implementation.*

Another factor to be taken into account when choosing the type of BMS to implement is the budget. Each case study starts with a budget that must be maintained and the type of BMS to be implemented will be adapted accordingly. In this sense, deliverable *C5.6 Financial plan for the replicability of the LIFE myBUILDINGisGREEN experience* has information to estimate the necessary investment for each type of BMS.

To structure the study, the different groups of BNS and the benefits and limitations of each one will be taken into account. As an example, the following is a list of possible solutions proposed by the Project depending on the implementation area.

Covers:

- mBIGCUVE
- mBIGCUVE-SUS
- mBIGBIOSOL
- mBIGUL
- mBIGSECAR

Facades:

- mBIGFAVE
- mBIGFAC

Ventilation protocols - nocturnal ventilation**.**

Outdoor spaces:

- mBIGPond / Pond
- mBIG_SUVE / Permeable pavement
- Trees




Example of BNS implemented in the myBUILDINGisGREEN Project: mBIGCUVE and mBIGCUVE-SUS roofs; mBIGFAVE green façade; mBIG_SUVE permeable pavement.

Once the SbN to be implemented have been identified, it is necessary to define their main technical characteristics. For this stage of the process, reference can be made to Deliverable *C2.4 - SBN Implementation Technical Manual and Annex 1. mBiG SBN prototypes of Deliverable A2. Elaboration of SBN Databases and Work Matrix*.

In this section it is essential to detail the characteristics of the selected SbN, including the most appropriate location and surface area, the materials needed for its construction, the technical aspects involved and the specific procedures to carry out its execution. It is important to consider the type of vegetation to be used, which should be adapted to the geographic location, climatic conditions and precipitation levels of the area. It is suggested to follow the recommendations of deliverable C2.1 *Guide for the selection of plant species adapted to climate change in* order to select the most appropriate vegetation for the type of SBN and the corresponding climate.

Also included are the processes necessary to carry out the assembly of the solution, the previous works to be carried out, prior to the installation of SBN and the limitations that may exist, specifying the need to implement an irrigation system, evacuation and drainage of rainwater, waterproofing of facade and/or roofs, electrical installations to be carried out and other aspects that may influence the execution. It is also recommended to determine the maintenance required for each solution, specifying the personnel in charge, budget available, schedule and whether equipment, training or specialized personnel are required to carry it out. Another element to be taken into account and to be defined in this phase is the regulations and permits that apply to the implementation of SbN in each specific case. Particular attention will be paid to regulations concerning structural safety, safety in use and accessibility, health and energy saving.

Finally, it is necessary to evaluate the resources available, in terms of material, financial and personnel resources. The cost of the BMS to be implemented must be adapted to the available budget.

4.4 Define a financial plan for interventions

Once the BMS have been established, the implementation project for the work will be carried out. In deliverable *C5.6 Financial plan for the replication of the LIFE myBUILIDINGisGREEN experience*, references for the implementation costs of the different SbN proposed by the LIFE myBUILDINGisGREEN project can be found. Then, each promoting entity will use the procedures it has established, and establish the level of investment required, study the sources of financing and make an appropriate amortization plan.

4.5 Establish an appropriate evaluation framework

It is important to monitor and evaluate the impacts of BDS implementation. To achieve this, it is necessary to plan the indicators and effects to be measured, making sure that they are representative and interesting for the project. For example, selecting indicators based on the main environmental and social challenges faced by schools is the strategy followed in the myBUILDINGis- GREEN project.

Table 1. Outline of the impact assessment methodology established for LIFE myBUILDINGisGREEN.

ENVIRONMENTAL CHALLENGES AND SOCIALS	VARIABLES
Adaptation and mitigation CC	**Indoor building temperature. Building envelope temperature. Exterior environmental conditions of the building. Modeling of energy savings Estimation of heating savings.**
Water management	**Water consumption Indicators related to savings in rainwater management.**
Management of green areas	**Increased plant and animal biodiversity. Number of adequate native plant species recovered**
Air quality	**Noise reduction levels from the outside. Number of installed bio-indicator species of contamination**
Urban regeneration	**Energy efficiency measures. Increase of green areas.**
Governance and participation	**Citizens' perception of urban nature. Learning policies and strategic plans for adaptation to CC. Open participatory processes.**
Social cohesion	**Number of agreements and disagreements.**
Public health and welfare	**Reduction in the number of absences and absences of students and teachers.**

It is necessary to establish the monitoring, calculation and evaluation methodology for each indicator. In addition, a forecast must be made of the human and technical resources required, as well as the time required to carry out the monitoring effectively. Once the indicators and their methodology have been established, the baseline monitoring is carried out, the period prior to the installation of the BMS, to see the starting situation of the building. This situation is compared with the data collected during the years following the implementation of BMS.

In addition, generating visibility and effectively communicating the positive impact of nature-based solutions (NBS) is critical to building trust in this approach. This, in turn, helps to gain support and useful contacts, as well as to generate interest in future implementations and replications of NBS.

4.6 Preparing the project and putting it out to tender

The elaboration of the project to be put out to bid is an important process to ensure the quality of the project implementation. Each developer, whether public or private, will follow its own procedures to launch the process of selecting the entity that will be in charge of carrying out the interventions. At this stage, the necessary documentation is prepared, the project requirements are defined and the evaluation criteria are established to select the most suitable contractor.

Bidding specifications are documents that detail the specifications, requirements, terms and conditions to be met by interested companies. This process ensures fair competition among participants and guarantees that companies understand the requirements and expectations of the project. Tender documents usually include information regarding the objectives and scope of the project, technical requirements, administrative and legal requirements to be met, contract terms and conditions and evaluation criteria.

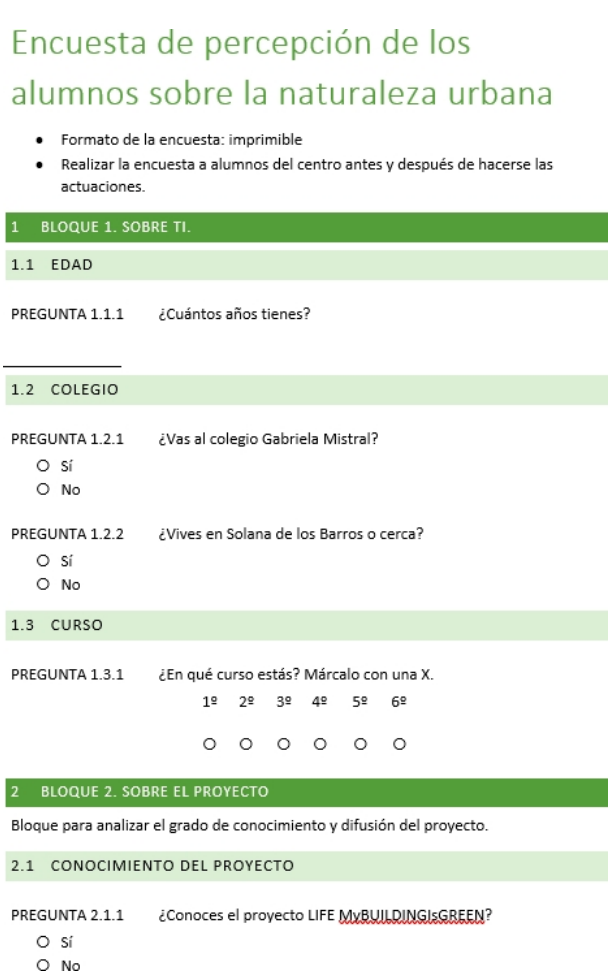
4.7 Active participation - involvement of key stakeholders.

Stakeholder involvement in the different phases of a BDS project through participatory activities leads to stronger and more sustainable results, as well as greater stakeholder satisfaction and commitment. On the one hand, the involvement of key stakeholders from the outset helps to improve acceptance of the solutions adopted. When people feel heard and see that their opinions are considered, they are more likely to accept and support the resulting decisions and feel responsible and committed. Conversely, if social perceptions are not adequately informed, they are more likely to accept and support the resulting decisions and feel responsible and committed.

be very negative. The involvement of different actors and stakeholders in the decision-making process enriches the quality of decisions by taking into account different points of view.

There are several types of participatory processes. As an example, some of the participatory activities carried out in the myBUILDINGis- GREEN project are described below.

Consultations and surveys: a survey was conducted for each school to gather the opinion and perception of students and citizens on urban nature. It is used to evaluate the degree of knowledge and assessment of the implemented BNS, as well as the perception of comfort.



Encuesta de percepción de los alumnos sobre la naturaleza urbana

- Formato de la encuesta: imprimible
- Realizar la encuesta a alumnos del centro antes y después de hacerse las actuaciones.

1 BLOQUE 1. SOBRE TI.

1.1 EDAD

PREGUNTA 1.1.1 ¿Cuántos años tienes?

1.2 COLEGIO

PREGUNTA 1.2.1 ¿Vas al colegio Gabriela Mistral?
○ Sí
○ No

PREGUNTA 1.2.2 ¿Vives en Solana de los Barros o cerca?
○ Sí
○ No

1.3 CURSO

PREGUNTA 1.3.1 ¿En qué curso estás? Márcalo con una X.
1º 2º 3º 4º 5º 6º
○ ○ ○ ○ ○ ○

2 BLOQUE 2. SOBRE EL PROYECTO

Bloque para analizar el grado de conocimiento y difusión del proyecto.

2.1 CONOCIMIENTO DEL PROYECTO

PREGUNTA 2.1.1 ¿Conoces el proyecto LIFE MyBUILDINGIsGREEN?
○ Sí
○ No

Example of the survey developed for students in the myBUILDINGisGREEN Project.

Demonstration workshop: Installation of an indoor vertical garden with the participation of students and teachers of a school in the different phases of implementation: installation of the structure, preparation of plants and substrate, irrigation system, design, coordination and communication of the activity. Finally, the planting of the vegetation in the vertical garden was done jointly. This type of workshop is intended to complement the training of students in the knowledge of nature, raise awareness of the benefits they bring, and normalize their presence both indoors and outdoors, also understanding the requirements they have.

Collaboration with CEIP Parque Alameda in Valladolid to install an indoor vertical garden in the entrance hall of the school.

6. SUMMARY AND CONCLUSIONS

By implementing the proposed BMS, a number of environmental, social and user welfare benefits are provided. The following indicators are positively impacted: building interior temperature, building envelope temperature, building exterior environmental conditions, energy savings, water consumption, rainwater management, plant and animal biodiversity, noise reduction levels from the exterior, energy efficiency measures, increased green space, citizens' perception of urban nature.

With this document, the SbN selection experience is shared so that other cities, public administrations, private entities, etc. can replicate it. It is important to keep in mind that it is necessary to adapt to the specific contexts, variations and challenges of each project. The replicability plan allows the intervention to be adapted and customized according to local characteristics, taking into account the infrastructure, available resources and particular needs of each project. This type of plan is particularly relevant to support the implementation of BDS, due to the challenges associated with its innovative nature and relatively unknown processes.