



# Life CLIVUT

## Climate Value of Urban Trees

LIFE18 GIC/IT/001217

**ACTION D MONITORING OF THE IMPACTS OF THE PROJECT ACTIONS:  
D1 Urban Climate Green Asset Strategy monitoring protocol**

August 2020

<b>PROGRAMME</b>	LIFE 2014–2020 LIFE Climate Governance and Information
<b>PROJECT ACRONYM</b>	LIFE CLIVUT

PROJECT CODE	LIFE18 GIC/IT/001217
TITLE	ACTION D MONITORING OF THE IMPACTS OF THE PROJECT ACTIONS
ACTION/TASK RELATED	D.1 LCA of Environmental and Climate of the Urban Climate Green Assets Strategy
ACTION/TASK RELATED	D2 Monitoring of Socio Economic Impact
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AUTHOR(S)	UNIPG- DICA
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## Introduction

Climate change has been identified as one of the main threats to humanity and to the long-term persistence of the living world in general (IPCC 2007).

The LIFE CLIVUT General Objective is to develop and implement the Urban Climate Green Asset Strategy in medium-size Mediterranean cities based on the shared planning and management of the urban green and natural spaces by urban planners and citizens.

The Strategy, designed according with an ecosystem-based approaches, will maximize urban green asset climate mitigation potential and deliver biodiversity and nature conservation benefits improving human safety, health and wellbeing.

Action D “MONITORING OF THE IMPACTS OF THE PROJECT ACTIONS” is divided in 2 sub actions:

- D1 LCA of Environmental and Climate of the Urban Climate Green Assets Strategy
- D2 Monitoring of Socio-Economic Impact

It is specifically designed to measure the effectiveness of the project actions, as compared to the initial situation, the objectives and expected results.

## Monitoring Process during Life Clivut project

The monitoring activity will be realized mainly in three times during the project implementation through the collection and elaboration of quantitative or qualitative information related to the project progress in each Municipality.

The first one at the beginning of the implementation phase, end of 2020 – a second one from October 2021 to December 2021 - and a third one at the end of the project that corresponds to the beginning of 2023.

**Table 1: Timing for data collection of the quantitative data**

	Timing
<b>First Monitoring Activity</b> (Defining the Baseline)	From November 2020 to end of February 2021 after the approval of the Monitoring Protocol (December 2020)
<b>Mid-term monitoring activities</b>	October 2021 to December 2021
<b>Third Monitoring Activity</b> (Including the Impact Assessment of the measures included in the Green Asset Strategic Plan)	At the end of the project (end of 2022 and beginning of 2023).

For specific Actions the monitoring will regard qualitative data focused on the monitoring and assessment of the increase of awareness and Knowledge of the different targets of the project: citizens, Public Administration and Planners, Students, Entrepreneurs. It will be carried on through enquires to the different participants. Therefore the data collections will be implemented in two times at the beginning and at the end of related actions/sub-actions.

## ACTION D1: LCA of Environmental and Climate of the Urban Climate Green Assets Strategy

### Quantitative Indicators

The indicators chosen for the quantitative monitoring of the effects of the project with respect to climate change mitigation objectives are described below.

Please note that the indicators refer to the impact of the project on the urban context.

## 1. Green areas in pilot municipality

The objective of Life Clivut is to calculate and disseminate the benefits that trees in urban areas bring for the reduction of the Causes (Impact) of Climate Change (CO2 emissions, PM10,) and the mitigation of their effects on the well-being of citizens (increase of the Temperature in the city better known as Heat Island, lung diseases etc).

In each pilot city data from the green areas and trees (public and private) will be collected . The monitoring will be carried out through the official statistical sources, the surveys of existing data within the Municipal Administrations of the pilot cities and also through the direct census of trees (Action A3 by the Project partners, C2 with the Citizens, and C3 with the students).

The "climatic" services of the trees present in each pilot city will be estimated through the algorithms developed in action A4 and present in the Web App created in the project and available at [www.lifeclivut.treedb.eu](http://www.lifeclivut.treedb.eu).

CRITERIA	INDICATOR	DATA TYPOLOGY	PERIOD			SOURCES	
			Baseline	years of project	End Project	BASELINE	END PROJECT
PUBLIC AND PRIVATE GREEN AREAS	Public Green Areas	HA	2019	2020-2022	2023	EUROSTAT/ Municipality	EUROSTAT/ Municipality
	Private green Areas	Ha	2019		2023	MUNICIPALITY land use data /estimation from satellite photos	MUNICIPALITY land use data /estimation
	Trees in public areas	Number and species	2019		2023	Municipality	Municipality /Life Clivut Platform
	Trees in private areas	Numbers	2019		2023	MUNICIPALITY land use data /estimation from satellite or aerial photos	Estimation from satellite or aerial Photo
	Trees planted in public areas funded by the project	Numbers and species		2020-2022	2023		Municipality /Life Clivut Platform
	Trees planted in public areas (other funds)	Numbers and species		2020-2022	2023		Municipality/Life Clivut Platform
	Trees planted in private areas funded by the project	Numbers and species		2020-2022	2023		Life Clivut Platform

Trees planted in private areas and (other funds)	Numbers and species		2020-2022	2023		
Trees substituted in public areas	Numbers and species	2019	2020-2022	2023	Municipality	Municipality/ Life Clivut Platform
Trees substituted in private areas (authorized by Municipality)	Numbers and species	2019	2020-2022	2023	Municipality	Municipality/ Life Clivut Platform
/Trees substituted in private areas (others)	Numbers and species		2020-2022	2023		Life Clivut Platform
Area covered by new and substituted trees	ha influenced by trees mitigation action			2023		Life Clivut Platform

## 2. CO2 capture and storage (sequestration)

Life Clivut support the 4 pilot Municipalities to design and adopt climate mitigation strategies and plan through the management of Urban Trees.

The CO2 reduction due to the increase / replacement of trees, both in the Pilot Cities and in the transfer cities, will be monitored using the data from the monitoring activities regarding the Green Areas referred to in the previous point.

- Estimates of CO2 capture will be made using the algorithms developed in action A4 and present on the [www.lifeclivut.tredb.eu](http://www.lifeclivut.tredb.eu), platform based on the following tracking data: number of public trees present at the start of the base line project (survey at the municipality and estimate through the data produced by the A2 Action census in the 10 pilot areas);
- New planting of trees during the project both funded directly by the project and from other sources of public and private funding (survey of the Administrations and activities with citizens);
- Replacement of both public and private trees with species recommended by the Strategic Plan (survey by the Municipal Administrations and activities with citizens).

For each of these indicators, will be calculated the annual CO2 sequestration capacity and storage during

their useful life of the detected trees.

CRITERIA	INDICATOR	DATA TYPOLOGY	PERIOD			SOURCES		METHODOLOGY
			BASELINE	YEARS OF PROJECT	END PROJECT	BASELINE	END PROJECT	
Carbon capture and storage	Carbon captured and stored by trees in public areas	tons/years	2019	2020-2022	2023	Estimation on trees data from Municipality		Life Clivut Platform Calculated by the platform
	Carbon captured and stored by private trees registered in the LIFE CLIVUT Platform	tons/years		2020-2022	2023			
Increase in Carbon capture and storage	Carbon captured and stored by new planted trees (in public and private areas)	tons/years		2020-2022	2023			
	Carbon captured and stored by substituted trees (in public and private areas)	tons/years		2020-2022	2023			

The calculation will allow the construction of the following indicators for CO2 capture:

- 1) CO2 reduction due to the planting of new trees in the 4 pilot cities;
- 2) CO2 reduction due to the replacement of existing trees with more performing species from a climatic point of view in the 4 pilot cities;
- 3) CO2 reduction due to the planting of new trees for the transfer of project actions to other cities;
- 4) CO2 reduction due to the replacement of existing trees with more performing species from the climate point of view for the transfer of project actions to other cities.

Carbon captured by trees in public areas	End 2020	End 2021	End project
	Ton/years		
Pilot Municipalities	Estimated using the 10 pilot census areas		
Transfer Municipalities	N.A		

Carbon captured by trees in private areas	End 2020	End 2021	End project
	Ton/years		
Pilot Municipalities	Estimated using the 10 pilot census areas		
Transfer Municipalities	N.A		

### 3. Air Quality

For air quality, the main indicators that are monitored at European level will be detected in the 4 Pilot Cities, shown in the following table:

CRITERIA	INDICATOR	DATA TYPOLOGY	PERIOD			SOURCES		METHODOLOGY
			BASELINE	YEARS OF PROJECT	END PROJECT	BASELINE	END PROJECT	
Air quality	CO2	per month/ media per years	2019	2020-2022	2023	Regional Agency for Environment	Regional Agency for Environment	Data from monitoring stations in the Municipality
	NOX							
	PM 10							





Pm10 Sequestration	Pm10 Captured by trees in public areas	mg per years and per month	2019	2020-2022	2023	Estimation on trees data from Municipality	Life Clivut Platform	Calculated by the platform
	Pm10 Capture by trees registered in the Life Clivut Platform	mg per years and per month		2020-2022	2023	Estimation on trees registered		

## 5. Reduction of electricity consumption

Trees have an important reducing effect on temperature in the City, which is normally 3-5 °C degrees higher than in the surrounding rural areas (Urban Heat Island).

The contribution of the project to the temperature reduction of the pilot cities will be estimated according to the different methods:

a) Estimation of the evapotranspiration of new trees planted or replaced and transformation. Data from the weather stations in the 4 Pilot Cities will be used to estimate the trees evapotranspiration.

CRITERIA	INDICATOR	DATA TYPOLOGY	PERIOD			SOURCES		METHODOLOGY
			BASELINE	YEARS OF PROJECT	END PROJECT	BASELINE	END PROJECT	
Electricity consumption reduction	Reduction on electricity due to evapotranspiration of new planted trees	Min & Max Daily Temp		2020-2022	2023	Municipality Weather Municipality	Calculated by the platform	

b) temperature monitoring inside buildings of representative types of those present in pilot cities in environments where the external walls are shaded by trees.

In each pilot city, 3-4 types of representative buildings will be identified. The types will be differentiated on the basis of construction materials and their energy classification. Sample buildings will be chosen based on the presence of areas on the same wall that are shaded by trees and areas completely exposed to radiation. In the rooms behind the façade, from June onwards, temperature and humidity meters will be placed to detect the temperature at different times of the day. The temperature in the rooms shaded by trees and in those exposed to direct solar radiation will be compared. Finally, the estimate of the electricity required will

be carried out and both rooms will be brought to a temperature of 20-21 ° C through air conditioning equipment.<sup>1</sup>

## 6. Biodiversity

Another important indicator will be the Biodiversity, its monitoring will help us to control and counter the spread of invasive and harmful plant species for the ecosystem.

The indicators identified concern these species: *Amorpha fruticosa*, *Catalpa bignonioides*, *Ailanthus altissima*

CRITERIA	INDICATOR	DATA TYPOLOGY	PERIOD			SOURCES		METHODOLOGY
			BASELINE	YEARS OF PROJECT	END PROJECT	BASELINE	END PROJECT	
Biodiversity	Number of alien species	number per ha per single specie	2019	2020-2022	2023	Municipality	Life Platform Clivut	From the Public trees census/ substitution/ other sources (life projects etc)

## Monitoring of the effects of the CLIVUT Green Asset Strategy

Life CLIVUT will design an **Urban Climate Green Assets Strategy** for the green areas of the Pilot Cities to optimize their climatic and environmental performance, and also identify new incentives for offsetting emissions through trees. Only the Municipality of Bologna (of the four pilot Municipality) has developed an Urban Plan for green areas including climatic aspects. Within the project, the plan will be up-dated with new data and actions.

## 7. Area affected by climate change covered by the Urban Climate Green Assets Strategy

The Urban Climate Green Assets Strategy is designed for all the administrative surfaces of the 4 pilot cities and those where the project results will be transferred. Therefore all the Area of the Municipality is considered as the impact area of the project.

CRITERIA	INDICATOR	DATA TYPOLOGY	PERIOD			SOURCES		METHODOLOGY
			BASELINE	YEARS OF PROJECT	END PROJECT	BASELINE	END PROJECT	

Dimensional impact of the project (Area affected by the project)	Area of Pilot Cities	Ha	2019	2020-2022	2023	Municipality	Statistical Administrative data
	Area of transfer Cities						

### 8. Total human population to benefit from the project

The values reported below are referred to the population of the municipalities that will adopt the Strategic Plan, plus the municipalities where the project will be transferred and replicated during the project, and where one or more actions of the project will be implemented (i.e. Trees census by the Life Clivut Platform. Capacity Building actions etc)

CRITERIA	INDICATOR	DATA TYPOLOGY	PERIOD			SOURCES		METHODOLOGY
			BASELINE	YEARS OF PROJECT	END PROJECT	BASELINE	END PROJECT	
Total Human population to benefit from the project	Resident population in the Pilot Cities	Number of citizens	2019	2020-2022	2023	Municipality	Population census data	
	Resident population in transfer Cities							
	Resident population in Cities where are implemented LC actions							

### 9. Population directly affected from the project actions in climate terms.

The project provides the plantation of new trees and replacement of existing ones. This will lead to an improvement in the air quality and comfort of the resident population near the area of new plantation. We chose to consider a range of 500 m from the site of the new plants equal to the possibility of reaching the plant areas in 10 minutes on foot (see 2020-2030 ONU sustainability objectives).

CRITERIA	INDICATOR	DATA TYPOLOGY	PERIOD			SOURCES		METHODOLOGY
			BASELINE	YEARS OF PROJECT	END PROJECT	BASELINE	END PROJECT	
Citizen Benefits	Resident population in the neighbourhoods where plants are planted / replaced in Pilot Cities	Number of Citizens living within 500 meters from the new plantations		2020-2022	2023	Municipality census	Municipality census	Estimation from population census data
	Resident population in the neighbourhoods where plants are planted / replaced in Transfer Cities	in public and private areas financed by the project		2020-2022	2023	Municipality census	Municipality census	

In order to make the effects of the benefits on the population more explicit, will also be collected statistical data relating to the incidence of diseases caused by air pollution and urban heat island on the population.

## IMPACT OF PILOT ACTIONS CONTAINED IN THE URBAN GREEN ASSET STRATEGY

The evaluation of the environmental impact of mitigation pilot actions and incentives contained urban green asset strategy will be carried on using the LCA methodology.

A benchmarking methodology will be used to evaluate the environmental effects in the absence and in the presence of such actions on the pilot cities.

The scheme of the assessment of the impact of each action is reported in the following table:

	LCA (CO2 Emission and equivalent)		Sources of Data	
	BASELINE	PROJECT RESULTS	BASELINE	PROJECT RESULTS
<b>ACTION C1</b>	Actual urban forest management practices (species, pruning, location )	New practices included/recommended in the Strategic Plan	Actual municipality regulation for green infrastructure management/ City Administration	Urban Climate Green Assets Strategy
<b>ACTION C2</b>	Actual choice of citizens for private gardens	New practices included/recommended in the Strategic Plan for private gardens	Interviews with nurseries and professionals and census data	Urban Climate Green Assets Strategy
<b>ACTION C3</b>	Actual green infrastructure in the school/University participating in the project	New practices included/recommended in the Strategic Plan	Data collection in the schools / university	Urban Climate Green Assets Strategy
<b>ACTION C4</b>	4 main business sectors (industry, tourism, retail, transport)	Incentives included in the strategic Plan for the sectors	Emission Literature and Case studies of Companies participating to the actions and main City events	Urban Climate Green Assets Strategy

## Improvements in green governance tools in pilot cities

Changes in governance will be detected, including green management techniques through a monitoring of the methods currently used and recommended for the management of trees in green areas, contained in official documents of the administrations (green regulation, green plan, recommended species, etc.).

The base line will be detected through the reconnaissance of the green regulations of the criteria currently adopted in the direct and indirect management of green areas and trees by the pilot municipalities. Any Changes will be monitored during the project induced by the drafting of a strategic plan.

	Green public areas	Green private areas open to public	Others Green private areas	Green public areas	Green private areas open to public	Others Green private areas
<b>ISSUES</b>	Present	Not present	Brief description of contents with particular reference to the climatic role of trees	Present	Not present	Brief description of contents with particular reference to the climatic role of trees

References to the role of trees in climate change						
Management of green areas by city associations						
Private sponsorship of green areas / tree plantings						
Incentives for the creation of private green areas and green roofs (green roofs etc.)						
Use of green areas for events						
Monitoring of the use of green areas						
urban gardens						
Historic Green						
Equipped green areas						
Classification of trees						
Monumental trees						
Tree protection criteria						
criteria for pruning						
criteria for substitution						
Criteria for care and maintenance of public areas						
Criteria for care and maintenance of private areas						
Trees balance						
Forecast of new plants						
criteria for Public green design						
criteria for Design private green areas						
Forbidden trees						
Recommended trees and related criteria						
calculation of the economic value of trees						