MANAGEMENT MANUAL FOR LOCAL CARBON MARKETS

CARBOMARK PROJECT

GENERAL PART

Development of policies for the creation of local voluntary carbon markets for mitigating climate change

INDEX

GENERAL PART

Graphs:

GENERAL PART

CHAPTER 1 - THE LOCAL VOLUNTARY CARBOMARK MARKET: operational guidelines and procedures.

1.1 Introduction - Ethic and guiding principles of the Market.

In recent years, between various activities aimed at mitigating climate change, the role of our forests has gained credibility mainly due to the efforts of the scientific community in defining a measurement and monitoring protocol for credits, and to the political consensus regarding the necessity of reducing emissions in the quickest and most efficient way possible. However, though many buyers are attracted to the Market of agro-forestry credits due to the "tangibility" that such projects offer, many others remain discouraged due to the complexity and the risks that may arise from such projects. In response to the growing relevance of forest mitigation projects in the international and Italian markets for the specific goal of offsetting greenhouse gas emissions, the Carbomark project has set itself two challenges:

- to develop mitigation projects which offer long-lasting and reliable carbon credits, and thus to contribute to the reduction of emissions on a local scale;
- to launch a market of local credits.

In this way, Carbomark aims at an acknowledgement of the role played by the forests, but also of the roles of other activities such as urban forestry, in mitigating climate change, and also aims at offering opportunities to forest owners for the climactic function performed by their woods and to public bodies that adopt "green policies".

The Carbomark project aims at developing carbon credits of high quality that not only guarantee the effective mitigation of emissions, but also increase investor trust in the sector. Together with the definition of credible and long-lasting credits, the project introduces the concept of the proximity offset. This principle responds to the necessity to adopt actions whose socio-environmental benefits are not only climactic, but are perceptible and appreciable by the local community and by emitters that invest in the Market.

In this way the investors-emitters do not only offset company emissions, but also contribute to improving the environment in which they operate.

The main inspiriting principles of the Carbomark Market can be summarised in the following points:

- harmonisation;
- rigour and credibility;
- transparency of methodologies and information;
- innovation.

1.1.1 Harmonisation.

The voluntary market across the globe, and particularly the Carbon Credit Market from agro-forestry mitigation activities, is highly diversified with regard to credit supply and demand, the credit types, and the methodologies used for developing projects. In particular, with regard to the supply of "forestry offsets", projects differ significantly according to the counting methodologies used and the certification standards adopted.

Historically, the Market share of voluntary agro-forestry carbon credits has been important, and in 2009 in terms of total volume it represented 24% of the total of credits, i.e. more than the double compared to 2008, when exchange halted at 11% of the total[1]. The main characteristic of this Market was, and remains, that it is not driven or dictated by a specific regulation. The growth in forestry certification standards and specific protocols for agro-forestry offset measures has certainly contributed to greater transparency and harmonisation, without however becoming a universally acknowledged system of standards and protocols.

In Italy, and particularly in recent years, the supply of offsetting credits on the voluntary market has also grown, particularly from afforestation, reforestation, and public green.

In this context, the Carbomark project puts forward the goal of defining the eligibility criteria for credits and the methodologies used in a transparent way, in order to guarantee that they are real, permanent, additional, and unique.

The methodology proposed by the project can contribute to the unification and harmonisation of the various existing approaches for the development of credits in the Italian and international voluntary markets, and construct a "**benchmark**" for those wishing to develop and adopt the types of forestry credits of the Carbomark Market.

1.1.2 Rigour and credibility.

One of the most critical aspects of offsetting credits has often been to demonstrate the credibility of the credits produced and their effective contribution to long-term mitigation. Aspects such as the permanence of credits from forestry activities or urban forestry and their potential reversibility, have contributed and continue to contribute to a fall in investor trust, causing them to opt for other credits with a guarantee of a long-term permanence of mitigation, such as projects in renewable energy and other projects that invest in clean technologies.

In order to increase and guarantee the credibility and reliability of the credits sold on the Carbomark Market, the following procedures and methodological approaches are followed:

- careful selection of eligible credits in the Market. Some credits that are generated by activities such as afforestation and reforestation, even though sought-after by investors and emitters in the Italian voluntary market for their appeal, have been excluded because it is difficult to demonstrate their financial additionality, insofar as the operation would probably have been sustained without the incentive of credits;

[1] Source: Hamilton et.al (2010) Building Bridges. State of the Voluntary Carbon Markets 2010. Forest Trends, Ecosystem Marketplace, Bloomberg New Energy Finance.

- identification of a methodology which counters the problem of the non-permanence of credits if unpredictable events occur, by using a buffer or credit reserve instrument which guarantees against eventual losses and small offsets. The share of these “provisional” credits insures against carbon losses and will not be returned at the end of the commitment period;
- definition of purchase contracts between buyers and sellers which identify, for both the parties, long-term commitments.

1.1.3 Transparency and information.

One of the crucial aspects of the global and Italian voluntary market is the transparency of information. The absence of binding rules and regulations means that as opposed to credits which are certified according to acknowledged certification standards, many other credits, including many forestry credits, are exchanged on the Market without offering duration guarantees, and, above all, without offering transparency regarding the counting and monitoring or credits and, thus, of the real and long-lasting offset of emissions.

The project has identified criteria for the choice and eligibility of credits, minimum requirements and methodologies to be used to tackle the crucial aspects of the projects, such as the permanence of credits, the **baseline**, and the counting and monitoring activities. Finally, specific protocols have been adopted for each type of credit, which clearly and transparently define, among the various features, the method for counting credits, the monitoring over time, and how to reduce the risk linked to the occurrence of disturbances, and the duration of the credits. These protocols are accessible and can be consulted by both buyers and sellers, but also by Market operators that wish to compare the procedures and the approach adopted.

Transparency of information is further guaranteed by the website (www.carbomark.org**), which allows the public to have access to project documents so that visitors, Market operators, buyers, and sellers are encouraged to carry out comparisons with other methodologies and types of credit**. The website also represents a window into the forestry offset market in Italy and abroad, encouraging mitigation actions.

1.1.4 Innovation.

Among the strengths of the voluntary market is its ability to experiment with innovative mitigation actions, and to test new types of credits which may then become the **mainstream** and be adopted into the regulated market. The greater flexibility of the voluntary market in fact allows for the adoption of more flexible methodological approaches and for the development of small-scale pilot projects.

The Carbomark Market, also in coherence with the objectives of the LIFE+ programme which finance highly innovative projects, has embarked upon two highly innovative activities:

- the creation of a credit exchange platform on a “local” level;
- the adoption of innovative mitigation measures for which protocols are defined for the counting of carbon sequestration. Among these measures, there is the use of wood products to replace energy intensive materials, urban forestry, and biochar.

1.2. Why the voluntary carbon offset?

In general when using the term **carbon offsetting**, we intend a mechanism in which, in parallel with the reduction of greenhouse gas emissions at the source, an emitter buys from a third party a quantity of carbon credits which is equivalent to the emissions that must be reduced. The fundamental principal of **carbon offsetting** is that a certain quantity of greenhouse gases produced in one place may be offset by reducing or sequestering the same quantity of carbon in another place.

In the voluntary market, offsetting occurs on a voluntary basis and not because it is required by a specific national regulation or by a particular sector fixing a “cap” on emissions.

In order to generate an effective environmental impact, the voluntary offset should ideally be accompanied by actions and efforts to reduce emissions at the source, and changes in individual behaviour or in the production process.

According to a report by the McKinsey Institute[2], the main opportunities for reducing greenhouse gases from now until 2030 are divided into four categories of action: energy efficiency, low carbon energy production, agro-forestry measures, and behavioural changes.

The long-term goal is the attainment of neutrality of emissions through measures for reducing energy consumption and waste, energy efficiency, the commitment to renewable energies, sustainable transport and finally, offsetting.

1.3 Reasons for entering the Market.

The voluntary market is driven by investors that buy credits for two principal reasons: to act on an exclusively voluntary basis in order to offset emissions; and to anticipate future regulations and norms which may introduce caps on emissions. Inevitably without an obligation to reduce emissions, **the emphasis of voluntary projects is on ethical aspects, public relations, and green marketing.**

The reasons for investing in a voluntary market can be summarised in six main factors where, in relation to the type of business and production activity performed by the emitter, each of factor may assume a crucial and prevalent role in motivation.

- **Corporate responsibility/environmental ethics.** The adoption of an emission reduction policy is part of a general strategy for improving social and environmental impacts. Together with its environmental goals, the company feels motivated to contribute to the reduction of greenhouse gas emissions for ethical reasons.
- **Image and public relations.** The company benefits from the positive image that derives from the battle against climate change in relations with investors, clients, and business partners.

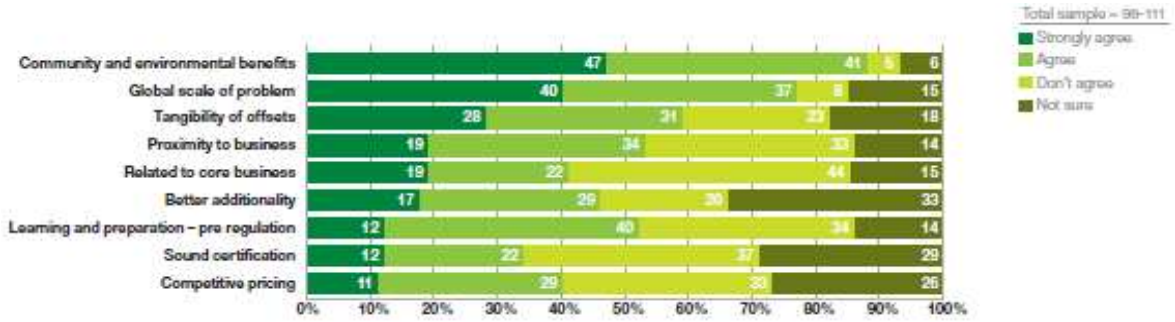
[2] Source: McKinsey (2010). Pathways to a Low-Carbon Economy. McKinsey&Company

- **The sale of "carbon neutral" products ".** This reason is particularly relevant for companies and industries whose products have a high "carbon footprint", such as energy intensive products and also mass consumption products, where the consumer perceives the impact of the product and where an emission reduction strategy for the product may contribute to gaining market shares.
- **Anticipation of future regulations (pre-compliance).** The prediction of future regulations which limit and pose a cap on emissions, or the prediction of a legislation which defines a cap on emissions, may encourage a company to adopt voluntary reductions in order to position itself in a more competitive area of economic and technological advantage.
- **Business model influenced by climate change di business.** Some service sectors such as insurance companies, infrastructures and services in tourist destinations may be particularly vulnerable to the impacts of climate change. For these reasons, these sectors voluntarily adopt actions to reduce and offset emissions.
- **Pure investment.** Some operators buy voluntary credits from a purely market perspective, with a view to sell them at a higher price in a regulated market or if the demand and price of that type of credit rises.

If these are the general reasons which encourage voluntary offsetting actions, **the specific interests of investors in agro-forestry credits, compared to other types of credit** represents an important element in understanding the reasons and the opportunities for local emitters to enter into the Carbomark Market.

According to a recent global survey concerning the interest in investing in the forestry credits market, among the main reasons for investing, as is shown in graph 1, **are environment and community benefits,** followed by the perception of the global scale of forestry and its impacts. The awareness that forestry measures and *in primis* the avoidance of deforestation, together with other measures such as forest management and afforestation, can contribute significantly to reducing the problem of climate change, is among the main factors that drive investors towards this type of project (Neef et al. 2009). **The proximity of the offset project** to the investor's production activity, as is the case for the Carbomark Market, represents a **motivational plus** when compared to making an investment in another country or distant area where the environmental benefits are perceived elsewhere.

Graph 1: reasons for investing in forestry carbon credits



Source: The Forest carbon offsetting survey 2009

1.4 Strengths of the Carbomark Market.

The Carbomark project has many strengths, they can be summarised in the following points:

- The credits in the Market are **project-based**. Of the 4 types of activities considered (forest management, wood products, urban forestry, and biochar), it is only for forest management that the problem of avoiding "**double accounting**" on a national level arises, insofar as wood products and biochar are excluded from articles 3.3 and 3.4 of the Kyoto Protocol. For afforestation activities, only those concerning the urban environment are included, in order to avoid the risk of double accounting with that which is counted on a national level (art. 3.3 PK).
- The counting of carbon sequestration from forest management activities, in the credit calculation formula, considers sequestration as generated by an activity that is additional to "**business as usual**" forest management. It is predicted that forest owners will adopt forest management strategies which are binding for 30 years, and which involve the sequestering of additional carbon with respect to the actual situation or to the current management practices on a local or regional level. Other than this, to avoid the risks of a double accounting, a coefficient will be introduced on the deductions for forest disturbances; it will be assessed on a local or national level, and the greater in value will be used.
- Under the hypothesis that a national register of carbon credits is created, the credit counted by the Carbomark project would not impair the credits generated by forest management counted on a national level. In fact, in terms of carbon sequestration, the "Carbomark" credit is generated by even more virtuous forest management activities, from those which are normally in force and actually counted in the national cap.
- The Carbomark project aims at solving the questions of additionality of the four agro-forestry activities in a credible and rigorous manner, even in the case of activities that are not considered in the Kyoto Protocol; and questions of permanence (30 year obligation) and baseline. Other than this, the basis for a calculation methodology for "innovative" credits, such as wood products and biochar has been put in place.
- An important aspect regarding the concept of additional policies is that "additionality" should be seen as part of the **whole system of reduction (forest-company**) activated by Carbomark, and not only as one of the sectors involved (e.g. forestry). In fact, the project aims at creating an "absorber-emitter" binomial which demonstrates to achieve an overall reduction in emissions compared with that which was the value of the system carbon balance before entering the Market. This can happen because carbon shares are not sold freely (as in other voluntary markets), but only to a group of companies that have previously declared their intent to reduce their carbon dioxide emissions during the commitment period of the project. This effective reduction in emissions, associated with the forest owner's obligation to maintain a greater stock of carbon, proves to be the result of additional policies, in comparison to that which the forest-company system used to put into use before its entrance into the Carbomark Market. Therefore, in the moment that the emitting companies and a specific forest producer sign the contract, the Carbomark Market generates a unique example of a reduction/mitigation policy for emissions.

During the implementation of commitments, this *unicum* creates an effective policy variation compared to that which forest owners and emitting companies would have been able to do separately, before the Carbomark Market. The project thus becomes the promoter of the improvement in the **environmental performance of the "forest-company" system**.

- The Regions of Friuli Venezia Giulia and Veneto are promoters of the Project, they collaborate with Market players in the calculation of credits and emissions, and have instituted two regional Observatories that will be responsible not only for the credit register, but also for the monitoring of the Market during and after the end of the project. This activity should guarantee the credibility and transparency of exchange operations within the Market.
- The Carbomark Market allows for the **implementation and replication** of a credible standard of reference, also in other administrative areas.
- In the Regions of Veneto and Friuli Venezia Giulia, similar projects created without the payment of carbon credits do not exist.
- The Carbomark project is not provided for by any regional or national regulations, but is a voluntary initiative.
- Without the project a rise in fixation, i.e., a reduction in emissions, would not have been achieved.

Through the Carbomark Project, we aim at achieving an improvement in policies towards local and voluntary Carbon Markets to mitigate climate change, by offering a valid and solid alternative to the voluntary reduction measures in the forestry sector; this kind of voluntary measures have flourished in Italy, but often involve afforestation and reforestation activities of doubtful additionality compared with that which is counted by article 3.3. of the KP.

The purchasing of credits in the Carbomark Market does not therefore interfere with commitments adopted by the Italian government at an international level insofar as the CAP outlined on a regional level will be guaranteed nonetheless.

With particular reference to sustainable forest management, it should be clarified that credits subject to sale on the Carbomark Market are intended not as veritable carbon credits, but as an indirect indicator of the additional commitments assumed voluntarily by forest owners as a demonstration of the voluntary implementation of "**best practices**" of forest management, associated with the connected environmental benefits.

With the Carbomark Market, we aim at demonstrating the possibility of monetising one of the many forest externalities not directly connected to the sale of wood. In this context, the Carbomark Market works exclusively with the aim of linking one of these forest externalities, i.e. the voluntary application of management practices that are better than reference standards, to the possibility of buying a deliverable brand in the "**green marketing**" company sector.

The Carbomark Market aims at offering an example for the possible implementation of a real voluntary Carbon Credit Market in the future, to be launched should full operational conditions persist, that is after 2012, upon the expiry of the KP commitments, and therefore not before the recording in the national balance report occurs in 2014. In any case, the system of calculations proposed by this manual will be valid until the end of 2012. After this date, the system will be updated bearing in mind the new regulations of the regulated market, and any subsequent national and international agreements.

CHAPTER 2 – HOW THE CARBOMARK MARKET WORKS

2.1. Characteristics of the Market.

The Carbomark Market operates in Italy, within the territory of the Regions of Veneto and Friuli Venezia Giulia. Should the supply of credits be greater than local demand, credits may be sold to other Italian emitters that do not have reduction obligations in the regulated market provided for by the Kyoto Protocol. The carbon offset and sequestration projects must instead only take place within the territory of the two Regions.

The Carbomark Market operates outside of the regulated market and the obligations provided for by the Kyoto Protocol, which was ratified by Italy. Joining the Market happens on a voluntary base, and emitters that join the Market do not assume binding obligations in terms of long-term emission reduction, even if it is desirable that the offset is accompanied by a commitment to curb emissions. The Market does not therefore function as a “cap-and-trade” system whereby an emission reduction cap is assigned to emitters. Joining the Market, although a voluntary action, does however involve obligations and commitments for buyers and sellers, mainly regarding the duration of the commitment, the respect for agro-forestry credit protocols, and the commitment not to resell credits.

The exchange of credits occurs in the form of a direct contract between buyers and sellers, in which both assume the entailed obligations.

2.1.1 Market players.

The pilot phase of the development of the Market requires the participation of the players described below.

Buyers of credits

The buyers in the Market are small- and medium-sized business, multi-utility companies and service companies which do not fall under the reduction obligations provided for by the Kyoto Protocol, i.e. they are not included in Annex I to the Directive 2003/87/EC which amends Directive 2003/87/EC establishing a Community-level a system for the exchange of CO_2 emission shares, known as EUA (EU Allowances). In particular cases, local public bodies may also buy credits. Buyers may come from all production sectors, but also from the finance sector (banks), the energy sector (multi-utility), local transport services, etc.

The Carbomark Markets asks buyers for a commitment to reduction, an element that is almost unique in Italy where transactions in the voluntary market happen on project, without obligations for the emitters.

Participation in the Carbomark Market induces companies not only to carry out **carbon offsetting**, but also and above all, to carry out **carbon insetting**, i.e. to institute a partnership or investment in an emission reduction activity, which falls within the company own sphere of influence and interest. Carbomark companies explore activities which go beyond carbon offsetting, looking for opportunities to cut emissions within the confines of their own activity.

In the first phase of activity, the Market is only open to operators within the territory of the two regions. In the event that supply of credits is greater than demand, other Italian emitters may also buy locally generated credits.

Sellers of credits

The sellers of credits are forest owners, local public bodies, and private individuals that have adopted agro-forestry measures which contribute to carbon sequestration. Joining the Market occurs subject to the verification of the seller's eligibility requirements and the mitigation actions adopted.

External auditors

Technicians with adequate training (see Special Part, Chapter 2, paragraph 2.4) perform the audit of the Carbomark Market system and credits.

Partners of the project

Other than market players, the partners of the Carbomark project also work within the Market having the role of defining protocols for the implementation of projects, purchase contracts, the structure and operation of the Market, as well as instituting a credit register, monitoring the projects and transactions during design and post-design phases. These activities take place within two "Carbomark Market Observatories", each of which focuses its activities within a particular Region.

Veneto Region - Is the lead partner and coordinator of the project and actions of the Market in Veneto, as well as of the Veneto Observatory.

The University of Udine and the University of Padua – They are responsible for the scientific and methodological aspects of the project. Together with other partners, they develop methodologies and protocols for the definition of agro-forestry credits, and coordinate the training of operators and professionals who are to apply such protocols.

The Region of Friuli Venezia Giulia - Is responsible for the actions of the Market in the Region of Friuli Venezia Giulia and for the Observatory, and collaborates with other partners in the development of protocols and methodologies.

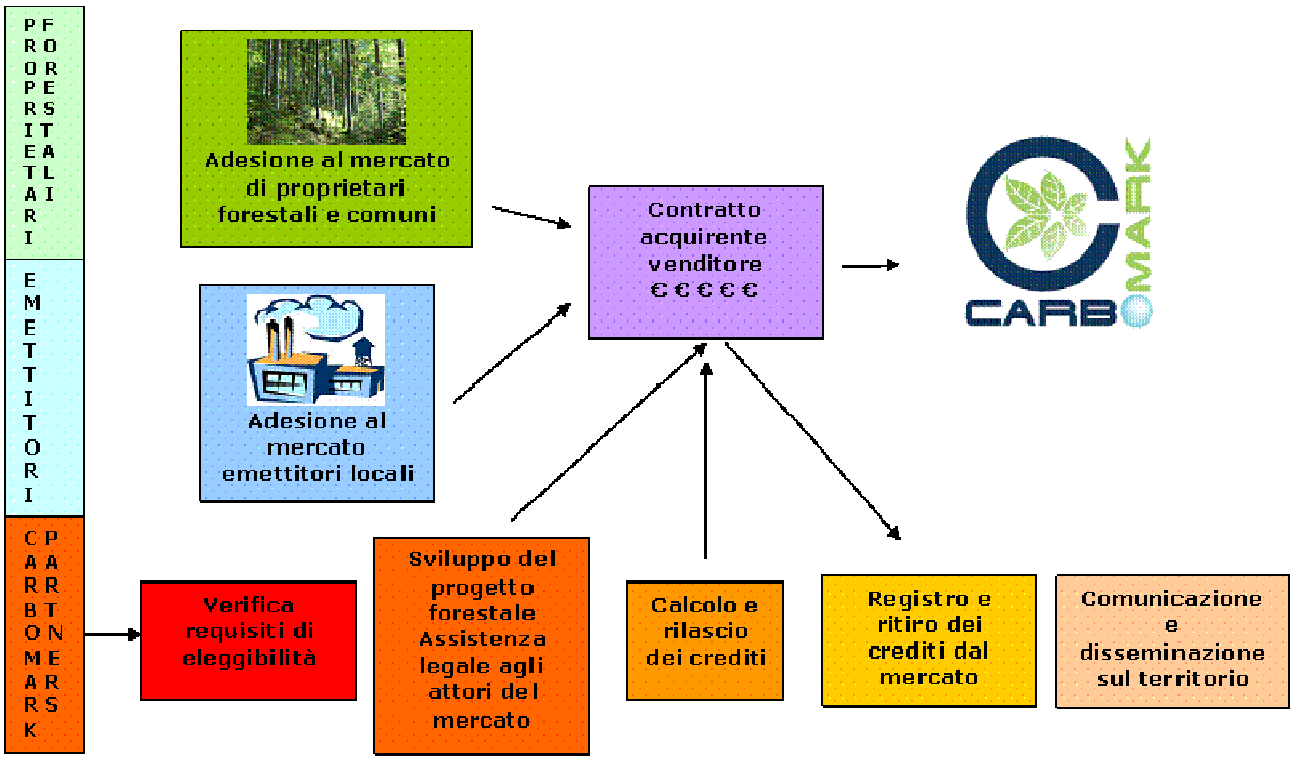
2.2. Exchange methods and the price of credits.

In the Carbomark Market, credits are generated by the following types of projects:

- carbon sequestration projects from sustainable forest management;
- urban forestry projects;
- projects which encourage the use of wood products in lieu of other energy intensive materials;
- production and distribution of charcoal in the soil (biochar).

La The fourth possibility, the production and use of biochar, for the time being is adopted at an experimental level.

Diagram 1: operation of the Carbomark credit Market



The projects generate carbon credits exchanged on the local market through a contract between buyers and emitters. The shares of credits generated by the project can be sold to a single buyer or divided and sold to different emitters. Table 1 shows the indicative prices of credits according to type and the main factors that contribute towards the definition of price on a local scale.

Table 1: indicative prices of carbon credits and the factors that contribute towards their definition.

Type of offset measure	Factors affecting carbon credits						Price range (€/tCO2)
	Price of credit on the International voluntary market	Additional benefits (biodiversity, recreational function, landscape, etc.)	Credit issued ex-ante or ex-post	Duration of credit according to the project	Existent and applicable certification schemes	Maintenance cost	
Forest management	Available	Medium/high	Ex-ante	30 years	PEFC FSC	Low	4 - 13
Long-lasting wood products	Unavailable	None	Ex-post	50 years	PEFC FSC	None	20-60
Urban forestry	Unavailable	High	Ex-post	30 years	None	High	30-80

Key:

High-weight factor

Medium- weight factor

Low- weight factor

The choice of the credit duration for forest management and urban forestry, equal to 30 years, is motivated by various factors.

First of all, for forestry projects, 30 years represent a sufficiently long period of time to guarantee the permanence of carbon sequestration policies, and a temporal guarantee to both mitigation activities and the credit buyer. From surveys carried out in the territory in which the Market operates, a longer period would represent a commitment which forest owners, but mainly local bodies, would not be able to assume upon joining the Market. Furthermore, in support of a permanence period of 30 years, intended as the minimum permanence of the credit, it is worth referring to other forestry projects including REDD, which on average refers to a credit lifecycle as being equal to 30 years (see for example, the first project to avoid deforestation, certified by the Voluntary Carbon Standard in Kenya where the permanence period of the credits was fixed at 30 years).

With regard to wood products, the duration of credits is linked to the average lifecycle of the wood products admissible into the Market, which on average, is between 30 and 50 years (Profft et al. 2009).

2.3. Elements of reference for the sale of carbon credits.

Below the main elements of reference which must be considered when buying and selling carbon credits are outlined, with reference to the voluntary market established by the Carbomark project.

General criteria

Public or private entities may buy or sell carbon credits, as detailed in chapter 2.1.1, if they are in possession of the requirements as defined by this Market Model Manual, and provided that they are registered to the Carbomark Market. Joining the Carbomark Market happens first by the signing of the manifestation of interest, via the online form on the Carbomark project website, following the instructions shown, and then by a specific letter of commitment (Annexes, A1, A2, A3 for sellers and Annex B for buyers).

The quantity of carbon credits exchanged on the Market between an individual buyer and seller is defined as a “carbon share”.

Sales procedures

Private entities that intend to put carbon credits up for sale are free to adopt the sale procedures that they consider most appropriate, except for the obligation to respect the minimum quantitative requirement, providing a sale announcement via the Carbomark project website. It is the responsibility of these entities to adapt themselves to the procedures to which public entities are bound.

Public entities that intend to put carbon credits up for sale can identify buyers via public auction notice procedures, respecting the national and community regulations in force.

On this point, it is highlighted that the methods of sale for carbon credits can refer to the procedures used for the sale of wood, notwithstanding the specificity connected to the application of this manual.

More specifically, with reference to Public bodies, for legal and regulatory aspects reference can be made to the Royal Decree of 23rd May 1924, no. 827 (in the *Gazzetta Ufficiale*,* 3rd June 1924, no. 130, ordinary supplement) “Regulation for the administration of assets and for the general accounting of the State”, or to Legislative Decree of 12th April 2006, no. 163 (in the *Gazzetta Ufficiale,* 2nd May 2006, no. 100) “Code of public contracts relative to works, services and supply, in implementation of Directives 2004/17/EC and 2004/18/EC” .

Publicity

Publicity relative to the intention to sell carbon shares must at least include information via the Carbomark project website and, for public entities, the addition of a specific “notification” on the municipal court notice board, or equivalent is required. It is the faculty of the seller to adopt additional publicity tools aimed at making its intention to sell more visible, such as individual invitations to players within the Carbomark Market, for example.

*Translator’s note: Italian official journal.

Call for purchase

Call for purchase made by buyers refers to the regulations for the specific auction notice, should they be necessary. Generally, the amount offered for a single t/CO_2 is indicated at the same time as indicating the quantity of shares one intends to purchase.

In the event that the most advantageous offer does not exhaust the available credits generated by the project, it is the responsibility of the seller to assign the remaining credits to the second highest offer and to continue until the credits and offers are exhausted. The assignment of carbon credits is decided solely based on the price offered. Price being equal, credits can be assigned to the buyer that intends to buy the greatest number. In the event that the number of credits is also equal, the auction may be awarded to the buyer that is closest geographically to the site which generates the carbon credits.

Purchasing procedures

The assignment of credits is formalised through a purchase and sale contract, drafted up on the basis of the copies devised by the Carbomark project, complete with eventual annexes.

The amount of carbon credits and the relative sale price is published on the Carbomark project website. Publication is the responsibility of the competent Observatory.

Ancillary clauses

It is forbidden to create complementary contracts between the seller and the buyer which modify the conditions regulating the Carbomark Market and which determine conditions different from those regulations provided for by the Carbomark Market, for either the buyer or the seller. Failure to observe this regulation will involve the expulsion of the responsible players from the Carbomark Market and a ban on their use of the Carbomark logo.

As an example and guideline, reference can be made to the auction notice model in Annex G, which may be integrated and/or modified according to the practices and procedures in use.

CHAPTER 3 - CREDIT TYPES EXCHANGED AND METHODOLOGIES ADOPTED.

3.1 Credits from forest management.

In the event that the players interested in selling carbon credits are forest owners, the aim of the Carbomark Market is to allow these players to sell the credits generated by sustainable forest management and receive payment for the beneficial climactic function that their forests produce for the community.

For this purpose, the forest owner undertakes to set aside part of the increase available for cutting to maintain the carbon stock, thus creating a saving in the wood voluntary increase which is additional with respect to obligation imposed by forestry regulations, by the previous local and regional standards, and coherent with regional forestry policy lines. Alternatively, the commitment may concentrate on the requalification of forest areas with low density coverage.

In order to join the market, pre-emptively, the manifestation of interest, available on the website www.carbomark.org on the page dedicated to the market, must be filled out.

Following the manifestation of interest, an admissibility assessment of the applicant and his property is carried out. If the result is positive, the project may be started, allowing for the quantification of potential carbon credits at the interested property. Credits that the forest owner decides to put on sale, once exchanged, are registered in the Registers managed by the relevant offices in the Regions (Kyoto Observatories), subject to the signing of commitments.

Once the storage capacity of the property in question has been defined in terms of credits, one may proceed to the following specifications:

- the register has the task of registering the credits and withdrawing them from the market;
- the credit registration date corresponds to the date on which the seller put the generated credits onto the market. In the event of first-time registration, it corresponds to the date upon which the seller **joined the market**;
- a unique identification code is assigned to the **carbon shares** sold;
- from the moment that registration occurs, the owner should sign a technical standard in which all commitments are clearly defined, under penalty of exclusion from the market;
- the minimum permanence period for registered credits is 30 years;
- the permanence period starts on the date of joining the market;
- credits ascribable to the market correspond to the annual share for the number of years that remain between joining the market and the date of **conclusion of the forest production management plan or equivalent tool**;

Following these specifications, the following notes are reported:

1. for sellers, the date of joining the market corresponds to the date on which they signed the commitments, provided for in Annex A1 of this manual.
2. for the purposes of the Carbomark market, a “carbon credit” is intended to mean the sequestration of a ton of CO2 equivalent created within a forest property/urban green /wood products/biochar, while “carbon share" is intended to mean the market value expressed in Euro of this carbon credit.
3. in the event of the revision of the forest production management plan, the share available for sale will refer to the information within the data of the expired plan and the number of years to be counted in order to calculate the overall share will be equal to 1, without prejudice to the possibility of raising the annual instalments until the natural expiry of the newly-approved plan.

Upon sale, a contract between the seller and the buyer is stipulated in which all terms of the operation are defined.

An example of a calculation of forest management credits.

By way of example, one may use the hypothetical situation of a forest owner with a forest production management plan in force in the year of his joining the market, and in which the quantity of credits is equal to 100t of CO_2 per year.

Table 2: example of a calculation of forest management credits.

Duration of the Forest Management Plan	Year of joining the market	Duration of the project	Shares expiration year	Eligible yearly instalments	Annual quantity of saleable credits (hypothetical) tCO2	Total quantity of saleable credits tCO2
2005-2015	2010	30 years	2040	6	100	600
2010-2020	2010	30 years	2040	11	100	1.100

As it is deduced from the table above, the maximum number of annual saleable shares depends on the year of joining the market, and corresponds to the number of years that have elapsed from joining the market to the expiry of the plan. The owner’s commitment to conserve credits lasts at least 30 years, which is longer than the duration of the forest production management plan (generally 10 years). The owner however undertakes to maintain a level of use in the future capable of guaranteeing the generation of credits in line with those inferable from the plan

Finally, in the event that the Plan is being reviewed, data will refer to the newly-expired plan, in absence of new consolidated information. When joining the market, the owner undertakes to maintain a level of use capable of guaranteeing the generation of credits in line with those inferable from the expired plan. The effective sale will regard credits inferable from the data contained within the expired plan for a single renewable yearly instalment, without prejudice to the possibility of raising these instalments until the natural expiration of the new plan, as soon as it has been approved.

The planned properties can generate credits for which the planning cycle has not been significantly interrupted. Therefore, an expired plan which is not yet under review cannot generate carbon credits for sale. With regard to sustainable forest management activities, two different actions which forest owners can follow in order to sell their eventually matured carbon credits, both publicly and privately, have been identified:

- **Saving of a part of the increase in wood.** The owner undertakes to set aside part of the increase available for cutting for the maintenance of the carbon stock accumulated in the forest;
- **Requalification of forest areas with low density coverage.** This measure exclusively regards forest areas that were already declared as woods in the reference year for the Kyoto Protocol, i.e. in 1990; otherwise their action could not be considered "requalification" but reforestation, and would therefore be counted as an activity that should be reported in the national greenhouse gas emissions inventory report (ARD activity, art. 3.3 of KP).

Additionality

Le The actions proposed on a forest management level put forward additional measures, with respect to a "**business as usual**" scenario, insofar as owners undertake to set aside a part of the usable increase according to that which is provided for by the Forest Management Plan or by the practices in use at a local or regional level, which represents the reference scenario or baseline, or to improve the conditions of the wood. The saleable credits in the project are additional to those counted on a national level in the "National plan for the reduction of green house gases". In the aforementioned Plan, the role of forest management in absorbing CO_2 is acknowledged (art. 3.4 of Kyoto Protocol), and therefore so is its contribution to the fulfilment of national objectives established by the Kyoto Protocol, provided that such activity was induced by human activity and was launched after 1990. Specifically, limits to the use of forest management in the national inventory of greenhouse gases for each signatory of the Kyoto Protocol have been established at an international level (cap for Italy is 10.2×10^6 $MgCO_2e\ yr^{-1}$ in the period 2008-2012, corresponding to 0.97 $MgCO_2e\ ha^{-1}\ yr^{-1}$ over a national forest area of 8.759.200 ha). The calculation and counting of credits from the forest management in the Carbomark Market takes into account, in the formula for credit calculation, that which has been counted at a national level, and saleable credits are calculated on the additional activities compared to forest management **as usual***.*

An important aspect regarding the concept of additional policies is that additionality should be seen as part of the whole system of reduction (forest-company) activated by Carbomark, and not only as one of the sectors involved (e.g. forestry). In fact, the project aims at creating an "absorber-emitter" binomial which demonstrates to achieve an overall reduction in emissions compared with that which was the value of the system carbon balance before entering the market. This can happen because carbon shares are not sold freely (as in other voluntary markets), but only to a group of companies that have previously declared their intent to reduce their carbon dioxide emissions during the commitment period of the project.

This effective reduction in emissions, associated with the forest owner's obligation to maintain a greater stock of carbon, proves to be the result of additional policies, in comparison to that which the forest-company system used to put into use before its entrance into the Carbomark Market.

Therefore, in the moment that the emitting companies and a specific forest producer sign the contract, the Carbomark Market generates a unique example of a reduction/mitigation policy for emissions. During the implementation of commitments, this *unicum* creates an effective policy variation compared to that which forest owners and emitting companies would have been able to do separately, before the Carbomark market. The project thus becomes the promoter of the improvement in the environmental performance of the "forest-company" system".

Credits are calculated considering the contribution that the woods in the Veneto and Friuli Venezia Giulia Regions must give to national policies, avoiding the double counting related to the international commitments sanctioned by the signing of the KP.

Permanence

The concept of permanence is crucial in forestry offset projects, since forests can act both as net absorbers and net emitters of carbon. In order to maintain the long-term functioning of forests as carbon absorbers, it is essential to confront the risks that may arise during the project lifecycle, as these risks may generate carbon losses. In the case of forest management, the risks are represented by disturbances including fire, parasite attack and breakage. The approach adopted in order to guarantee the permanence of carbon credits is based on the "**buffer**" principle, which was also adopted by the international certification standard of forestry credits, the "Voluntary Carbon Standard", in the guidelines for AFOLU projects (VCS 2008). According to this approach, in each forestry project a share of non-saleable credits is set aside to cover unforeseen losses of carbon due to forest disturbances. The quantity of credits set aside is calculated on the quantification of the risks of such events occurring on a regional scale, which is in turn deduced from the statistics regarding such events over the last 30 years, a the return time corresponding to the duration of the commitment to permanence. Furthermore, the buffer is calculated on the basis of risks for each forest type. The analysis of the buffer, according to forest type, is shown in Table 5.

The permanence of generated credits is guaranteed by means of the analysis of historic series of extreme disturbances in the two regions (Veneto and Friuli Venezia Giulia).

The methodology for calculating the buffer area is explained subsequently, in paragraph 3.1.2.

3.1.1. Methodology and calculation models for credits from sustainable forest management (SFM)

a) Saving of the wood increase

Methodology adopted for the counting of credits

Properties in which a forest production management plan or equivalent tool with is present are admitted for the generation of credits through forest management activities.

In forest properties in which the owner undertakes, through the signing of a contract, to save a certain percentage of the increase, this saving will produce CO_2 credits. Only the plots of property which have a production function can generate credit.

The generation of credits can be implemented via two approaches, which can also be jointly applied, and are aimed at demonstrating the additionality and voluntary character of the generated credits:

- the voluntary commitment to determine a quota for growth in the planning stage, anticipating a level of use which is lower than the growth levels potentially allowed by the various forestry regulations or policies adopted by the various competent Forestry Administrations, i.e. by the practices in use on a local or regional level. In this case, the potential growth allowed represents a sort of baseline or an indicator of good silvicultural practices. The element of additionality is the commitment to implement, during the planning stage, rates of use that are more restrictive than those potentially allowed, or that are more restrictive than the practices in use at a local or regional level;
- the voluntary commitment not to use part of the growth provided for by forestry planning tools at a general level.

In all cases there can be a commitment to generate credits, commitment which may regard all or part of the eligible area, or be defined by identifying specific plots to which the saving policy will be applied.

In these contexts, additionality is always guaranteed since the forest owner, in adhering to the voluntary market, intentionally saves part of the wood increase from potential forestry use, and by signing a 30-year contract binds himself to generate and maintain the CO_2 credits that he sold to the Carbomark Market voluntarily and supplementary to the provisions of the law on the matter.

The permanence of credits is be guaranteed by applying a **buffer** defined in percentage terms on the increase, in compensation of any carbon releases caused by biotic and abiotic disturbances; the incidence of this **buffer** is proportional to the risk of the occurrence of the event with a specific return time.

The minimum information necessary to estimate the carbon credits generated in a forest property is:

- growing stock or stem volume;
- percentage of increase (from wood core sampling of sample plants);
- real annual growth which the owner undertakes to realise.

This information allows for an estimation of arboreal and epigeal biomass within the limits of the wooden stem volume, while the high uncertainty in the estimate, verified by the bibliography, and the non significant variation in stock for the validity period of the generated credits, means that carbon variations in hypogeal and soil biomass are not estimated.

Saving of the increase: methodology for calculating the CO_2 shares generated

Only forest owners that have a management plan can participate in the so-called "Saving of wood increase" activity, and only their property production plots may be considered in the counting.

Furthermore, in order to account for the commitments assumed by Italy in an international context (CAP = 10.2 x 10^6 $MgCO_2e$ yr^{-1} over the 2008-2012 period, correspondent to 1.16 $MgCO_2e$ ha^{-1} yr^{-1} on a national forest area of 8.759.200 ha), only owners for which the following relationship has been verified, will be able to take part in this activity:

$$\sum_{i=1}^{n}\left[(I_{c,i} - Rp_i - D_{Italia}) \times BCEF_i \times 0.5 \times \frac{44}{12} - CAP\right] \times S_{b,i} > 0$$

Where:

n is the number of production plots;

$I_{c,i}$ the current increase in volume of the *i* th production plot per surface unit (m^3 $ha^{-1}yr^{-1}$);

Rp_i is the growth foreseen by the plan for the *i* th production plot per surface unit (m^3 $ha^{-1}yr^{-1}$);

D_{Italia} is the average amount of growing stock per hectare annually lost in Italy (Ditalia = 0.66 m^3 ha^{-1} yr^{-1}).

To calculate the coefficient, an average wood area of 47.530 ha covered by fire in the period 1990-2009 has been considered (source: Corpo Forestale dello Stato; http://www3.corpoforestale.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/1665), as well as an average growing stock equal to 144.9 m3 ha-1 (INFC, 2008). The total growing stock burned annually has thus been "spread" across the national forest area of 10,467,533 ha;

BCEFi is a biomass conversion and expansion factor (Mg m-3) for the conversion of wood stem volume of the i th plot into total dry biomass (Tab. 2, average data from Tab. 4.5, IPCC, 2006);

0.5 is the coefficient to transform total dry biomass into Mg of carbon (MgC/Mg);

12/44 is the coefficient to convert Mg of carbon into Mg of CO_2 equivalent (($MgCO_2e$/MgC);

CAP is the commitment, signed by Italy on a national level, which must be guaranteed 1.16 MgCO2e ha-1 yr-1);

$S_{b,i}$ is the area of the *n* th production plot (ha).

Owners should undertake to save a percentage of the wood increase which is greater than that defined by the applicable regulations, and to maintain generated the credits for a period of at least 30 years.

The credit is quantified at the level of the Forest Production Management Plan, the Felling Series Plan or equivalent tool, considering the following parameters:

- only productions plots;
- potential growth of arboreal and epigeal biomass (Rp);
- annual growth of the forest property concerned (Rr);
- risk of the occurrence of disturbances (the spread of fires, parasite attacks, breakage) (d).

The calculation of credit involves the application of some reduction factors to avoid double accounting with respect to the commitments that Italy has assumed on an international level, sanctioned by the ratification of the Kyoto Protocol.

The risk of disturbances happening was estimated through the distribution of events using the historical series available on a regional level, and by determining the percentage of incidence of the event with a return time of 30 years. The credits generated as a result of this forestry activity are therefore inclusive of a buffer area in order to guarantee credit permanence.

Simultaneously to the renewal of the management plan (thus every 10-12 years), the monitoring of the credits effectively generated by the property should also be carried out. In the event that there is a deficiency in credits generated compared to the amount expected, the **buffer** area, where wood samples cannot be taken, will be enlarged.

1. The quantification of generated credit in terms of biomass for the individual production plots i is carried out according to the following equation:

$$C_{m,i} = (1 - d_i) \times (R_{p,i} - R_{r,i}) \times BCEF \quad \textbf{(1)}$$

where

$C_{m,i}$ CO_2 biomass quantity generated in the plot *i* (Mg ha^{-1} yr^{-1}),

d_i reduction coefficient which accounts for the possibility of disturbances linked to fires and/or parasite attacks occurring within the plot. The value is determined on a local scale using the methodology described below. The reduction of credit linked to the application of this coefficient is necessary for the creation of “an insurance policy” for the buyer, linked to the characteristics and the specific location of the property, and thus to the risk that some of the credits generated may be compromised following fires or biotic or abiotic disturbances. In order to guarantee the commitments assumed by Italy in an international context, if the estimated value of the coefficient is lower than that reported for the nation (d_n=0.12; Tabacchi et al., 2010), the national coefficient will be used. In the event that the reduction coefficient is greater than that reported for the nation (0.12), the coefficient value calculated on a local basis will be adepte.

$R_{p,i}$ potential growth of arboreal and epigeal biomass (m^3 ha^{-1} $year^{-1}$),

$R_{r,i}$ annual growth in biomass of the plot (m^3 ha^{-1} $year^{-1}$) which the owner undertakes not to exceed

BCEF biomass conversion and expansion factor (Mg m^{-3}) to convert the wood stem volume into total dry biomass (Tab. 2, average date from Tab. 4.5, IPCC, 2006).

Table 3: correspondence between the forestry categories of the Regions of Friuli Venezia Giulia and Veneto and the INFC categories to then premise the application of the correct biomass conversion and expansion factors (BCEF) displayed in table 3.

FVG forestry series map categories	Veneto forestry series map categories	INFC Categories	
Oak-Hornbeams and Hornbeams	Oak-Hornbeams and Hornbeams	Oak, Downy Oak and English Oak woods	Broad leaved tree
Oaks and Chestnuts	Oaks and Chestnuts	Chestnuts	
Manna Ash-Black Hornbeam and Oak-Hornbeams	Manna Ash-Black Hornbeams	Black Hornbeams, Hornbeams	
Beeches	Beeches	Beeches	
Other areas of alluvial forests	Willow trees and other particular forms	Hydrophile forests	
Other areas of riparian woodland	-		
Other formations	-	Other deciduous forests	
Birches and Common Hazels	Birches and Common Hazels		
Acer-Fraxinus and Acer-Tilia	Acer-Fraxinus and Acer-Tilia		
Black Alder	Black Alder		
Black Locust and other anthropogenic formations	-		
Neocolonisation	-		
Lowland wooded areas	-		
-	Euganean formations with Mediterranean elements		
Coastal formations	Coastal formations	Mediterranean Pine	Coniferous
Black Pine and Scots Pine	Scots Pine	Scots Pine and Mountain Pine	
	-	Black Pine and Bosnian Pine	
Firs	Firs	White Fir forests	
Norway Spruce - Beeches	Norway Spruce-Beeches	Red Fir forests	
Norway Spruce	Norway Spruce		
Larches	Larches	Woods of Larches and Swiss Pines	
Mountain Pines	Mountain Pines	Other coniferous forests, pure or mixed	
Reforestation	Anthropogenic formations		

Table 4: values of the biomass conversion and expansion factors (BCEF, Mg m-3) average data from Tab 4.5 (IPCC, 2006).

	BCEF (Mg m^{-3})	
Growing stock (m^3)	Broad-leaved	Coniferous
<20	3	2.4
21-40	1.7	1.2
41-100	1.4	0.9
100-200	1.05	0.7
>200	0.8	0.7

2. Potential growth can be determined using two methods:

   - The first is applicable where regional regulations are present that were approved before 1990 and that acknowledge the importance of forest management for reducing the concentration of CO_2 in

the atmosphere (Region of Veneto – Decree of Regional Government 1252/2004 - 3604/2006), that is the presence of management practices resulting from the application of regional regulations, implemented from a regional (and not local) approach, which can represent a baseline for the calculation of credit. In such context, for example, the saving policy adopted by the Region of Veneto has involved the reinforcement of management practices expressly connected to the accumulation of $CO_{2,}$ affecting the average recoveries expected by the forestry management plans in force on a regional level which, with good reason, may be employed as a baseline of reference

This approach allows not to penalise those owners that in the past, following specific regulations or those related to forestry, decided to reduce the growth spontaneously by implementing a saving policy (additionality and voluntariness), and that, therefore, would not be capable of applying further reductions to utilisation. In this case, therefore, the potential growth at overall production level is equal to:

$$R_{p,i} = \overline{su} \times Ict_i \qquad \textbf{(2)}$$

where:

Ict current total increase in arboreal epigeal biomass (m3 ha-1 year-1) of the considered production plot i, estimated on the basis of the information available by using one of the methods described below, deduced from the forest production management plan or equivalent tool;

su average utilisation percentage deduced from the forestry statistics on a regional scale (%).

For example, in the case of the Region the average utilisation percentage of all the production high forests managed is 33% (Original data processed by the Unità di Progetto Foreste e Parchi of the Region of Veneto based on the data from the Sistema Informativo Forestale. Such datum can be the subject of periodic updates in virtue of the statistical data acquired from time to time.

- The second, applicable in the absence of a specific regulatory background which encourages a reduction in growth (for example, the Region of Friuli Venezia Giulia), considers the potential growth as equivalent to that programmed by the forest planning instruments, and considers the commitment as additional the commitment to reduce utilisation compared to that which was originally foreseen. This method could be particularly effective in the assessment of credits generated by copses. In this context, additionality is represented by an additional commitment, as opposed to a local practice (planned growth). This approach may make reference to situations in which planned recoveries are sufficiently high, while it will be difficult to apply where policies for wood sampling that are too prudent are already punt in place.

3. The quantity of credits generated in terms of CO2 equivalent, taking a quantity of carbon equal to 50% of dry biomass (IPCC/OECD/IEA 1997) and multiplying by 44/12 to convert carbon into CO2, is equal to:

$$C\_ha_{CO2} = Cm \times 0.5 \times \frac{44}{12} \quad \textbf{(3)}$$

where C_ha_{CO2e} is the credit in CO_{2e} (Mg CO2e ha^{-1} yr^{-1}).

4. The credits generated per the area unit are to be multiplied MgCO2e ha-1 yr-1) by the total wooded area of the plot, or of the reference area, in order to obtain the total credit available for the area in question.

$$C_{CO2} = C\_ha_{CO2} \times Sb \quad \textbf{(4)}$$

in which *Sb* is the wooded area of the plot (or of the reference area) (ha).

5. **The credit generated at the level of Forest Production Management Plan Felling Series Plan** will be provided by the summation of credits of the individual production plots:

$$Ct_{CO2e} = \sum_{i=1}^{p} C_{CO2} \quad \textbf{(5)}$$

Where Ct_{CO2e} is the credit of entire forest production management plan in CO_{2e} (Mg CO_2e yr^{-1}),

p is the number of production plots in the plan,

C_{CO2} is the credit of individual production plots of the plan (Mg CO_2e yr^{-1}).

After making the conversions above, at the level of productive felling series, equation 1 can be summarised as follows:

$$Ct_{CO2e} = \left[\sum_{i=1}^{n} (1 - d_i) \times (R_{p,i} - R_{r,i}) \times BCEF_i \right] \times Sb \times 0.5 \times \frac{44}{12}$$

where *i* is the production plot i^{th} considered for calculation, and Sb is the felling series area (ha).

3.1.2. Example of calculation of the credit from sustainable forest management (SFM)

Properties with 10 slots of beech production in an overall production area of 1000 ha. According to the current Forest Management Plan, valid over 2000-2010, the expected growth was equal to 2500 m^3 year-1 that is 50% of the current increase (equal, in total, to 5000 m^3 year-1). The property intends to reduce growth by 10% compared to that which was provided in the expired plan. At the felling series level, the credit was quantified according to the following steps:

a) verification of the additionality condition:

At present (BAU), the difference between the current increase and the growth expected according to the plan, net of the average growing stock which is lost every year per hectare in Italy, due to fire, is equal to:

$$\sum_{i=1}^{n}\left[(I_{c,i} - Rp_i - D_{Italia}) \times BCEF_i \times 0.5 \times \frac{44}{12}\right] \times S_{b,i} = \left[(5 - 2.5 - 0.66) \times 0.8 \times 0.5 \times \frac{44}{12}\right] \times 1000 = 2699$$

Since this quantity (2,699 $MgCO_2e$ $anno^{-1}$) is greater than the national CAP (1.16 x 1000 = 1.160 $MgCO_2e$ $year^{-1}$), the property can enter into the C-Mark market.

b) calculation of credit:

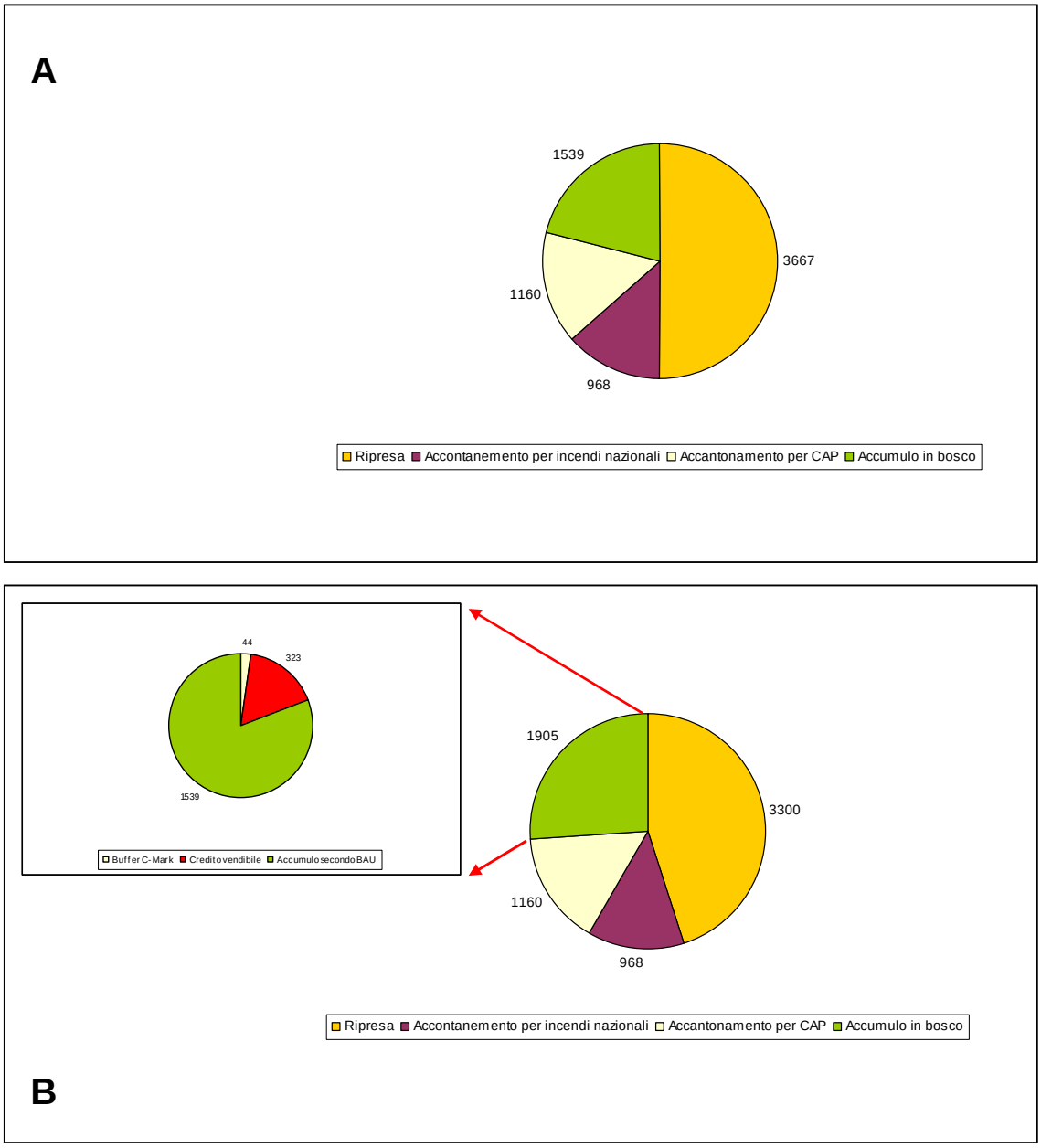
$$C_{m,i} = \left[\sum_{i=1}^{n}(1 - d_i) \times (R_{p,i} - R_{r,i}) \times BCEF_i\right] \times Sb \times 0.5 \times \frac{44}{12} =$$

$$= (1 - 0.12) \times (2.50 - 2.25) \times 0.80 \times 1000 \times 0.50 \times \frac{44}{12} = 323$$

Since the plan has already expired, the quantity that can be sold is, as a maximum, the quantity of one year, equal to 323 $MgCO_2e$ $year^{-1}$.

Figure 1 summarises the division, between the different sections in a “business as usual” (BAU) condition, of the current yearly increase at the level of production felling series, and after implementation of the C-Mark market.

It is clear that the application of C-Mark market guarantees the fulfilment of the national commitments, and at the same time makes the accumulation of carbon in woods increase in an actually additional way.



Graph 2 – distribution of the current increase between the different sections in business "business as usual (A)" conditions and after the implementation of Carbomark.

All values are expressed in $MgCO_2e\ yr^{-}1$. Please note the increase in the accumulation in woods connected to credit generation subsequent to growth reduction (in red: 323 $MgCO_2e\ yr^{-1}$) and buffer (44 $MgCO_2e\ yr^{-1}$).

b) Requalification of forest areas of low density coverage

This action involves forest owners whose land use was classified as “wood” in 1990, according to the forest definition by the INFC, but which do not fall into the definition of wood given by the Regions involved, i.e. they do not fall into the definition specified by Legislative Decree 227/01. These owners may pursue offset operations aimed at the requalification of woods.

Additionality is guaranteed as such operations will not occur without a carbon credit market. Even if such an action is not applicable across the large areas of the Regions of Veneto and Friuli Venezia Giulia, it will nevertheless be interesting to establish a methodology which could then be applied to the development of voluntary markets operating in other contexts.

Methodology for the identification of eligible areas

The National Inventory of Forests and Forest Carbon Pools (INFC), using the definition adopted for the **Temperate and Boreal Forest Resources Assessment 2000** (UN-ECE-FAO 2000), defines as wood any land with arboreal coverage greater than 10%, a size greater than 0.5 ha, and a minimum mature tree height of 5 m (ISAFA 1998). The project activity will therefore define as eligible all areas which, in 1990, were classified as “woods” according to this definition but not by the pertinent regional or national legislation. In practice we propose photographic interpretation per points on geo-reference aerial photos.

Each sample point will be attributed to, the corresponding land use class of the year 1990; the classes identified by photo-interpretation are: wood, non-wooded productive and unproductive. Each point classified as ‘wood’ will be attributed to the corresponding class of arboreal coverage. For the size of a wooded area in a low arboreal coverage class, the “count for points” method will be employed, already used in the first phase of the INFC (Corona 2000, Tabacchi 2001). In order to attribute each point to one of the three categories of use under inspection, and, for the wood category, to a density class, a procedure proposed by De Natale et al. (2003) has been used, analogous to the methodology employed in the first phase of the INFC (INFC 2003 available online at www.isafa.it/scientifica/pubblicazioni/pu_infc/ALGT/Man_1/Man_1.pdf) and in other recent studies (Corona et al. 2005, Salvadori 2006, Lamedica 2007, De Natale et al. 2007).

Methodology adopted for the counting of credits

The action will be applicable only when using species adapted to the ecology of the site and choosing autochthonous species in order to avoid the introduction of vegetation that may represent a “disturbance” for the surrounding ecosystem. In requalification activities it is therefore crucial to have a basic knowledge of the ecological conditions of the site and of its original floristic composition.

The information necessary for the assessment of credits produced by requalification are:

- species used;
- age of plants used;
- number of plants used;

- increase in species used;
- eventual growing aid and operations expected in the years following planting (thinning);
- disturbance indicators in the project areas (pyrological potential, susceptibility to parasite attacks, susceptibility to breakage by wind).

Credit will therefore be calculated based on the following equation:

$$Cm = I_{ct} \times (1 - d) - i \quad \textbf{(7)}$$

Where:

- *Cm* is the credit in arboreal epigeal biomass (Mg ha-1 year-1),
- I_{ct} is the current total increase in arboreal epigeal biomass (Mg ha-1 year-1),
- *d*, is the risk of the occurrence of disturbances,
- *i*, are the sampling operations planned for biomass (Mg ha^{-1} yr^{-1}).
-

3.1.3. Methodology for guaranteeing credit permanence (= guarantees and safety buffer)

Susceptibility to disturbance is assessed considering the three different types of natural disturbance:

- risk of the spread of fires;
- risk of parasite attacks;
- risk of breakage.

These risks are assessed according to the information available, by forestry category or macro category, for the two regions.

For each forestry category the magnitude (in area or m^3) of the event with return time of 30 years has been determined, using extreme distribution. The relationship between this event and the total value of the category has then been identified.

Methodology

Based on the sample series available, the distribution of extreme events probability was identified by using type I extreme distribution (or Gumbel distribution). The function of accumulated probability is expressed as follows:

$$P(Si < S) = e^{-e^{\left(-\frac{x-u}{\alpha}\right)}} \quad \textbf{(8)}$$

Area covered by fire or m^3 of wood destroyed by breakage $-\infty<S<\infty$,

form factor $0<\alpha<\infty$,

position factor $-\infty<u<\infty$.

The assessment of distribution parameters was carried out the method of moments:

$$\alpha = \frac{\sqrt{6s}}{\pi} \quad \textbf{(9)}$$

With s statistical variation of the sample.

$u = \bar{x} - 0.5772\alpha$ (15)

With $\bar{x}$ average of the sample.

The law of probability can be written in an appropriate way by introducing the reduced variable *w*:

$$w = \frac{x-u}{\alpha} \quad \textbf{(10)}$$

$$F(x) = e^{-e^{(-w)}} \quad \textbf{(11)}$$

$$w = -\ln\left(\ln\left(\frac{1}{F(x)}\right)\right) \quad \textbf{(12)}$$

A probability *P(S)* has been assigned to each datum registered in the temporal series available to us, ordering the sample series in ascending order, and attributing each event a sample frequency equal to:

$$P(S_m) = \frac{m}{N+1} \quad \textbf{(13)}$$

With *m=1* minimum event (minimum area covered by fire or minimum m^3 of wood destroyed)

*m=N maximum event (*maximum area covered by fire or maximum m^3 of wood destroyed).

Let us assume that the sample surplus frequency coincides with the probability of overtaking. Once the law of sample distribution of the series in our possession is identified, the extreme value linked with a definite return time (Tr) is also identified, assuming that:

the probability of not overtaking linked to *Tr* will be equal to the complement of its frequency

$$P(S_m) = P^* = \frac{Tr - 1}{Tr} \quad \textbf{(14)}$$

by using the inverse law of frequency distribution, after having calculated the corresponding reduced variable at point (12), we will find the area value which corresponds to the return time data Tr:

$$S_m = w\alpha + u \quad \textbf{(15)}$$

To forestry categories where historical data are unavailable, the average value derived from other categories has been assigned.

Table 5: percentage value of the buffer, relative to the considered disturbances, associated with the forestry categories according to the definition by the Regions of Friuli Venezia Giulia and Veneto and by the *National Inventory of Forests and Forest Carbon Pools* (INFC).

FVG forestry series map categories	Veneto forestry series map categories	INFC Categories	Fire buffer	Abiotic disturbances buffer	Meteoric disturbances buffer
Coastal formations	Coastal formations	Pine forests of Mediterranean Pines	9.03%	0.02%	0.67%
Oak-Hornbeams and Hornbeams	Oak-Hornbeams and Hornbeams	Oak, Downy Oak, English Oak woods	0.09%	20.75%	0.67%
Oaks and Chestnuts	Oaks and Chestnuts	Chestnuts	1.96%	0.05%	0.67%
Manna Ash-Black Hornbeam and Oak-Hornbeams	Manna Ash-Black Hornbeams	Black Hornbeams, Hornbeams	3.37%	7.96%	0.67%
Beeches	Beeches	Beeches	1.40%	2.00%	0.86%
Black Pine and Scots Pine	Scots Pine	Scots Pine and Mountain Pine	7.34%	3.04%	0.10%
	-	Black Pine and Bosnian Pine	7.34%	3.04%	0.10%
Firs	Firs	White Fir forests	0.09%	0.01%	0.05%
Norway Spruce-Beeches	Norway Spruce-Beeches	Red Fir forests	0.12%	0.14%	0.31%
Norway Spruce	Norway Spruce		0.12%	0.14%	0.31%
Larches	Larches	Woods of Larches and Swiss Pines	0.06%	13.75%	2.97%
Other areas of alluvial forests	Willow trees and other particular forms	Hydrophile forests	1.31%	0.34%	0.67%
Other areas of riparian woodland	-		1.31%	0.34%	0.67%
Other formations	-	Other deciduous forests	1.31%	0.34%	0.67%
Birches and Hazels	Birches and Hazels		1.31%	0.34%	0.67%
Acer-Fraxinus and Acer-Tilla	Acer-Fraxinus and Acer-Tilla		1.31%	0.34%	0.67%

FVG forestry series map categories	Veneto forestry series map categories	INFC Categories	Fire buffer	Abiotic disturbances buffer	Meteoric disturbances buffer
Black Alder	Black Alder		1.31%	0.34%	0.67%
Black Locust and other anthropogenic formations	-		1.31%	0.34%	0.67%
Neocolonisation	-		1.31%	0.34%	0.67%
Lowland wooded areas	-		1.31%	0.34%	0.67%
-	Euganean formations with Mediterranean elements		1.31%	0.34%	0.67%
Firs	Firs	Other coniferous forests pure or mixed	n.c	n.c	0.67%
Reforestation	Anthropogenic formations		9.03%	0.02%	0.67%

3.1.4 Verification and monitoring of credits: outline for multistage sampling.

In order to verify the fulfilment of the commitments and achievement of goals provided for, audit activities are scheduled as described in chapter 2 of the Special Part of this Manual.

These audit activities, both those performed by internal staff involved in the management of the market, and those performed by staff external to the management of the system, are paired with monitoring activities.

The monitoring activities, which will be integrated into the planning processes, is paired with a document and inspection control on the application state of the plan, once it has been revised.

The monitoring, integrated into the planning process, will particularly concern the verification of the difference between the current increase of the previous plan and the current increase of the subsequent plan, net of the utilisations that have happened and the eventual disturbances surveyed.

In order to allow for a true and continuous monitoring of the credits generated, which will allow for a comparison on the objective basis of the information collected while reviewing the plans, the following protocol for standard survey is proposed, with surveys to be organised and carried out at the first usable review, and to be continued through the subsequent reviews.

It is understood that other mass surveying systems may be adopted, for example the application of the tariff system to diametric seriations from total ingrowth survey, as from the latest inventory update, if the update was carried out taking into account the total ingrowth, or to seriations from the processing of LiDar data, etc., and of the increase, provided that such systems, in the opinion of the relative Observatories, can guarantee adequate levels of accuracy.

The real formation of sold credit is assessed, on an incremental basis, using the following formula:

$$Ir = su_p \times (Ic \times p) - (U_p)$$

where *Ir* is the residual increase present in the forest production management plan net of the utilisations (m^3),

su_p (%)is the potential utilisation percentage (relationship between potential growth and current increase) determined on the basis of the method of credit calculation that was used (for example, in the case of Veneto, su_p=33%; in the case of Friuli Venezia Giulia it will be the utilisation percentage at the moment of joining the market),

Ic is the current increment of the new plan, that is of the latest monitoring (m^3 ha^{-1} $year^{-1}$),

p is the period passed between the two monitoring surveys (years) that is, the reference period expressed in years (generally equal to the duration of the management plan),

U_p are the utilisations performed during the course of the reference period (m^3).

The residual increase must be reported in terms of CO_2 equivalent (taking a quantity of carbon equal to 50% of dry biomass - IPCC/OECD/IEA 1997 – and multiplying by 44/12 to convert carbon into CO_2) in order to verify that this value is greater or equal to the credit sold within the Carbomark market by the same property:

$$C_{CO_{2e}} = Ir \times BCEF \times 0.5 \times \frac{44}{12} \times S_b$$

where *BCEF* is biomass conversion and expansion factor (Mg m^{-3}) (Tab. 2, average data from Tab. 4.5, IPCC, 2006), as shown in table 4, which takes into account the wood density differences between conifers and broad-leaved trees and is sufficiently accurate to be considered the object of the estimate;

S_b wooded area of the reference area.

Outline of multistage sampling.

We propose a system of multistage sampling as it requires an overall sample number which is lower than for systematic sampling (Corona, 2000).

Multistage sample extraction.

This is carried out in the following phases:

subdivision of the population into primary units → primary units = production plots of the Plan or those included in the commitments assumed by the forest owner;

with particular reference to high forest, extraction of the production plots with a probability proportional to their areas, guaranteeing a sampling that extends across at least 50% of the plots included in the commitments assumed by the forest owner;

subdivision of the primary and secondary units → sampling areas (= sample plot (AdS));

definition of the number and location of AdSs. The number of areas to be prepared is proportional to the size of the plot to be surveyed, while their distribution must guarantee substantial spatial homogeneity and adequately represent the forest typologies present (e.g. in the case of the relascope for height contours).

The square sample plots can be arranged with a density corresponding to around one AdS every 10 ha, while for the relascope sample plots, it is advised to arrange 1 every 1.5 ha, up to a maximum of 30 relascope plots per plot (in accordance with regional regulations).

When the primary sample units (plots) are of different sizes, the number of secondary units (AdSs) to be extracted can be established proportionally to the size of the primary units. The sampling of primary units will be conducted in such a way that the larger plots have a higher probability of being extracted (probability proportional to their area A_i).

OPTION 1 (square sample plots with side length 20 m)

The secondary units extracted will be **square sample plots of side length 20 m** (400 m^2), and surveys will be carried out within these areas (CRA-ISAFA and CFS, 2006). These AdSs can be stably identified by surveying the spatial coordinates of the four corners.

The surveys will therefore be the following:

- total ingrowth with a minimum threshold of 17.5 cm (if possible when carrying out the survey, it is advised to lower the ingrowth threshold to 7.5 cm);
- surveyed height of the 5 trees closest to the centre of the sample plot, and of the 3 trees with the greatest diameter in the sample plot (8 heights per AdS);
- the counting of rings in the last centimetre of the growth (e.g. using the trephor) in height sample trees (8 increases per AdS) or of the thickness of the last 10 rings, in relation to the formula which will be used for the calculation of the percentage increase.

Estimation of arboreal epigeal biomass.

By using the data from the ingrowth measurement carried out in every sample plot, diametric distribution will be calculated to which volume tables for forest production management will be applied (La Marca 1999). This data must be used to assess the epigeal biomass present through the methodology indicated in paragraph 3.1.

Assessment of growth.

The data relative to the number of rings present in the last centimetre allow determining the percentage increase in volume, estimated by using the Schneider formula (Philip 994, La Marca 1999) relative to individual plots:

$$I\%_{c_i} = \frac{k}{Dbh \times N}$$

or rather, should the thickness of the last 10 outermost rings be surveyed, through the Schneider formula as modified by Mayer-Lötsch:

$$I\%_{c_i} = \frac{k \times S}{Dbh \times 100}$$

where I%c is the percentage increase (m^3) of each sample tree,

Dbh (cm) is diameter at 1.30 m,

N is the number of rings in the last centimetre,

S is the thickness in mm of the last 10 growth rings,

and *k* is Schneider constant, whose value can vary from 400 to 600 depending on the increase in height of the trees, and can be defined based on the dendrological composition of the surveyed woods or, as for example for the Autonomous Region of F.V.G., can be automatically defined in relation to the volume tariff adopted by the software processing the forest management plan data.

Different values in the proposed range may be assumed coherently with the forest production management practices in force, by highlighting however that a K = 400, referring essentially to the single increase in basal area, can constantly understate the increase percentage (Hellrigl 1986).

Processing the data obtained on epigeal biomass and increase.

Multi-stage extraction allows for the extension of results relative to the different attributes of interest (arboreal biomass, increase, CO_2 credit) to individual plots as well as to the entire productive felling series or area identified and destined for the fixation of atmospheric carbon dioxide.

Values for individual plot surveyed.

We recall that:

j = primary units extracted (sampled production plots),

i = secondary units extracted (sample plots surveyed in every j^{th} extracted plot),

n = number of secondary areas extracted in every surveyed plot,

m = number of primary units extracted (plots in which sampling took place),

Aj = area of the plot,

A = total area of the production plots of the Forest Production Management Plan.

Estimator of the average value of the attribute *x* of interest (in the plot):

$$\overline{X_j} = \frac{\sum_{i=1}^{n} x_{ij}}{n} \qquad \textbf{(16)}$$

With *n* being the number of the sample plots per plot; x_{ij} value of the attribute x in the i^{th} sample plot of the j^{th} primary unit.

Variance of the attribute *x* in the surveyed plot:

$$s_{xj}^2 = \frac{\sum_{i=1}^{n} (x_{ij} - \bar{x}_{ij})^2}{n-1} \qquad \textbf{(17)}$$

Value of the attribute for the whole plot:

$$X_j = \overline{X}_j \times A_j \qquad \textbf{(18)}$$

Values for the entire productive felling series.

Estimator of the attribute *X* for the entire productive whole:

$$X_{TOT} = \frac{1}{m} \sum_{j=1}^{m} \frac{X_j}{W_j} \qquad \textbf{(19)}$$

with *m* = number of primary units extracted, $W_j = \frac{A_j}{A}$

variance:

$$s_{X_{TOT}}^2 = \frac{\sum_{j=1}^{m} \left(\frac{X_j}{W_j} - X_{TOT} \right)^2}{m(m-1)} \qquad \textbf{(20)}$$

and standard error:

$$s_{X_{TOT}} = \sqrt{s_{X_{TOT}}^2} \qquad \textbf{(21)}$$

OPTION 2 (relascope sample plots)

Relascope sample plots.

Alternatively to the square sample plots with side length equal to 20 m, relascope plots may be prepared in the primary areas (plots) extracted; the sampling design will however remain composed of two stages.

In this case, the secondary units will be **relascope plots**:

- relascope sampling will be carried out on the selected plots;
- in a quantity equal to 1 plot every 2 ha only up to a maximum of 30 sample plots
- for diametric classes with a minimum ingrowth threshold of 17.5 cm (if it is possible during the survey, it is recommended to lower the ingrowth threshold to 7.5 cm);
- height will be surveyed in half the sampling points until obtaining at least 3 measurements for every surveyed diametric class (classes of 5 cm);
- in the height sample trees the rings of the last centimetre of growth will be counted.

Assessment of diametric distribution from relascope surveys.

For each plot where relascope surveys have been carried out, diametric distribution must be calculated (La Marca 1999):

$$Nha^{-1} = \frac{\Phi \times N_{D_i}}{g_{1.30}} \qquad \textbf{(22)}$$

where Φ = numbering factor (band used in the relascope test)

D_i = diametric class considered (cm)

$g_{1.30}$ = basal area at 1.30 m in height (m^2)

This data will be used to assess the epigeal biomass present in the plot using the methodology indicated in paragraph 3.1.

Assessment of growth.

For the assessment of growth, please refer to that which has been explained above.

Processing of the epigeal biomass and increase data obtained for the entire productive whole.

We recall that:

j = primary units extracted (sampled production plots)

i = relascope plots carried out in each j^{th} extracted plot

n = number of relascope plots carried out in each surveyed plot

m = number of primary units extracted (plots on which the sampling was carried out)

Aj = area of the plot

A = total area of the production plots of the Forest Production Management Plan.

Estimator of the attribute *X* for the entire productive whole:

$$X_{TOT} = \frac{1}{m}\sum_{j=1}^{m}\frac{X_j}{W_j} \qquad \textbf{(24)}$$

with m = number of primary units extracted, Xj overall value of the attributed in the j^{th} plot,

$$W_j = \frac{A_j}{A}$$

variance:

$$s^2_{X_{TOT}} = \frac{\sum_{j=1}^{m}\left(\frac{X_j}{W_j} - X_{TOT}\right)^2}{m(m-1)} \qquad \textbf{(25)}$$

and standard error:

$$s_{X_{TOT}} = \sqrt{s^2_{X_{TOT}}} \qquad \textbf{(26)}$$

The arboreal epigeal biomass, measured by adopting the methodology described hereby, represents, together with the percentage increase data, the essential element for assessing the current increase and subsequently the credit that can be generated and/or has been generated. This comparison happens only on an incremental basis, net of utilisations and disturbances, that is, by comparing the different levels of current increase and not the different levels of epigeal biomass present.

In the event that from the comparison of incremental information relative to the two subsequent inventories, a loss in increase greater that the predefined buffer emerges, suitable offsets should be carried out either within the forest production management plan or within the Carbomark market.

Information relative to the increase will provide information concerning the real level of growth of the wood which must be compared with the assessment available at the moment that CO_2 credits are sold.

3.2 Credits from wood products.

Wood products represent an opportunity for the possible mitigation of forestry measures. In wood products, carbon is immobilised until the wood decomposes or is burned and/or disposed of. Furthermore, by replacing other energy intensive materials such as aluminium and steel with wood, smaller levels of CO_2 emissions and other pollutants are produced during the lifecycle of the product.

In the approach adopted by the Carbomark Market for this measure, only the CO_2 equivalent content immobilised within wood products is considered, without taking into account smaller emissions that result from the effect of replacement compared to the use of more energy intensive materials. In the launch phase of the Carbomark Market, the choice to pursue activities linked to the use of wood products was constricted to only wood with structural uses, such as beams, flooring, walls, and lamellar wood, and this for the following reasons:

- average lifespan is longer than other wood products and therefore permanence is greater, on average from 50 to 100 years;
- possibility of use in public tenders or in private construction;
- exogenous variables affect to a lesser extent on the choice of these products, including consumer preferences and market trends etc.

Forest management measures aimed at increasing the production of long-lasting wood assortments (e.g. beams) instead of short-lived products (e.g. paper and panels) were not analysed, insofar as the type of silviculture adopted in the territory of the two involved Regions is already prevalently permeated with the production of wood for medium-long term duration, mainly through the high forest system.

Owners of credits

With regard to credit owners, they may be Public Bodies or construction entrepreneurs, professional associations or a private individuals wanting to create infrastructures with a quantity of structural wood greater with respect to the on used in a “business as usual scenario” (BAU) as defined below in the paragraph on additionality. The **fundamental unit of analysis** is thus represented by the definitive project of a building or infrastructure constructed by one of the aforementioned entities and already passed through testing by competent Authorities.

Localisation and the short distribution chain of wood reward factor

Buildings and infrastructures must be created by players within the Regions of Friuli Venezia Giulia and Veneto. All buildings/infrastructures completed after 1st January 2008 may be considered since they pass the test of additionality described below.

In addition, considering the fact that the Carbomark Market intends to reward actions developed on a local level, in the area of locally generated “credits from wood products”, the concept of wood short

distribution chain is also introduced. The introduction of the concept of the short distribution chain and of the reward factor for the use of local wood is coherent with a market which not only supports the use of wood in local infrastructures, but also the use of local wood in order to reduce the energy balance caused by the transportation of materials. Moreover, the short distribution chain of wood not only allows for a saving in greenhouse gas emissions, but also for the use of local wood, and in particular cases, it allows the wood to be traced back to its forest of origin.

For these reasons, a factor of 1 is applied to the credit calculation for wood products where it is confirmed that the material comes from within 70 km of the site of use, while a reduction factor of 0.8 is applied if the material has come from more than 70 km far from the site of use. This coefficient is based on several studies which have compared energy balances, relative to transport emissions, of wood products coming from forests within 70 km from the site of use and from distances over 1,000 km. On average, the different in terms of emissions is 20% less for a short distribution chain.

Additionality and baseline

In order to generate credit, only buildings/infrastructures, created or to be created, which lead to a greater reduction of CO_2 compared to a business as usual scenario (BAU) will be considered. The additionality criteria will be satisfied when the creation of the building/infrastructure effectively involves a greater use of wood for structural purposes compared to the threshold represented in the BAU. This threshold is defined as follows:

$$BAU = 0{,}24 \times \frac{V_l}{V_c}$$

where V_l is the volume of wood used in construction (m^3 wood), V_c is the total volume constructed (m^3 constructed), 0.24 is a reduction coefficient deduced from CNEL (2001) to refer the BAU (m^3 wood / m^3 constructed) only to wood used for structural purposes.

Both V_l and V_c can be reported on different scales according to the information available, and more precisely:

municipal scale: average wood consumption in construction and volume constructed are deduced from the statistics of the Municipality in which the building was created, reported over the last five years;

regional scale: average wood consumption in construction and volume constructed are deduced from the statistics of the Region in which the building was created, reported over the last five years;

national scale (to use only if municipal or regional data is unavailable): fixed value of BAU equal to 0.02 m3 structural wood/m3 constructed (http://faostat.fao.org/site/291/default.aspx; ISTAT, 2002).

Permanence

The standard permanence of credit derived from wood products is **30 years**: a carbon credit created in 2009 will remain should, for the entire duration of the credit (30 years), point out eventual problems which may cause a reduction in permanence to the competent Kyoto Observatory in order to agree upon which actions are to be taken (reconstruction or acquisition of offsetting credits in the Carbomark Market).

The proposed methodology considers only wood used for structural purposes for generating credits from wood products, insofar as, on average, the lifecycle of these products is at least between 30 and 50 years (Profft et al., 2009). Therefore, this choice notably reduces the risks linked to non-permanence for at least 30 years.

Methodology for credit calculation

Credit relative to wood products is saleable ex-post that is, after the definitive project for the building and/infrastructure has been approved, and after the creation of the building and its certification by the competent Authorities. Only the fraction of certified wood used may generate credits. The documentation that must be presented in order to generate credits is:

- executive project from which the share of wood for structural use utilised is deduced;
- the percentage of certified wood (FSC, PEFC or similar);
- the certificates of the building testing issued by the competent Authorities (only for already created buildings).

Credit will be calculated according to the following equation:

$$C_{CO2} = (\frac{V_{l_i}}{V_{c_i}} \times a - BAU) \times k \times V_c \times 0{,}45 \times 0{,}5 \times \frac{44}{12}$$

in which C_{CO2} is in Mg CO_2 equ.; Vl_i is the overall quantity of wood for structural use used in the building *i* (m^3 wood); Vc_i is the overall volume of the building *i* (m^3), a (%) is the percentage of certified wood for structural use from the total wood used.

The coefficient *a* is necessary to guarantee that the use of wood products does not cause a negative impact on the woods of origin and on emissions, particularly as a result of deforestation elsewhere (**leakage effect**).

K is a short distribution chain reward factor, equal to 1 for wood products originating from woods within 70 km of the site of use of the wood, and shifting to 0.8 for wood products that originate from woods farther than 70 km from the site of use.

3.3 Credits from urban forestry.

3.3.1 Introduction.

The sequestration of atmospheric CO_2 by trees in an urban environment is linked to their growth and to their mortality. These two processes are, in turn, dependent on the species, age, and structural characteristics of urban green.

In general, the planning and management of urban green in order to maximise CO_2 fixation should take the following aspects into account:

- to plant the greatest number of trees possible, and immediately replace any that has died;
- to supply the planted out trees with an optimal growth environment (for example, sufficient space for the development of foliage and roots);
- to create different growth conditions for trees that are of different species and ages;
- to group together plants of different species but with similar management requirements (irrigation, pruning, fertilisation, etc.);
- to improve the maintenance techniques for public green through reducing emissions linked to this activity.

Therefore, involved in the activity of managing public green is “the ensemble of the operations of planting out and/or maintenance of public green in order to increase the carbon stock, whilst also considering the CO_2 emissions that derive from the execution of these operations”.

It is possible to identify two types of activity that can generate saleable CO_2 credits within the Carbomark Market:

- **urban afforestation projects;**
- **improvement of the management of public green**.

3.3.2 Projects for urban afforestation

In the event that this activity is chosen to generate CO_2 credits, urban afforestation projects that have been created within the municipal territory from 2008 may be taken into consideration. In this case, the managing Municipality/Body should demonstrate by providing the documentation needed that these projects were realised but not due to national or regional laws or municipal regulations (e.g. implementation of EU instructions regarding the reduction in GHG emissions by 20% through the increase in plants planted out in the municipal territory).

The project must have been created by the managing Municipalities/Bodies within one of the following regions: Friuli Venezia Giulia or Veneto.

The standard permanence of the CO_2 credits calculated according to the methodology reported further down this chapter is **30 years**: a carbon credit created in 2009 will remain stocked until 2039, and, if subsequently reissued due to plant death, for example, it must be replaced. Therefore, the owner of the credit should, for the entire duration of the project (30 years):

- annually quantify the carbon stocks within its plantation
- replace dead trees in all project sites: the dead trees must be replaced within a year from when they are removed in order to maintain the fixation capacity of the plantation;
- in the event that replacement of dead plants does not occur, eventual emissions must be offset within the Carbomark Market.

The confines of the project include all operations that are influenced by the activity of the project itself, i.e. the number of fundamental project units (planting sites), and the material used in the project for the planting out and maintenance of the plants must be taken into account.

The limits for the calculation of GHGs include all sources, sinks, and reserves that are influenced by the application of the project, and which must be considered for the calculation of reductions and carbon credit. For the purposes of Carbomark, carbon stocked in trees and GHG emissions associated with the use of motor vehicles and equipment for the planting out and maintenance of trees are taken into account. At the moment, other elements such as shrubs, dead wood, and soil are not considered as, although there is some research quantifying flows of C through them, it is difficult to standardise, measure, and check how the realisation of urban afforestation projects can alter them. The GHG sources and sinks which should be considered in the project are listed in table 6.

Table 6: GHG sources and sinks which must/can be considered in urban afforestation projects.

Source/sink	
Carbon stocked in trees	obligatory
Emissions linked to planting out	obligatory
Emissions linked to maintenance	obligatory
Emissions linked to monitoring	obligatory
Indirect effects linked to the realisation of the project (e.g. energy saving) which cannot however be used for the generation of shares in the Carbomark system	optional
Replacement effect linked to the use of waste productions for the production of energy which cannot however be used for the generation of shares in the Carbomark system	optional

Leakage is defined as the increase in emissions or the reduction in the sequestration of GHGs caused by an afforestation project, which is not quantified within the confines of the project itself. In the case of urban afforestation projects, leakage is most frequently represented by the transfer of financial resources to project sites from other sites that are not linked to the project. For example, the movement of financial resources for the pruning of trees already present within the municipal territory to those planted out as part of the project could cause a reduction in the life of the former, and thus a reduction in the overall capacity of carbon fixation. Leakage will be checked for and confirmed through the use of the public green management plan (Tree Maintenance Plan – TMP) during the monitoring phase of the project. If the reduction in financial resources is greater than 10% of that which the TMP provides for the already existing trees, and cannot be attributed to a cause outside the realisation of the project, then no reduction will be quantified for that year.

Carbon credits that may be sold by the managing Municipality/Body in case a urban afforestation project is carried out, are represented by the tons of CO_2 equivalent that are fixed annually, net of emissions generated from to the realisation of the project and to the maintenance of the plants planted out:

$$C_{CO_2} = Sequestro\_annuale - emissioni$$

in which C_{CO2} is the credit generated annually (t_{CO2} year-1), Annual_sequestration is the annual sequestration of CO_2, and emissions are the annual emissions of CO_2 of the vehicles and equipment used for the planting out and for the maintenance of the trees.

Credit can be sold ex-post.

The annual sequestration of CO_2 will be quantified at the end of every year of the project as the difference between the carbon stocks present at the end of the year in the course of t_1 and those present at the start of the year t_0:

Annual_sequestration = Stock $CO_{2\,(t1)}$ - Stock $CO_{2\,(t0)}$

3.3.3 Management of public green

In this case, the fundamental unit of analysis is not relative to a single plot of land upon which an afforestation project is realised, but is represented by the entire municipal territory where a public green management plan is in the course of validity, and where a survey of green spaces has already been carried out. The spatial position of each fundamental unit (plants or groups of plants) must be noted and registered in a suitable database. For the purposes of implementation of the local market, indirect effects on GHG emission linked to the realisation of the project will not be considered due to the difficulty in calculating and checking.

For the purposes of credit generation, only public green management activities in which an increase in the amount of CO_2 fixed by all plants on the municipal territory occurs, compared to previous survey, will be considered.

The Municipality/Body must furthermore demonstrate by suitable documentation that this increase was not caused by national or regional laws or municipal regulations (e.g. the implementation of the EU instructions regarding the reduction of GHG emissions by 20% through the increase in planting in the municipal territory).

The standard permanence of CO_2 credit calculated according to the methodology described in this chapter and generated by the management of public green is **30 years**: a carbon credit created in 2009 will remain stocked until 2039 and, if it is reissued following plant deaths, for example, it must be replaced. Therefore, for the entire duration of the project (30 years), the owner of the credit should):

- annually quantify the carbon stocks and emissions due to the management of public green;
- replace dead trees: dead trees must be replaced within one year of their removal.

The confines of the project include all operations that are affected by the activities of the project itself, i.e. the entire area of the public green space and the material used for the planting out and for the maintenance of the green space must be taken into account. Planting sites will be calculated within the administrative borders of the municipality considered and, may include streets, parks, cemeteries, green strips, car parks, and other public areas identified during the presentation of the request to join the Market by the managing Municipality/Body.

The confines for the quantification of GHGs include all sources, sinks, and reserves which are affected by the management of the public green and that must be considered for the calculation of reductions and of carbon credit. For the purposes of Carbomark, carbon stocked in trees and GHG emissions associated with the use of motor vehicles and equipment for the planting out and maintenance of trees are taken into account. At the moment, other elements such as shrubs, dead wood, and soil are not considered as, although there is some research quantifying flows of C through them, it is difficult to standardise, measure, and check how the urban afforestation projects can alter them. The GHG sources and sinks of which must be considered in the project are listed in table 6.

The credit calculation method for the management of public green is based on the comparison between the variations in net flows of carbon (stock – emissions) occurring over the course of a year.

The credit can only be sold ex-post.

Therefore the CO_2 credit will be quantified as the difference between the net stock at time t_0 according to the equation:

$$\mathbf{CO_2\ Credits = (Stock\ CO_2 - Emissions)_{t1} - (Stock\ CO_2 - Emissions)_{t0}}$$

In the event that one year negative CO_2 credits are generated, emissions must be offset within the Carbomark Market.

3.3.4 Quantification of credit

The quantification of stocks will happen through the Monitoring Plan, and will be based on the annual measurement of a sample of trees planted out as part of the afforestation project, or, in the event of public green management, will be based on the measurement of a sample of fallen trees within the municipal territory, and on the subsequent extrapolation of information related to the entire population based on the management plan of the green space. In this phase, direct measuring methods should be used. As this approach involves a statistic extrapolation of the results from the sample, the sampling method must be stratified according to species and age class, and the final assessments must have a minimum level of statistical confidence of 90%. If the sampling creates a lower level of statistical confidence, then the estimates of carbon stocks must be discounted according to the coefficient reported in table 7 and based on the sampling error calculation according to the formula:

Sampling error (90% statistical confidence) = (standard error * 1.645)

The standard error (S.E.) is calculated according to the equation:

$$S.E := \frac{\sigma}{\sqrt{n}}$$

in which σ is the standard deviation between the sample plots and n is the number of sample plots carried out for the estimation.

Table 7 : carbon stock reduction coefficients measured depending on the sampling error.

Sampling error	Percentage of reduction of the carbon stock calculated
0-5%	0%
5.1-10%	10%
10.1-15%	20%
15.1-20%	30%
>20%	100%

In the monitoring plan, the sampling method must be indicated, and in particular the number of trees sampled and their position within the municipal territory.

The obligatory variables to be collected for every sample tree in order to quantify the carbon stock are as follows:

- species;
- diameter at 1.30 m from the ground, measured to the nearest 0.1 cm, only for arboreal plants with a diameter greater than 5 cm.

The sampling and measuring methodologies must be statistically appropriate and approved by the Carbomark Market Observatory. **All sample plots must be identified in a permanent way on the land, for the purposes of monitoring the project. The centres of the sample plots, the portions of road or the individual trees must be geographically referenced, and the measuring methodologies must be documented and made available for the technicians carrying out the monitoring.** All the adopted methodologies must necessarily include the criteria detailed in table 8.

Table 8 : criteria to be described for sampling.

Section		Parameter	Description
Arboreal biomass	Obligatory	Diameter a 1.30 m	Minimum sample diameter (recommended: 5 cm)
		Measurement system	Description of the tools used for the measuring of diameter, height, etc.
		Measurement standard	Description of measurement errors
		Stratification	Description of the stratification method adopted
		Sample plot	Description of the sample plots (number, dimensions, localisation)
		Allometric equations	Description of the allometric equations used for the estimation of biomass and relative bibliographic references
Energy saving and reduction in emissions	Optional	Diameter at 1.30 m	Minimum sample diameter (advised 5 cm)
		Measurement system	Description of the instruments used for the measuring of diameter, height, etc.
		Measurement standard	Description of measurement errors
		Climactic zone	Description of the climactic zone
		Building	Description of the methods for quantifying energy consumption by buildings
		Allometric equations	Description of the allometric equations used for the estimation of biomass and relative bibliographic references

The estimation of biomass and carbon will occur in two phases: 1) determining of green volume; 2) conversion of green volume into dry weight, carbon and tons of CO_2 equivalent.

- Estimation of the green volume will be based on the use of the diameter at 1.30 m (D) of each plant, using the suitable species-specific allometric equations for trees grown in an urban environment whose coefficients a and b will be deduced from the available literature (e.g. McHale, 2008; Pillsbury et al., 1998):

$$V = a \times D^b \quad \textbf{(1)}$$

In the event that allometric equations specific to plants grown in urban environments are not available, equations can be used that are for plants grown in forests (e.g. Ter-Mikaelian and Korzukhin, 1997, or regional volume tables for forest species), subsequently applying a reduction factor equal to 0.8 due to the difference in growth between urban and forest environments.

- Determining dry biomass (BEFC) will involve multiplying the volume by the biomass conversion and expansion factor:

$$BF = V \times BEFC \quad \textbf{(2)}$$

By way of example, see Table 4 Examples of basal density of wood for several forest species. In the event that density information is not available for the considered species, a fixed density of 450 kg m^{-2} should be applied.

- Determining total dry biomass (above+roots):

$$BF_{tot} = BF \times 1.28 \quad \textbf{(3)}$$

- Conversion of dry biomass into carbon using conversion factor of 0.5:

$$C = BA \times 0.5 \quad \textbf{(4)}$$

- Conversion of carbon stock (tC) into CO_2 equivalent (tCO_2 equ.):

$$CO_2 = C \times \frac{44}{12} \quad \textbf{(5)}$$

The **annual emissions of CO_2 from vehicles** are those associated with the transportation of staff and trees for green spaces management activities. The calculation of emissions from vehicles is based on the quantity of fuel used annually (litres $year^{-1}$) and a factor of emissions (kg CO_2 $litre^{-1}$):

$$CO_2 = (TC_g \times EF_g) + (TC_d \times EF_d) \quad \textbf{(6)}$$

in which TC = annual consumption (l $year^{-1}$) of petrol (TC_g) or diesel (TC_d), EF = emission factor (EF_g = 2.38 kg CO_2 litre $petrol^{-1}$; EF_d = 2.65 kg CO_2 litre $diesel^{-1}$). If the effective consumption values of fuel are not available, they may be determined based on the characteristics of the vehicle (make, model, year), and the number of km the vehicle has been driven.

The **annual CO_2 emissions of the equipment** for planting out the plants and for the management of these plants are quantifies by using the equation:

$$CO_2 = HRS \times LF \times HP \times EF \quad \textbf{(7)}$$

in which HRS is the number of hours of use per year, LF is the load factor, HP is the maximum power (kg CV^{-1} $hour^{-1}$), EF is the average CO_2 emissions per hour of use (kg CO_2 $hour^{-1}$). Some indicative values of LF, HP and EF are outlined in table 9, while in table 10 several examples for calculating hours of use are given.

Table 9: Load factors, maximum power in horsepower (CV) and emission factors.

Equipment	Load factor (LF) (Nowak et al., 2002)	Maximum power (HP; kg CV^{-1} ora^{-1})	Emission factor (EF; kg CO_2 $hour^{-1}$)
Aerial basket (45 CV)	0.505	0.783	0.568
Motor hoe	0.465	0.775	
Chainsaw (2 CV)	0.500	0.429	
Chainsaw (7 CV)	0.500	0.429	
Chipper (50 CV)	0.370	0.783	

Table 10: Hours of use of different tools for the management of public green.

Diameter (cm)	Pruning				Collection			
	Chainsaw (2 CV)	Chainsaw (4 CV)	Collection truck	Chipper	Chainsaw (2 CV)	Chainsaw (4 CV)	Collection truck	Chipper
1-6	0.05	-	-	0.05	0.3	-	0.2	0.1
7-12	0.1	-	0.2	0.1	0.3	0.2	0.4	0.25
13-18	0.2	-	0.5	0.2	0.5	0.5	0.75	0.4
19-24	0.5	-	1.0	0.3	1.5	1.0	2.2	0.75
25-30	1.0	-	2.0	0.35	1.8	1.5	3.0	1.0
31-36	1.5	0.2	3.0	0.4	2.2	1.8	5.5	2.0
>36	1.5	0.2	4.0	0.4	2.2	2.3	7.5	2.5

3.3.5 Verification and monitoring of credits: the monitoring plan.

The project owner has the obligation to carry out monitoring on the project through a public green management plan (Tree Maintenance Plan – TMP), and a monitoring programme for the project (see Annex F).

Public green management plan.

The registration of the activities of planting out and maintaining green space and of the relative costs is fundamental for the quantification of leakage and of the carbon credits which may be sold on the local market. For the purposes of standardising the annual report, activities are subdivided into five operational areas:

- Planting out of plants:

- Number of plants planted out every year, excluding the replacement of dead plants;

- Number of plants planted out to replace dead plants;

- Species used, sizes and position.

- Care of young plants (< 5 years):

- Number of plants inspected/pruned every year;

- Annual cost.

- Care of adult plants:

- Number of plants inspected/pruned every year;

- Annual cost.

- Removal of plants:

- Number of plants removed;

- Annual cost.

- Administrative costs.

Monitoring plan for trees.

The monitoring plan for trees is fundamental to the decision regarding the methods used for the quantification of carbon credits. It must involve the following indications:

- sampling method;
- description of the measurement methodology;
- value and description of coefficient used in equation 1;
- description of the statistical methods used to extrapolate the results of the sampling;

- methods used for the quantification of error.

Collection of data on emissions and GHG sequestration.

This report should indicate the following information necessary for the quantification of carbon credits generated annually by the project:

- data on the species, sizes, sampling date, position of the sample plots;
- parameters used in the allometric equations;
- annual quantity of fuel used for the planting out and management of green spaces.

3.4 Credits from biochar.

3.4.1 Biochar: project proposal.

A project for the production and use of biochar for the reduction of GHG emissions is defined as the ensemble of operations for producing biochar via the process of pyrolysis and its application to the soil in order to increase the carbon stock, net of GHG emissions deriving from these operations. Biochar is defined as a carbon-rich compost produced by the pyrolysis of vegetable biomass. In this type of project, **the fundamental unit of analysis is represented by the pyrolyser which produces biochar from vegetable waste.** The beneficiary of the carbon credit which derives from the production and use of biochar as a soil fertiliser is the owner of the pyrolyser. For obtaining carbon credits, only the production of biochar at temperatures higher than 350 ºC will be considered.

Demonstration of additionality

Carbon credits are only generated from projects which respect the criteria of the additionality of the investments made with respect to the conditions of ordinary management, i.e. to the business as usual scenario. With regard to biochar, the requirement of additionality is satisfied the moment that distribution of the produced biochar in the soil has been guaranteed.

Confines of the project

The project includes physical and geographical confines which include all the operations that are affected by the project itself. Therefore, they include:

- the production areas of crop remnants and other vegetable biomass;
- the areas where crop remnants or other vegetable biomass would be used if the project were not in force;
- the areas where the pyrolysis of vegetable biomass occurs;
- the location where remnants from the pyrolysis process are deposited;
- the areas in which biochar will be distributed;
- the routes travelled in order to transport crop remnants to the pyrolysis machine and subsequently, to transport the biochar produced to the land for application.

The project should be realised by Municipalities within the following regions: Friuli Venezia Giulia and Veneto.

For the purposes of Carbomark, for the calculation of emissions and the removal of emissions of CO2, N2O and CH4 during the project, the GHG sources and sinks listed in Table 11 must be considered.

Table 11: GHG sources and sinks considered in the project for the production and use of biochar.

	Type of emission	Gas	
Project activity	Emissions from the pyrolysis process	CO_2	Included
		N_2O	Excluded
		CH_4	Excluded
	Emissions from transportation and application of biochar	CO_2	Included
		N_2O	Excluded
		CH_4	Excluded
	Emissions from fuels/energy used	CO_2	Included
		N_2O	Excluded
		CH_4	Excluded
	Removal of emissions from the storage of carbon in the soil	CO_2	Included
		N_2O	Excluded
		CH_4	Excluded

Permanence of credits

For its high degree of stability, the biochar added to the soil allows for the sequestration of part of the carbon for a duration that may last over 1000 years (varying according to the type of biomass used to obtain the biochar, the conditions of pyrolysis, work performed on the soil, etc…). For the purposes of Carbomark and as a caution, one may consider the permanence of credits to be 100 years. Therefore a carbon credit generated in 2009 will remain stocked until 2109.

The credit beneficiary (the owner of the pyrolyser) must guarantee that, once produced, the biochar will be distributed onto agricultural land (see the paragraph on ‘monitoring’).

Determining the baseline (initial situation 'without project')

With regard to biochar, the baseline is considered to be equal to zero: every addition of biochar to the soil will be counted for the purposes of carbon credits, net of emissions derived from its production.

Environmental impact of the project (Leakage)

By leakage, we mean every change in GHG emissions determined by the project itself but occurring outside the confines of the project. In the case of biochar application to the soil, emissions beyond the confines of the projects are not predicted (changes in land use or emissions caused by long-term storage of biochar outside the confines of the project are not expected).

3.4.2 Methodology and calculation of credits, emissions, reductions and/or removal of GHG over the course of the project.

The quantification of emissions and removal of GHG is obligatory and must be reported annually. The carbon credits that can be sold by the owner of the pyrolyser are represented by the tons of CO_2 equivalent (tCO_2e) of biochar incorporated into agricultural land, net of emissions caused by its production and distribution:

Carbon credit (tCO_2e) = Removal of $CO_{2,y}$ – Emissions of $CO_{2,y}$ – lack of CO_2 sequestration due to the burying of crop remnants.

Calculation of removal.

- Calculation of net removal of GHGs due to the project activities

They are calculated by subtracting the emissions associated with the project from the GHG removal due to the project:

$$C_{net,y} = C_{sequest,y} - PE_y$$

where $C_{net,y}$ = net removal of GHGs caused by the project activity in year y ($tCO_2e\ year^{-1}$); $C_{sequest,y}$ = removal of GHG caused by the project activity in year y ($tCO_2e\ year^{-1}$); PE_y = emissions caused by the project in year y (tCO_2e).

- Calculation of GHG removal caused by the project activity

The removal of GHGs caused by the distribution of biochar in the soil will be taken into consideration:

$$C_{sequest,y} = Q_{residui,y} * CC_{residui,y} * SC_{carbon\text{-}CO_2}$$

where $C_{sequest,y}$ = removal of GHGs caused by the project activity in year y ($tCO_2e\ year^{-1}$); $Q_{residui,y}$ = the quantities of residual matter pyrolysised in year y (tons) which will be returned to the soil as biochar; $CC_{residui,y}$ = average of fixed content of carbon present in the residual matter pyrolysised in year y (%); SC_{carbon}-CO_2 = is the stoichiometric relationship between carbon and CO_2 (44/12).

Calculation of the lack of carbon sequestration generated by decomposition of crop remnants in aerobic conditions:

$$MCsequest,y = \Delta CDOM,y + \Delta CSOM,y$$

where $MC_{sequest,y}$ = lack of GHG removal caused by decomposition of crop remnants in aerobic conditions in year y (tCO_2e); $\Delta C_{DOM,y}$ = average annual difference of sequestered C in pools of dissolved organic matter (DOM) which would be derived from rendering organic the biomass which was instead used for the production of biochar in the year y (tCO_2e, calculated empirically through models, following the outlines of the IPCC Guidance, Tier 3); $\Delta C_{SOM,y}$ = average annual difference in carbon sequestrated in pools of organic matter in the soil (SOM) which would be derived from rendering organic the biomass which was instead used for the production of biochar in the year y (tCO_2e, estimated by using models including the *Century* or *SCUAF soil organic matter model 8*);

Calculation of emissions.

The project emissions are synthesised in the following equation:

$$PEy = PEpirol,y + PEfuels,y + PEtransportation,y + PEmachinery,y + PEother,y$$

where PE_y = project emissions during the year y (tCO_2e); $PE_{pirol,y}$ = emissions from the pyrolysis process in year y caused by synthesis (non-biodegradable) (tCO_2e); $PE_{fuels,y}$ = emissions caused by the additional use of fossil fuels for pyrolysis in the year y (tCO_2e); $PE_{transportation,y}$ = emissions caused by the collection and transportation of crop remnants or pyrolysised residual matter in the year y (tCO_2e); $PE_{machinery,y}$ = emissions caused by the use of machinery for the application of biochar to the land (tCO_2e); $PE_{other,y}$ = CO_2 emissions caused by the use of fossil fuels and/or electric power from other structures used (tCO_2e).

The individual CO_2 emission entries are calculated as follows:

$$PEpirol,y = Q1emissions,y + Q2emissions,y + Qnemissions,y$$

where $PE_{pirol,y}$ = emissions from the pyrolysis process in the year y caused by non-biodegradable material (tCO_2e); $Q1_{emissions,y}$ = emissions from the first non-biodegradable material pyrolysised; $Q2_{emissions,y}$ = emissions from the second non-biodegradable material pyrolysised, $Qn_{emissions,y}$ = emissions from the n^{th} non-biodegradable material pyrolysised.

The factor $Q_{emissions,y}$ is equal to:

Qemissions,y = Qmaterials,y * CALmaterials * EFn-bmaterials

where $Q_{materials,y}$ = the quantity of pyrolysised material in the year y (kg); $CAL_{material}$ = calorific value net of the material (MJ kg^{-1}); $EF_{n\text{-}bmaterial}$ = factor of CO_2 emissions of the material (tCO_2 $M^{J\text{-}1}$).

PEfuels,y = Qc,y * CALc* EFc

Where $PE_{fuels,y}$ = emissions caused by the additional use of fossil fuels for pyrolysis in the year y (tCO_2e); $Q_{c,y}$ = the quantity of fossil fuels used in the year y (kg or l); CAL_c = calorific value net of the fuel (MJ l^{-1} o MJ kg^{-1}); EF_c = factor of CO_2 emissions of the fuel (tCO_2 MJ^{-1}).

PEtransportation,y = Qct,y * CALct * EFct

where $PE_{transportation,y}$ = emissions caused by the collection and transport of residual or pyrolysised vegetation in the year y (tCO_2e); $Q_{ct,y}$ = quantity of fuel used for transportation in year y (l or kg); CAL_{ct} = calorific value of the fuel used for transportation (MJ l^{-1} o MJ kg^{-1}); EF_{ct} = factor of CO_2 emissions of the fuel used for transportation (tCO_2 MJ^{-1}).

PEmachinery,y = Qcm,y * CALcm * EFcm

where $PE_{machinery,y}$ = emissions caused by the use of machinery for the application of biochar (tCO_2e); $Q_{cm,y}$ = quantity of fuel used by the machinery in the year y (l o kg); CAL_{cm} = calorific value net of fuel used for the machinery (MJ l^{-1} o MJ kg^{-1}); EF_{cm} = factor of CO_2 emissions of the fuel used for machinery (tCO_2 MJ^{-1}).

PEother,y = Qelettr,y * EFelettr

where $PE_{other,y}$ = emissions from other sources (tCO_2e); $Q_{electr,y}$ = electricity consumed in the year y (Kwh); EF_{electr}= weighted average of the CO_2 emission factor of electricity calculated in the year of electricity use ($kgCO_2e$ kWh^{-1}).

3.4.3 Verification and monitoring of credits: the monitoring plan.

The monitoring plan provides for the control and relative documentation of the following parts of the biochar production chain:

- annual quantity of biochar produced;
- percentage composition of the volatile and solid carbon residues, ash, and humidity of the biochar produced. A sufficient number of samples of biochar must be taken in order to reduce variability to a level no higher than 20% (uncertainty range of 20%) using a sampling error with a level of statistical confidence of 95%. These assessments will be performed by following the

methodology proposed in the 'Standard Test Method for Chemical Analysis of Wood Charcoal' – ASTM D1762-84 (2001). The residues obtained by pyrolysis will be considered biologically inert if the relationship between volatile and solid carbon composts is equal to or less than 50%. Four annual samples are recommended;

- annual quantity of pyrolysised crop remnants (Qmaterials,y) and the annual quantity of non-biodegradable material. The latter must be determined by the assessment of emissions from the pyrolysis process caused by synthesised material (PEpirol,y). As in point (2), a sufficient number of samples must be taken in order to reduce variability to levels no higher than 20% (uncertainty range of 20%) using a sampling error with a level of statistical confidence of 95%. Four annual samples are also advised in this case;
- annual quantity and type of additional fuel used during the pyrolysis (Qc,y) to allow for an estimation of emissions;
- annual quantity and type of fuel used for transportation (Qct,y) to allow for an estimation of emissions;
- annual quantity and type of fuel used for using machinery for the distribution of biochar (Qcm,y) to allow for an estimation of emissions;
- annual quantity of electrical power used (Qelectr,y) to allow for an assessment of emissions;

The credit beneficiary should demonstrate that the biochar produced has been integrated into the soil in order to guarantee the sequestration and storage of carbon. For this reason, the owner of the pyrolysis machine should document:

the quantity of biochar distributed per hectare per agricultural owner (tons of biochar ha^{-1}). In order to maintain and increase the fertility of the agricultural solid, distribution of biochar is advised at no higher than 40 tons ha^{-1} per $hectare^{-1}$;

that the distribution of biochar has been performed through representative sampling of the soil and the analysis of total carbon. The sampling must have been carried out for every agricultural owner that will use biochar (a representative sample per company), and should be performed immediately after the distribution or incorporation of biochar into the soil (within a maximum of one month after distribution).

In order to assess the effective carbon sequestration caused by the used of biochar in the soil, a sampling must be **performed every five years for a period of at least 20 years**, on a representative number of agricultural soils upon which the produced biochar has been distributed.

3.5 Summary of the characteristics of agro-forestry credits

Table 12: characteristics of credits from forest management.

CARATTERISTICHE DEI CREDITI FORESTALI DEL MERCATO VOLONTARIO CARBOMARK													
		Caratteristiche delle attività di mitigazione											
		Individuazione dei limiti del progetto	Determinazione della baseline	Valutazione del rischio di non permanenza			Prova dell'addizionalità dell'attività	Rilascio del credito	Periodo di validità dei crediti	Misurazione /conteggio del sequestro di carbonio	Monitoraggio della performance	Proprietà dei crediti di carbonio	Supporto politico
			Standard minimi	Fattore di rischio	Cause: disturbi naturali	Metodologia adottata per ridurre il rischio	Definizione di test di addizionalità	Ex ante ex post	Durata del progetto	Definizione della metodologia di conteggio	Monitoraggio dell'assorbimento delle emissioni nel tempo	Definizione dei diritti sui crediti e degli aspetti fiscali	Interesse politico e attrattiva pubblica per l'attività
Gestione forestale	Risparmio dell'incremento legnoso	Area geografica	Serbatoi di carbonio come da inventario nei piani di gestione forestale in vigore	0-basso (0-7%), medio (> 7% < 14%), alto (14-21%)	Attacchi parassitari	Approccio "buffer".Accantonamento di una quantità di crediti sulla base del rischio dell'evento misurato sulle statistiche regionali di quella categoria di eventi negli ultimi 30 anni. Il rischio è legato alla tipologia forestale interessata dal progetto.	Il sequestro di carbonio è addizionale rispetto a quanto previsto dai piani di gestione forestale in vigore. Il proprietario forestale si impegna a mettere da parte una parte dell'incremento legnoso invece che utilizzarlo come previsto dal piano	Ex ante	30 anni	Linee guida IPCC LULUCF, equazioni allometriche locali	Attività di monitoraggio svolta dagli osservatori regionali di Kyoto e dalla revisione ogni 12 anni del piano di gestione forestale	Contratti vincolanti firmati da acquirenti e venditori (proprietari forestali)	Medio
				0-basso (0-7%), medio (> 7% < 14%), alto (14-21%)	Incendi	Approccio "buffer".Accantonamento di una quantità di crediti sulla base del rischio dell'evento misurato sulle statistiche regionali di quella categoria di eventi negli ultimi 30 anni. Il rischio è legato alla tipologia forestale interessata dal progetto.							
		Serbatoi di carbonio 1.Biomassa legnosa vivente epigea		0-basso (0-7%), medio (> 7% < 14%), alto (14-21%)	Schianti da vento o da neve	Approccio "buffer".Accantonamento di una quantità di crediti sulla base del rischio dell'evento misurato sulle statistiche regionali di quella categoria di eventi negli ultimi 30 anni. Il rischio è legato alla tipologia forestale interessata dal progetto.							
		Regola del de minimis: conteggio di uno dei serbatoi di carbonio che si prevede aumenti il carbonio sequestrato											
			Standard minimi	Fattore di rischio	Cause: disturbi naturali	Metodologia adottata per ridurre il rischio	Definizione di test di addizionalità	Ex ante ex post	Durata del progetto	Definizione della metodologia di conteggio	Monitoraggio dell'assorbimento delle emissioni nel tempo	Definizione dei diritti sui crediti e degli aspetti fiscali	Interesse politico e attrattiva pubblica verso l'attività
Gestione forestale	Riqualificazione di aree a bassa densità arborea	Area geografica	Serbatoi di carbonio come da inventario nei piani di gestione forestale in vigore	0-basso (0-7%), medio (> 7% < 14%), alto (14-21%)	Attacchi parassitari	Approccio "buffer".Accantonamento di una quantità di crediti sulla base del rischio dell'evento misurato sulle statistiche regionali di quella categoria di eventi negli ultimi 30 anni. Il rischio è legato alla tipologia forestale interessata dal progetto.	Il sequestro di carbonio è addizionale rispetto a quanto previsto dai piani di gestione forestale in vigore. Il proprietario forestale si impegna ad aumentare la biomassa presente in bosco aumentando la densità tramite piantatumazione di nuovi alberi.	Ex ante	30 anni	Linee guida IPCC LULUCF, equazioni allometriche locali	Attività di monitoraggio svolta dagli osservatori regionali di Kyoto e dalla revisione ogni 12 anni del piano di gestione forestale	Contratti vincolanti firmati da acquirenti e venditori (proprietari forestali)	Basso
				0-basso (0-7%), medio (> 7% < 14%), alto (14-21%)	Incendi	Approccio "buffer".Accantonamento di una quantità di crediti sulla base del rischio dell'evento misurato sulle statistiche regionali di quella categoria di eventi negli ultimi 30 anni. Il rischio è legato alla tipologia forestale interessata dal progetto.							
		Serbatoi di carbonio 1.Biomass legnosa vivente epigea											
		Regola del de minimis.Conteggio di uno dei serbatoi di carbonio che si prevede aumenti il carbonio sequestrato		0-basso (0-7%), medio (> 7% < 14%), alto (14-21%)	Schianti da vento o da neve	Approccio "buffer".Accantonamento di una quantità di crediti sulla base del rischio dell'evento misurato sulle statistiche regionali di quella categoria di eventi negli ultimi 30 anni. Il rischio è legato alla tipologia forestale interessata dal progetto.							

Table 13: characteristics of credits from urban forestry.

CARATTERISTICHE DEI CREDITI FORESTALI DEL MERCATO VOLONTARIO CARBOMARK													
Caratteristiche delle attività di mitigazione													
Descrizione attività di mitigazione		Individuazione dei limiti del progetto	Determinazione del periodo di riferimento	Valutazione del rischio di non permanenza			Prova dell'addizionalità dell'attività	Rilascio del credito	Periodo di validità dei crediti	Misurazione /conteggio del sequestro di carbonio	Monitoraggio della performance	Proprieta dei crediti di carbonio	Supporto politico
Misure di afforestazione			Standard minimi	Fattore di rischio	Cause	Metodologia adottata per ridurre il rischio	Definizione di test di addizionalità	Ex ante ex post	Durata del progetto	Definizione della metodologia di conteggio	Monitoraggio dell'assorbimento delle emissioni nel tempo	Definizione dei diritti sui crediti e degli aspetti fiscali	Interesse politico e attrattiva pubblica per l'attività
	Forestazione urbana	Area geografica: area fisicamente sotto la giurisdizione/controllo del Comune	Piano del verde urbano in vigore, regolamenti nazionali ed europei in vigore	Zero, Basso (5-15%) Medio (15-40 %) Alto (40-60%) Fallimento	Disturbi naturali (attacchi parassitari, schianti etc) e disturbi antropici (atti vandalici, inquinamento del suolo e dell'aria)	Sostituzione degli alberi morti	Test di performance. Le piantagioni saranno addizionali rispetto a quanto previsto dai regolamenti comunali (piano del verde urbano), nazionali ed europei (es.come il Patto dei sindaci)	Ex-post, su base annuale. Ogni anno viene effettuato il monitoraggio dell'effettivo sequestro di carbonio della piantagione	20 anni	Equazioni allometriche	Piano di manutenzione del verde urbano e scheda di monitoraggio della piantagione	Contratti vincolanti firmati da acquirenti e venditori (Comuni)	Alto
		Serbatoi di carbonio 1.Biomassa arborea epigea			Cambiamento d'uso del suolo a causa di diversa zonizzazione (nuove infrastrutture, rete di trasporto etc.)	Misurazione conservativa (= in difetto) del carbonio accumulato dall'attività							

Table 14: characteristics of credits from wood products.

CARATTERISTICHE DEI CREDITI FORESTALI DEL MERCATO VOLONTARIO CARBOMARK													
Caratteristiche delle attività di mitigazione													
Descrizione attività di mitigazione		Individuazione dei limiti del progetto	Determinazione della baseline	Valutazione del rischio di non permanenza			Prova dell'addizionalità dell'attività	Rilascio del credito	Periodo di validità dei crediti	Misurazione /conteggio del sequestro di carbonio	Monitoraggio della performance	Proprieta dei crediti di carbonio	Supporto politico
			Standard minimi	Fattore di rischio	Cause	Metodologia adottata per ridurre il rischio	Definizione di test di addizionalità	ex ante ex post	Durata del progetto	Definizione della metodologia di conteggio	Monitoraggio dell'assorbimento delle emissioni nel tempo	Definizione dei diritti sui crediti e degli aspetti fiscali	Interesse politico e attrattiva pubblica per l'attività
Sostituzione materiali ad alta intensità energetica con prodotti legnosi	Prodotti legnosi di lunga durata	Area geografica	Statistiche regionali/inventari sull'utilizzo di prodotti legnosi ad usi infrastrutturali	Basso	Durata del prodotto legnoso inferiore al ciclo di vita medio del prodotto	Assicurazione	Test dei regolamenti locali o utilizzo di una quantità di prodotti legnosi al di sopra della soglia definita dalle statistiche regionali/nazionali	Ex post	50 anni	Carbonio stoccato nel prodotto legnoso utilizzato	Autorità locali,osservatori regionali di Kyoto	Titolari dei crediti sono i titolari dei progetti (imprese costruttrici, privati, enti pubblici). Contratti vincolanti firmati da acquirenti e venditori (proprietari forestali)	Alto
		Serbatoi di carbonio. Prodotti legnosi 1) carbonio stoccato in prodotti legnosi utilizzati per usi infrastrutturali (travature, tetti, ponti etc.)											

Table 15: characteristics from biochar credits.

CARATTERISTICHE DEI CREDITI FORESTALI DEL MERCATO VOLONTARIO CARBOMARK

		Caratteristiche delle attività di mitigazione											
	Descrizione attività di mitigazione	Individuazione dei limiti del progetto	Determinazione della baseline	Valutazione del rischio di non permanenza			Prova dell'addizionalità dell'attività	Rilascio del credito	Periodo di validità dei crediti	Misurazione /conteggio del sequestro di carbonio	Monitoraggio della performance	Proprieta dei crediti di carbonio	Supporto politico
			Standard minimi	Fattore di rischio	Cause	Metodologia adottata per ridurre il rischio	Definizione di test di addizionalità	Ex ante ex post	Durata del progetto	Definizione della metodologia di conteggio	Monitoraggio dell'assorbimento delle emissioni nel tempo	Definizione dei diritti sui crediti e degli aspetti fiscali	Interesse politico e attrattiva pubblica per l'attività
Misure agricole	Biochar	**Area geografica.** Area di raccolta dei residui colturali, impianto a biomassa di produzione del biochar, area di distribuzione del biochar.Aree incluse nei territori regioni Veneto e FVG	Utilizzo di biochar nei territori del mercato (regioni Veneto e FriuliVenezia Giulia). Al 2009 era pari a zero	Da basso a nullo	Cambiamento d'uso del suolo	Misurazione conservativa (= in difetto) del carbonio accumulato dall'attività	L'addizionalità è garantita dall'assenza di produzione di biochar utilizzato nei suoli agricoli nelle due regioni interessate dal mercato	Ex post	100 anni	Linee Guida IPCC	Piano di monitoraggio	Contratti vincolanti firmati da acquirenti e venditori (produttori biochar)	Alto
		Serbatoi di carbonio. Bilancio di emissioni ed assorbimenti di CO2 dalla produzione in centrale alla distribuzione su suoli agricoli											

CHAPTER 4 - ENVIRONMENTAL INTEGRITY.

The primary aim of offset actions and the carbon credits generated by them is to sequester a measurable quantity of carbon dioxide. It is thus fundamental that the sequestration and/or cutting down are real, measurable and verifiable. Environmental integrity Takes AS ITS reference the environmental requirements linked to mitigation; the credits must satisfy such requirements before being sold on the Market. For this reason, the Carbomark project has defined protocols and methodologies which will tackle the technical, economic, and legal aspects of the projects, guaranteeing them credibility as saving actions. Though the offset projects in their pilot phase are not certified by a body and/or third party standard, the mechanisms and methodologies adopted make reference to some international standards such as the Voluntary Carbon Standard guidelines for the Land Use, Land Use Change and Forestry projects. Furthermore, the projects and credits are subject to internal control and auditing.

The methodologies adopted thus have the objective of improving not only the credibility of the credits generated but also guaranteeing solidity from an environmental point of view. In this sense, it is desirable that projects may be considered as “best practices” in the future, and may become a point of reference for those wishing to develop forestry mitigation projects in Italy and abroad.

4.1 Environmental integrity: environmental requirements of credits.

Environmental integrity is particularly important for forestry credits as they concern potentially reversible offset activities whose duration must be guaranteed through a system of obligations and commitments for owners, and a system of monitoring and control. Furthermore, it concerns a crucial characteristic of all credits sold on the voluntary market linked to the withdrawal of the credit once it has be exchanged in order to avoid its double accounting and even its double sale in the one or more voluntary markets.

Environmental integrity can therefore be assessed by observing the way in which the following characteristics and requirements are defined and tackled by the working protocols of the credits and the Market:

- additionality,
- permanence;
- integrity, withdrawal, and cancellation of credit;
- verification of the off-set.

4.1.1 Additionality.

When referring to additionality, we are referring to the ownership of mitigation actions which would not have been performed without the incentives offered by the sale of credits. Additionality is fundamental as to allow mitigation actions to induce an effective saving and sequestration of CO_2 with respect to a business as usual situation. The four typologies of exchanged credits are subject to rigorous “additionality tests”, while the projects which fail the tests or that are whose additionality is doubtful, are excluded.

4.1.2 Permanence.

Permanence refers to the duration of the credit over time and to its non-reversibility. This characteristic is fundamental in ensuring that the sequestration action carried out by the credit is real and credible.

In reality, forestry credits for forest management and urban forestry *in primis,* as opposed to other mitigation actions, are subject to a series of disturbances including fires, parasite attacks, and breakages, which does not only compromise and reduce the ability of the plants to fix carbon, but also converts a forest from an absorber to an emitter of carbon.

In order to guarantee the durability and permanence of sequestration action for forest management and urban forestry credits, and the storage of carbon for wood products, two mechanisms designed to guarantee permanence have been created and defined:

- a “buffer” system which, based on the measured risk which verifies disturbances to the wood, sets aside reserve credits aimed at covering any eventual losses,
- a monitoring system which verifies the sequestration entity during the project lifecycle and at its conclusion.

4.1.3 Integrity, withdrawal, and cancellation of credit.

The voluntary market, due to the absence of a system of binding rules, is configured like an exchange platform whereby transactions are not regulated by a system of binding regulations. For this reason, it is fundamental not only that the methodologies are as transparent as possible, but also that a procedure is provided for that ensures the registration of credit and the assigning of a unique code which as a guarantee of uniqueness, in order avoid the same credit being sold more than once. In order to overcome this problem, many voluntary market operators such as the Voluntary Carbon Standard, the Gold Standard, and the Voluntary Carbon Offset have developed their own registers which retrace sold credits and withdraw and cancel them once the transaction is completed. A register which belongs to the Regional Observatory is also predicted for the Carbomark Market.

The functions of the register include:

- to retrace carbon credits generated by Carbomark offset projects;
- to register carbon credits generated by the projects (type of project, quantity, and duration of credit, information regarding ownership, monitoring plan);
- to register information regarding the buyer and seller involved in the sold carbon shares and the sales contracts for the carbon shares;
- assign a unique registration code to the carbon shares exchanged on the Market;
- to withdraw and cancel the sold carbon share from the Market.

In the Market, the credits are the offset units generated by offset projects and are expressed in t/CO_2 eq. These are subject to internal verification procedures and an internal auditing process, at the end of which they are classified as “saleable” insofar as they satisfy the requirements of the Carbomark offset protocols.

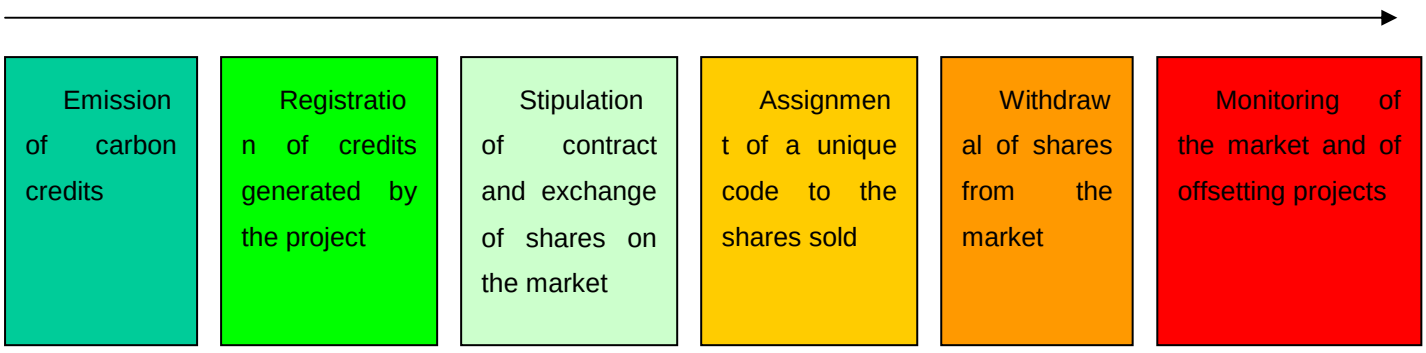
The projects generate many units, the carbon credits, which will be registered in the Market with reference to the project and their owner. The carbon credits of a project are sold **“aggregated” into carbon shares** which represent the quantity effectively sold and bought on the Market.

Each share is assigned a unique registration code, and is subject to withdrawal and cancellation from the Market, as reported in the register. This procedure guarantees the uniqueness of the exchanged shares and the credibility of the mitigation action in general, fine tuning a mechanism which prevents the eventual double accounting or fraudulent use of credits.

Normally, the withdrawal of credit shares occurs within a maximum of 3 months from the stipulation of the contract and is assigned with a unique registration code which identifies it unequivocally. After the assignment of this unique registration code, the shares can no longer be exchanged.

Responsibility for the withdrawal and cancellation of the credit lies with the regional observatory which keeps the credit register. The Observatories of the Regions of Veneto and Friuli Venezia Giulia are respectively obliged to keep and update the register of Carbomark credits.

Diagram 2: example of the lifecycle of carbon credits and shares.



4.1.4 Verification of the offset.

In the Carbomark project, carbon credits are generated from a pool of mitigation activities which include sustainable forest management, urban forestry, the use of long-lasting wood products and biochar. In each of these projects and activities, the effective mitigation occurs in different phases throughout the duration of the project, both ex-ante and ex-post with reference to the phase of effective carbon sequestration. Some carbon credits are sold ex-ante, before the sequestration is effectively completed and may cause doubts in the buyer regarding the fulfilment of the offsetting of emissions.

In order to guarantee that projects carry out the carbon sequestration to which the sold shares correspond, the project protocol predicts that the seller of the shares, the public or private entity, will adopt a

monitoring plan. This plan, which can also coincide with other forms of planning that are in force or have been adopted, provides specific directives regarding the verification of the quantity of offset carried out, if the credits generated were sold ex-ante, and therefore according to estimations and predictions. The ex-ante assessment, insofar as it is accurate and subject to internal auditing, may in fact distance itself from the quantity of carbon sequestered ex post. For this reason, each offset project will have a monitoring plan, as outlined in table 11.

Table 16: Verification of the offset carried out by credits.

Mitigation activity	Sale of credit with respect to the effective offset	Mechanism of verification and monitoring
Sustainable forest management	Ex- ante - Ex-post	Forest management plan, monitoring plan
Urban forestry	On an annual basis, simultaneously with the sequestration	Plan of public green and/or monitoring plan
Wood products	Ex-post	No plan envisaged
Biochar	Ex-post	Monitoring plan

4.2 Environmental sustainability of carbon credits.

With regard to mitigation projects developed on a global level, forestry projects represent one of the categories with the greatest potential for creating a wide range of additional environmental and social benefits to the community, beyond those climactic ones.

Among the many environmental benefits and services generated by woods for the community are the following:

- conservation of biodiversity;
- functions linked to water including the hydrogeological function, a reduction in surface erosion and the purification of water;
- recreational function;
- landscape benefits;
- climate benefits from the reduction in CO_2;
- climate benefits from the lowering of temperatures;

- production function (wood products, biomass for energy purposes, secondary products).

The offset projects adopted are characterised by particularly fulfilling some of the functions listed above.

Among these, urban forestry projects primarily create benefits like the recreational function, the improvement of the urban landscape and the lowering of summer temperatures, which contributes to a reduction in the energy consumption of air conditioning installations.

Biochar projects also have positive environmental effects which go beyond the limits of simply reducing emissions. Among these effects, one may list the increase in soil fertility, and a more stable structure with a reduction in run-off and soil degradation caused by intensive, long-term farming. Furthermore, biochar is renowned for its ability to absorb pollutants such as heavy metals, rendering such elements inactive in the soil.

With regard to forest management projects, offset activities are integrated with sustainable forest management which is already aimed at rendering the woods multifunctional. Thus, in this case, the project first proposes to increase the carbon sequestration function of the woods in question, for which the generated carbon credit represents an offset to the owner for a climactic service supplied by the woods. Nevertheless, the forests in both regions supply a wide range of services to the community: a higher level of biodiversity, different functions linked to the water cycle and to its quality, the recreational function, and the various production functions.

For the aforementioned project typologies, carbon credits and their Market prices also reflect and capture the environmental benefits bestowed upon the community. In the case of small-scale urban forestry projects in terms of sequestered $CO_{2,}$ for example, the environmental benefits become much more significant than the climactic ones, operating in an urbanised environment where the environmental value of a wood is very high, even if the woos is very small in size.

For long-duration wood products, the main function is the action of replacing with wood other materials which are more energy intensive; other direct environmental benefits have not been identified. Nevertheless, the fact that credits can be generated only by wood that is certified as having come from a sustainably managed forest, guarantees that upstream of the production chain, the forests of origin are providing a wide spectrum of environmental services.

CHAPTER 5 - ANALYSIS OF MARKET RISKS.

The Carbomark Market positions itself as a pilot scheme aimed at activating and incentivising voluntary actions linked to the fight against climate change.

The contents and aims of the project place themselves within the context of an innovative and experimental action with two main objectives:

1. the design, definition, and application of innovative technical-scientific protocols for the four types of carbon credits;

2. the development of a local market which owners, public bodies, and local-scale emitters may join.

The sensitivity analysis is aimed at identifying the criticalities and elements of weakness, mainly in reference to these two actions.

Even if the objectives of the project are reached, the success of the Market as a pilot and innovative scheme is linked to a series of external variables on which its impact as an instrument aimed at reducing greenhouse gas emissions will depend.

5.1 Risks linked to the application of technical-scientific protocols.

In the voluntary Carbomark Market, the technical-scientific protocols at the basis of the definition of carbon credits, were internally defined according to methodologies developed by researchers, **policy makers**, and project partners. In this phase, a procedure for consulting other players on a local, national, and international level in order to discuss the contents of the adopted methodologies was not put in place.

With regard to the protocol, much attention has been placed on the best way to tackle two key questions linked to the exchange of carbon credits in a rigorous manner: the risk of non-permanence of the credit and the risk of double accounting. Both these problems have been rigorously tackled, and, with regard to the second, every aspect that may give rise to some doubt on the superimposition of credits from forest management exchanged at a local level, and the counting of forest management on a national level, according to that which is provided for by article 3.4 of the Kyoto Protocol, has been clarified. This measure in fact provides that on a national level, agro-forestry activities and in particular forest management, will be counted in the national balance of greenhouse gases. It is nevertheless desirable that in a second phase of the Market, a debate and/or consultation, widened to include different **stakeholders** and public and private players, is launched in order to discuss the technical-scientific protocols adopted. This discussion is particularly important with regard to carbon credit certification standards. Although the Carbomark mark does not yet represent a credit certification standard, but a methodological protocol valid only within the Carbomark Market, in the future it would also be appropriate to hold open discussions with accredited international standards for the certification of forestry credits in order to identify elements of strength and weakness in comparison with other certifications.

With regard to the risk of double accounting of credits, and particularly to the possibility of a double sale by the credit owners, the management of the credit register established at the Observatories represents an

element which protects against any such fraudulent use. However, in the future this function could be better carried out by a player which is outside of the Observatory in order to guarantee impartiality with respect to those players that develop projects and carbon credits, among which are also the Observatories.

5.2 Risks and elements of Market weakness.

To some extent, the characteristics of the Carbomark Market can be likened to those of markets in general, as platforms of free exchange where supply and demand of goods meet. In order to function correctly, some Market characteristics have been briefly listed below:

- heightened transparency and information on exchanged goods and their characteristics;
- elasticity of supply and demand and the high number of players participating in the Market.

With regard to the first requirement, the Carbomark voluntary Market represents a “new” exchange platform, insofar as the goods exchanged, i.e. the ton of CO_2 equivalent, does not physically enter the Market but represents an intangible **commodity.** For some credits, such as those from forestry management, the exchange, in the form of a contract between buyer and seller of credits, concerns an asset, i.e. the ton of CO_2, which will be generated in the future, once the transaction has happened; a characteristic which exposes the exchange to a margin of uncertainty. Furthermore, this type of transaction involves a “waiting cost” for the buyer: an expression of the value of time in money or opportunity cost involved in waiting for an extended period of 10 to 30 years before CO_2 sequestration is realised. At the moment this waiting time, which may also be expressed in terms of interest rate, is not reflected in the price of the credit realised ex-post, but may represent a penalising element compared to those credits which at the moment of exchange, are already realised and for which the seller does not have to wait.

Furthermore, at the initial phase, the limited information available regarding the carbon credits Market and the reduction and offsetting of emissions in general may impede the fulfilment of this goal and limit the number of participating players.

Another element of weakness in the initial phases is represented by the scarce number of transactions which renders supply and/or demand not very flexible. The credits exchanged, the expression of a reduction in CO_2 on a local level, are generated by projects negotiated on the basis of single transactions. In the first phase of the Market, these transactions are limited insofar as the minimum number is fixed at 10 transactions per Region. Although it would be desirable to have a higher number of buyers and sellers entering the Market, at the moment there remains uncertainty regarding the quantity of transactions which will be brought to a close. A limited number of exchanges would render supply and demand non flexible, and, in particular, the price of the exchanged credit, more than being the result of the real value of the Market, would be a price agreed by the parties in the sales contract. On the other hand, a high number of transactions, would contribute to the definition of the real value attributed to the exchanged forestry credit, as well as constituting a reference **benchmark,** a quotation based on reality.

CHAPTER 6 - THE ROLE OF THE OBSERVATORIES.

The Regional Observatories or “Kyoto Observatories” are structures which have two principal duties:

1. to represent a point of reference for players participating in the Market;
2. to manage that Market according to what is provided for by the system manual and technical documents prepared during the Market creation phase.

Given the involvement of the two Regions in the project, two localised Observatories are established at the respective involved Regional Administrations, where a structure is created which is equipped with adequate computer systems, and staff who are suitably trained and specifically dedicated to the project activities.

The technicians of the Regional Observatories will be supported by and will actively collaborate with technicians from the Universities of Padua (TESAF) and Udine (DISA), partners of the Carbomark project.

The activity of the Regional Observatory is as follows:

- quantitative analysis of CO_2 fixation, and creation of a list of possible credit sellers within the four sectors of reference (sustainable management, green urban spaces, wood products, and biochar); in this context practices will be put into action which have been identified by the system to control the objective and subjective conditions of access and all the dynamics which may affect the quantity of shares managed by the system, and the control of additionality and permanence guarantees of the credits, as well as the implementation of actions that must be carried out;
- quantitative analysis of CO_2 emissions in the start-up phase of the project, i.e. the creation of a list of emitter companies, the quantity and variation of emissions, the duration guarantees and the implementation of the activities which must be carried out;
- potential analysis of CO_2 fixation and of the emissions of SMEs carried out via the calculation protocols defined in the technical documents;
- preparation of the contract models about the mechanisms and dynamics of the sale of carbon credits, which will be applied to the relevant parties;
- implementation and maintenance of the carbon credits register to ensure a correct and updated management of the carbon shares exchanged on the Market, as well as their registration and withdrawal from the Market;
- support service concerning on auction notices, drafting of contracts, commitments taken up by the parties, audits (see the Special Part of the System Manual, Chapter 2), commitments undertaken by signing the technical standard for joining the system, and environmental communication carried out by the players participating in the project;
- management of the use of the Carbomark logo (see Special Part of the System Manual, Chapter 1) and of the communication connected to the project;
- preservation and correct management of the documentation relative to the system;

- management and implementation of the project's website, www.carbomark.org, also as a valid and effective instrument for communicating with Market players and for promoting the Carbomark model;
- communication and dissemination of project activities and general information regarding climate change;
- preparation of technical notes, newsletters, climate change reports and reports on carbon forestry on a regional, national and international scale.

The carbon credit registers.

These registers are managed and handled in electronic and paper-based formats by the competent Regional Observatory. The Market sectors, following the completion of the manifestation of interest and subsequent joining of the Market, are fully aware of accepting the specifications laid out in the System Manual, particularly with reference to the adoption of the privacy procedure defined in Enclosure E.

For the detailed functions and obligations of the registers, please see chapter 4.1.3 and diagram 2.

The register is responsible for assigning a unique identification code to the carbon shares which are exchanged and sold on the Market. It is also responsible for their registration and their withdrawal from the Market.

Subsequent to each insertion, the specifically designed database will be integrated with the data relative to the potential of CO_2 fixation or emissions, using the calculation protocols defined in the technical documents.

Following the signing of the disciplinary for joining the Market, data relative to the shares put up for sale, the share requests presented by emitters, and eventual transactions performed following the signing of contracts between buyer and seller, will be inserted into the register.

A copy of the various sales contracts will also be registered by the Observatory.

The information contained in the registers must allow for the unequivocal identification of Market participants, allowing for easy and rapid communication with the Regional Observatory and ensuring constant and correct control of Market participants and the exchange of realised shares. The registers must always be up-to-date and enforced in order to reach the aim of controlling and managing the Market.

Website.

To guarantee a correct and complete management of the project, a specifically designed website has been set up: www.carbomark.org.

The site was created to allow for:

- suitable presentation of the project, prepared material and eventual meetings;

- the creation of an accessible communication platform for the project partners and Market participants;
- the publication of identification information for promotional purposes and for the diffusion of the project and the logo, should it be expressly requested by Market participants.

The site will be managed by the Regional Observatories whose aim it is to carry out updates and implement them in order to provide a clear vision regarding the advancement of the project and the development of the local market.

These activities will be performed using the specifically prepared manual which describes the operational procedures which the Observatory supervisor must follow.

On the website there are some limited access pages which only project partners and Market players may access in order to have an appropriate channel available for the rapid exchanging of information, communication and the material necessary for the project and Market development.

Annex A1 - Signing of commitments to join the Carbomark Market for credits from sustainable forest management.

To the Supervisor of the Kyoto Observatory of the Region of ……

at ……

Address ……, ……

……..

SUBJECT: Signing of commitment to join the Carbomark Project

For the purpose of participating in the Market and registering in the Carbomark register of credits, the forest owner _____, here represented by Mr./Ms. _____

undertakes to:

- set aside part of the wood increase available for cutting to maintain the carbon stock and thus carry out a saving on such increase, as an extra or additional commitment (best practices);
- approve the counting methodology for credits used and described in the system manual;
- accept the clauses concerning the periodic verification on the management of the abovementioned area as well as the related guarantees, identified in the manual and put in place so that the quantity of credits registered in the register is effectively achieved;
- carry out the sustainable management of the forest also according to that which is established by the forest production management plan, in order to produce carbon credits being subject of registration;
- ensure the fixation of CO_2 absorption for a binding period of at least 30 years, and, for this purpose, guarantee that this commitment also remains a part of the review of subsequent forestry management plans;
- during the binding thirty-year period, programme growth that is compatible with the quantity of CO_2 fixed and object of the sale;
- in the event of the cession of all or part of the property, transfer the obligations connected to this contract to the new owner;
- subject itself to a first party control as a guarantee to the system;

- guarantee access to the forest property and all information necessary for the control of the credits presented;
- in the event that, even for natural unforeseen and/or exceptional causes, the safety levels required by the system manual are exceeded, carry out offsetting within the Carbomark Market;
- sell the credits generated by forest management to buyers which have joined the Carbomark Market and signed the relative commitments;
- use the Carbomark mark according to that which is specified in the system manual.

Read and signed.

Date and location _____

For the property _____

The representative _____

Annex A2 - Signing of commitments to join the Carbomark Market for credits from wood products.

To the Supervisor of the Kyoto Observatory of the Region of ……..

at ……

Address ……., ……

……..

SUBJECT: Signing of commitment to join the Carbomark Project

For the purpose of participating in the Market and registering in the Carbomark register of credits, the subject _____, here represented by Mr./Ms. _____

undertakes to:

- approve the counting methodology for credits used and described in the system manual, and provide the documentation necessary for their calculation;
- ensure the fixation of CO_2 absorption for a binding period of at least 30 years;
- in the event of the cession of all or part of the property, transfer the obligations connected to this contract to the new owner;
- for the entire duration of the credit (30 years), report any problems that may result in a reduction in permanence to the competent Kyoto Observatory, in order to agree on actions to be taken (reconstruction or purchase of offsetting credits on the Carbomark Market);
- subject itself to a first party control as a guarantee to the system;
- guarantee access to the site and all information necessary for the control of the credits presented
- in the event that, even for natural unforeseen and/or exceptional causes, the safety levels required by the system manual are exceeded, carry out offsetting within the Carbomark Market;
- sell the credits generated to buyers that have joined the Carbomark Market and signed the relative commitments;
- use the Carbomark mark according to what is specified in the system manual.

Read and signed.

Date and location _____

For the property _____

The representative _____

Annex A3 - Signing of commitments to join the Carbomark Market for credit from public green.

To the Supervisor of the Kyoto Observatory of the Region of ……..

at ……

Address ……., ……

……..

SUBJECT: Signing of commitment to join the Carbomark Project

For the purpose of participating in the Market and registering in the Carbomark register of credits, the Municipal Administration/Body _____, here represented by Mr./Ms. _____

undertakes to:

- approve the counting methodology for credits used and described in the system manual;
- accept the clauses concerning the periodic verification of the management of the abovementioned area, as well as the related guarantees, identified in the manual and put in place so that the quantity of credits registered in the register is effectively achieved;
- ensure the fixation of CO_2 absorption for a binding period of at least 30 years;
- subject itself to an internal control as a guarantee of the system;
- guarantee access to the site and all information necessary for the control of the credits presented;
- in the event that, even for natural unforeseen and/or exceptional causes, the safety levels required by the system manual are exceeded, carry out offsetting within the Carbomark Market;
- carry out the monitoring of the project through a management plan of public green (Tree Maintenance Plan – TMP), a tree monitoring plan and an activity for the collection of data on emissions and the sequestration of GHGs as described in the system manual;
- sell the credits generated to buyers which have joined the Carbomark Market and signed the relative commitments;
- use the Carbomark mark according to what is specified in the system manual.

Read and signed.

Date and location _____

For the property _____

The representative _____

Annex B - Signing of commitments to join the Carbomark Market for buyers.

To the Supervisor of the Kyoto Observatory of the Region of ……..

at ……

Address ……., ……

……..

SUBJECT: Signing of commitment to join the Carbomark Project

For the purpose of participating in the Market and registering in the Carbomark register of credits, the company _____, here represented by Mr./Ms. _____

undertakes to:

- respect the binding regulations on administration and the environment (registration in the register of companies, authorisation of emissions, etc.);
- carry out an assessment and measurement of company greenhouse gas emissions using the inventory methods identified by the Carbomark Market;
- adopt policies that are aimed at improving environmental performance in such a way that an approach dedicated to the complete offsetting of emissions does not predominate, without providing for additional company policies aimed at the reduction of these emissions;
- sign the commitments and accept the contractual conditions of Carbomark;
- in the event of the cession of all or part of the property, transfer the obligations connected to this contract to the new owner;
- subject itself to a first party control as a guarantee to the system;
- guarantee access to the company and all information for the necessary controls;
- do not sell the purchased credits to other entities whether they are members of the Carbomark Market or not;
- use the Carbomark mark according to what is specified in the system manual, and communicate in a correct and clear way the offset activity realised with the project.

Read and signed.

Date and location _____

For the property _____

The representative _____

Annex C1 – Outline of sale contract within the Carbomark Market – Sustainable forest management.

Sales contract within the Carbomark Market between

Mr./Ms. _____ born in _____ on _____ acting as _____ f the company/body _____ with registered office in _____(city), _____ (street), VAT number _____ owner of the forest property named "_____" as defined by the Management Plan, hereinafter referred to as "seller"

and

Mr./Ms. _____ born in _____ on _____ acting as _____ f the company/body _____ with registered office in _____(city), _____ (street), VAT number _____, hereinafter referred to as "buyer"

Whereas:

- The Region of Veneto is the leader of a Life project known as Carbomark (Life Project+ LIFE07 ENV/IT/000388) under the title "Development of policies for the creation of a local voluntary Carbon Market for the mitigation of climate change".
- This project provides for the creation of a pilot voluntary "Market" for the sale of carbon shares relative to carbon credits, known as the "Carbomark Market".
- For the purposes of the Carbomark Market, by "carbon credit" one intends the sequestration achieved within a forest property of a ton of CO_2 equivalent, while for "carbon share" one means the market value, expressed in €, of this carbon credit.
- The Carbomark Market makes reference to a technical standard named "Manual on the Market model", lodged in the Region of …….. – Management office…….– Service ……., ……. (street); such technical standard is an integral part of this act, and regulates the commitments of those which have joined the Carbomark Market.

- The seller, after having looked over the technical standard and the binding commitments provided for by it, joined the Carbomark Market via the procedures outlined on the website www.carbomark.org, on _____(date).
- The buyer, after having looked over the technical standard, joined the Carbomark Market via the procedures outlined on the website www.carbomark.org, on _____ (date).
- The seller intends to commercialise the carbon credits originating from the management of the forest area specified below:
- Management Plan: _____
- Municipality: _____ Location: _____
- Plots: _____
- Based on the indications outlined in the technical standard, this forest area is expected to generate _____ carbon credits
- The buyer intends to offset, via the purchasing of _____ carbon credits, the emissions produced by the activity of _____ at the facility situated in the Municipality of _____, _____ (street), relative to the period from _____ to _____
- The seller has activated the suitable public auctions for the sale of its carbon credits on _____, identifying the buyer as the buyer, and establishing the value of the carbon share in _____€ for an overall total of carbon shares equal to _____ €.

Now therefore the parties hereto agree as follows:

art 1. **<u>Commitments of the seller</u>**

- Sell and transfer no. _____ of carbon credits originating from the management of the forest area mentioned in the preamble above.
- Respect the regulations of the “Manual on the Market model” mentioned in the preamble above, which is an integral part of this act.
- Activate offsetting mechanisms within the Carbomark Market in the event that, even for natural unexpected and/or exceptional causes, all or part of the carbon credit are not be generated, in order to re-establish the total amount of the carbon credits, object of this sales contract.

art 2. **<u>Commitments of the buyer</u>**

- Accept and purchase no. _____ of carbon credits from the seller.

art 3. **Payment of carbon shares**

- The payment of carbon shares sold by this act will be cleared by a single payment simultaneously with the signing of this contract through _____.
- Following the payment, the seller will issue suitable receipt.

art 4. **Agreements between the parties and arbitration clauses**

- The parties agree that this act will be registered only in the case it is used, with fees at the expense of the applicant, pursuant to art. 5, paragraph 2 of Presidential Decree 26th April 1986, no. 131. Any stamp duty fee of this contract is at the expense of the buyer.
- All controversies that may arise from this contract, including those connected to its validity, interpretation, execution and termination, will be deferred to the decision of a sole arbitrator appointed by the Region of …….. The arbitrator's decision will be binding according to the law. Any arbitration costs will be divided equally between the seller and the buyer.
- For anything not expressly provided for in this agreement, the applicable laws shall be applied.

Read, signed and approved

Location _____ date _____

The seller

Mr./Ms. _____

The buyer

Mr./Ms. _____

Following the reading of these commitments and their signing, a copy of this contract is lodged in the Region of …… – Management office…….. – Service …….. – Party responsible for the proceedings: _____ (Tel. _____/_____)

Annex C2 – Outline of sale contract within the Carbomark Market – Wood products.

Sales contract between

Mr./Ms._____ born in _____ on _____ acting as _____ of the body _____ with registered office in _____ (city), _____ (street), VAT number _____ owner of the building named _____ located in the Municipality of _____, _____ (street), hereinafter referred to as "seller"

and

Mr./Ms._____ born in _____ on _____ acting as _____ of the company/body _____ with registered office in _____ (city), _____ (street), VAT number _____, hereinafter referred to as "buyer"

Whereas:

- The Region of Veneto is the leader of a Life project known as Carbomark (Life Project+ LIFE07 ENV/IT/000388) under the title "Development of policies for the creation of a local voluntary Carbon Market for the mitigation of climate change".
- This project provides the creation of a pilot voluntary "market" for the sale of carbon shares relative to carbon credits, known as the "Carbomark Market".
- For the purposes of the Carbomark Market, by "carbon credit" one intends the sequestration achieved within a forest property of a ton of CO_2 equivalent, while for "carbon share" one means the market value, expressed in €, of this carbon credit.
- The Carbomark Market makes reference to a technical standard named "Manual on the Market model", lodged in the Region of …….. – Management office ……..– Service ……., ……. (street); such technical standard is an integral part of this act, and regulates the commitments of those which have joined the Carbomark Market.

- The seller, after having looked over the technical standard and the binding commitments provided for by it, joined the Carbomark Market via the procedures outlined on the website www.carbomark.org, on _____.
- The buyer, after having looked over the technical standard, joined the Carbomark Market via the procedures outlined on the website www.carbomark.org, on _____.
- The seller intends to commercialise the carbon credits which originate from the permanent use of the certified wood, utilised for the creation of structural parts of the building for public use, which it owns.
- Based on the indications outlined in the technical standard , the permanent use of this wood will generate _____ carbon credits
- The buyer intends to offset, via the purchase of _____ carbon credits, the emissions produced by the activity of _____ at the facility situated in the Municipality of _____, _____ (street), relative to the period from _____ to _____.
- The seller has activated the suitable public auctions for the sale of its carbon credits on _____ identifying the buyer as the buyer and establishing the value of the carbon share in _____€ for an overall total of carbon shares equal to _____ €.

Now therefore the parties hereto agree as follows:

art 1. **<u>Commitments of the seller</u>**

- Sell and transfer no. _____ of carbon credits originating from the management of the permanent use of wood utilised for the creation of structural parts of the aforementioned building which it owns.
- Respect the regulations of the “Manual on the Market model” mentioned in the preamble above, which is an integral part of this act.
- Activate offsetting mechanisms within the Carbomark Market in the event that, even for natural unexpected and/or exceptional causes, all or part of the carbon credit is not generated, in order to re-establish the total amount of the carbon credits, object of this sales contract.

art 2. **<u>Commitments of the buyer</u>**

- Accept and purchase no._____ of carbon credits from the seller.

art 3. **Payment of carbon shares**

- The payment of carbon shares sold by this act will be cleared by a single payment simultaneously with the signing of this contract through _____.
- Following the payment, the seller will issue suitable receipt.

art 4. **Agreements between the parties and arbitration clauses**

- The parties agree that this act will only be registered in case it is used, with fees at the expense of the applicant, pursuant to art. 5, paragraph 2 of Presidential Decree 26th April 1986, no. 131. Any stamp duty fee of this contract is at the expense of the buyer.
- All controversies that may arise from this contract, including those connected to its validity, interpretation, execution and termination, will be deferred to the decision of a sole arbitrator appointed by the Region of …….. The arbitrator's decision will be binding according to the law. Any arbitration costs will be divided equally between the seller and the buyer.
- For anything not expressly provided for in this agreement, the applicable laws shall be applied.

Read, signed and approved

Location _____ date _____

The seller

Mr./Ms. _____

The buyer

Mr./Ms. _____

Following the reading of these commitments and their signing, a copy of this contract is lodged in the Region of ……. – Management office……. – Service …….. – Party responsible for the proceedings: _____ (Tel. _____/_____)

Annex C3 – Outline of sale contract within the Carbomark Market – Green spaces.

Sales contract between

Mr./Ms._____ born in _____ on _____ acting as _____ of the body _____ with registered office in _____ (city), _____ (street), VAT number _____ owner/manager of the areas destined for tree-filled green spaces situated in the Municipality of _____, hereinafter referred to as “seller”

and

Mr./Ms._____ born in _____ on _____ acting as _____ of the company/body _____ with registered office in _____ (city), _____ (street), Vat number _____, hereinafter referred to as “buyer”

Whereas:

- The Region of Veneto is the leader of a Life project known as Carbomark (Life Project+ LIFE07 ENV/IT/000388) under the title “Development of policies for the creation of a local voluntary Carbon Market for the mitigation of climate change”.
- This project provides for the creation of a pilot voluntary “market” for the sale of carbon shares relative to carbon credits, known as the “Carbomark Market”.
- For the purposes of Carbomark Market, by “carbon credit” one intends the sequestration achieved within a forest property of a ton of CO_2 equivalent, while for “carbon share” one means the market value, expressed in €, of this carbon credit.
- The Carbomark Market makes reference to a technical standard named “Manual on the Market model”, lodged in the Region of …….. – Management office…….– Service ……., ……. (street); such technical standard is an integral part of this act and regulates the commitments of those which have joined the Carbomark Market.

- The seller, after having looked over the technical standard and the binding commitments provided for by it, joined the Carbomark Market via the procedures outlined on the website www.carbomark.org, on _____(date).
- The buyer, after having looked over the technical standard, joined the Carbomark Market via the procedures outlined on the website www.carbomark.org, on _____(date).
- The seller intends to commercialise the carbon credits originating from the management of tree-filled public green spaces which he owns, following operations which will guarantee a carbon accumulation greater than the average of that product in the 5 years precedent to the year this contract is stipulated.
- Based on the indications outlined in the technical standard, the tree-filled public green space which the seller owns will generate_____ carbon credits.
- The buyer intends to offset via the purchasing of _____ carbon credits, the emissions produced by the activity of _____ at the facility situated in the Municipality of _____, _____ (street), relative to the period from _____ to _____.
- The seller has activated the suitable public auctions for the sale of its carbon credits on _____ identifying the buyer as the buyer, and establishing the value of the carbon share in _____€ for an overall total of carbon shares equal to _____ €.

Now therefore the parties hereto agree as follows:

art 1. **<u>Commitments of the seller</u>**

- Sell and transfer no. _____ of carbon credits originating from the management of the tree-filled public green spaces mentioned in the preamble above.
- Respect the regulations of the “Manual on the Market model” mentioned in the preamble above, which is an integral part of this act.
- Activate offsetting mechanisms within the Carbomark Market in the event that, even for natural unexpected and/or exceptional causes, all or part of the carbon credit is not generated, in order to re-establish the total amount of the carbon credits, object of this sales contract.

art 2. **<u>Commitments of the buyer</u>**

- Accept and purchase no. _____ of carbon credits from the seller.

art 3. **Payment of carbon shares**

- The payment of carbon shares sold by this act will be cleared by a single payment simultaneously with the signing of this contract through _____.
- Following the payment, the seller will issue suitable receipt.

art 4. **Agreements between the parties and arbitration clauses**

- The parties agree that this act will only be registered in case it is used, with fees at the expense of the applicant, pursuant to art. 5, paragraph 2 of Presidential Decree 26th April 1986, no. 131. Any stamp duty costs of this contract are at the expense of the buyer.
- All controversies that may arise from this contract, including those connected to its validity, interpretation, execution and termination, will be deferred to the decision of a sole arbitrator appointed by the Region of …….. The arbitrator's decision will be binding according to the law. Any arbitration costs will be divided equally between the seller and the buyer.
- For anything not expressly provided for in this agreement, the applicable laws shall be applied.

Read, signed and approved

Location _____ date _____

The seller

Mr./Ms. _____

The buyer

Mr./Ms. _____

Following the reading of these commitments and their signing, a copy of this contract is lodged in the Region of ……. – Management office…….. – Service …….. – Party responsible for the proceedings: _____ (Tel. _____/_____)

Annex D - Control check-list for forest management audits.

The control check-list shown below is aimed at helping with the first verification of the requirements for accessing the Carbomark Market and as the first useful element for conducting audits at the forestry companies.

Indicator	Status	Notes
Date of manifestation of interest		
Name of property		
Representative		
Telephone number		
E – mail		
Management plan code		
Validity		
Status (Valid – Expired – Revision)		
Certified (PEFC – FSC) (YES/NO)		
Area of Production high-forest (GPA)		
Number of plots involved		
Current annual increase		
Annual growth		
Real growing stock/ha		
Average height/ Stock norm. /ha	m.	Mc/ha
Saving for accumulated stock		
First assessment of high-forest credits		
Area of production copse (GPA)		
Number plots involved		

Average increase in maturity		
Annual growth		
First assessment of copse credits		
First assessment of total annual credits		
First assessment of total eligible credits		
RESULT		
Date of form completion		
Signature of completer		
Detailed credit calculation performed	YES/NO	Credits =
Internal inspection visit conducted *		
Result of audit		

Note:

*Through the audit, one must verify the possibility of joining the Market, showing the applicant the relative technical standard, the seller/buyer contract outline, and the operation mechanisms of the Market (quantity and type – general or by plot – of credits generated by copse or high forest, etc). The audit report is drawn up and, in case, the technical standard for joining Carbomark is directly and formally countersigned by the parties.

Annex E – Privacy procedure.

Privacy policy according to art. 13 of Legislative Decree 30th June 2003 no. 196 "Code regarding the protection of personal information"

In conformity with that which is provided for by art. 13 of Legislative Decree no. 196/2003, we underline that information supplied with this application is directed to participation within the Carbomark Market. Information is managed on paper and electronically and processing will be carried out using technological and manual instruments at the offices of "The Kyoto Observatories" and by employees of the Regional Administrations of Veneto and Friuli Venezia Giulia, the project promotional bodies. The management of electronic information will be carried out with the assistance of the website, www.carbomark.org, located in an external server to the Regional Administrations.

The conferment of information is compulsory for participation in the project, in order to allow for the preparation of the documentation necessary for credit and emission calculations and subsequent communications between those operating in the local market.

Failure to confer any or all of the required information will result in the applicant not being allowed to participate in the project, and the cancellation of the process due to the impossibility of performing the preliminary inquiry necessary.

The Administration may use the information contained in this application exclusively in the field and for the institutional purposes of the project, which are:

- carrying out procedures to allow for the assessment of carbon credits;
- communication to external specialised companies involved in the project for the assessment of emissions;
- consultation via the project website (www.carbomark.org), using authentication credentials of the list of Market participants for the exclusive aim of matching supply and demand;
- also processed for statistical aims.

Upon the written request of Market participants, it will be possible to publish their identifying information on the website in order to make their voluntary participation to the Carbomark project known.

According to Legislative Decree no. 196/2003 the treatment of personal information will be subject to the principles of correctness, lawfulness and transparency, protecting its confidentiality.

The data controllers are: The Region of Veneto/Regional Council and the Autonomous Region of Friuli Venezia Giulia/Regional Council.

The data supervisors are:

- for the Region of Veneto, the Manager of the Department of Forests and Mountain Economy, *Direzione foreste ed economia montana* - Via Torino, 110 30172 Mestre (VE, Italy);

- for the Autonomous Region of Friuli Venezia Giulia the Manager of the Central Department of Agricultural, Natural and Forest Resources, *Direzione centrale risorse agricole, naturali e forestali* - Via Prefettura 10 33100 Udine (UD, Italy).

Furthermore, some external players have been identified as **data supervisors**:

- the administrator of the website www.carbomark.org resident at the server location, owned by the company EngiMedia s.a.s. in via Miranese 426/E - 30174 Chirignago (VE, Italy);
- the Head of the Legal Department of the company *Ambiente, Parco Scientifico Tecnologico* VEGA - Edificio "Auriga" Via delle Industrie, 9 - 30175 VENEZIA Marghera, Italy, for Market research relative to the emitting companies;
- the Head of the Legal Department of the company Starter srl, via Cartiera 47 33080 Porcia (PN, Italy) for research on possible Market players.

The subjects are entitled to exert the rights provided for by article 7 of Legislative Decree no. 196/2003.

Annex F - Outline of the monitoring of forest plantations in an urban environment

SCHEDA DI MONITORAGGIO DELLA PIANTAGIONE FORESTALE IN AMBIENTE URBANO

La scheda di monitoraggio nasce con lo scopo di fornire sufficienti informazione e trasparenza sul monitoraggio delle piantagioni forestali in ambiente urbano e sui crediti da forestazione urbana generati e scambiati nel mercato CarboMark.
Le informazioni raccolte dalla scheda rappresentano la piattaforma di dati necessari non solo per la quantificazione dei crediti ma anche per il monitoraggio del progetto ai fini del rispetto del protocollo di riferimento dei crediti da FU nel mercato.
La scheda è complementare alla scheda di manutenzione della piantagione che fornisce informazioni sulla piantagione (numero, specie), le condizioni degli alberi messi a dimora, le potature, le fallanze e le sostituzioni al fine di mantenere la piantagione vitale e di garantire che la durata e la permanenza del sequestro di carbonio stimato sia il più possibile in linea con il sequestro effettivo misurato ex-post.

SCHEDA DI MONITORAGGIO DELLA PIANTAGIONE FORESTALE IN AMBIENTE URBANO

DATI GENERALI SULLA PIANTAGIONE									
Comune a amministrativo			**Proprietario della piantagione**						
Anno di impianto		Superficie interessata		Durata del progetto		Anno di monito raggio			
Specie utilizzate									
Metodo di quantificazione del serbatoio di carbonio									
Descrizione delle procedure per misurare e campionare le piante (campionamenti sul terreno, aree di saggio, remote sensing)									
Metodo usato per stimare la crescita delle piante ex-ante									
Descrizione dei modelli/dati adottati per misurare e convalidare il sequestro di carbonio ex-post									
Sequestro in tCO2 previsto ad ettaro (ex-ante)			Sequestro in tCO2 ad ettaro ex-post						
PERMANENZA DEL SEQUESTRO									
Metodo adottato adottato a garanzia di perdite di carbonio	1. Buffer 2. Misurazione CO2 conservativa (in difetto) 3. Assicurazione								
Quantità di perdite verificatesi in tCO2	tCO2 totale % CO2 sequestrata/anno		Rischio di ulteriori perdite	SI	NO				

Annex G – Auction notice model

AUCTION NOTICE

SINGLE AUCTION FOR THE SALE OF NO. _____ T. of CO_2

IN ACCORDANCE WITH the LIFE Carbomark project approved by the decision of the LIFE Committee on 28th July 2008;

IN ACCORDANCE WITH the regulations of the Regional Council which approve the project concerned and the related activities connected to the creation of the Carbomark project;

HAVING ACKNOWLEDGED that with note no. _____ of _____, the Municipality of _____ has formally joined the Carbomark project as provided for by the System Manual of the Carbomark Market;

WHEREAS at the Observatory of Carbomark Carbon Credits, constituted within the framework of the Unit of Forest and Park Projects of the Region of Veneto, the Municipality has allowed for the input of an overall quantity of _____ T of CO_2 into the local Carbon Market;

HAVING ACKNOWLEDGED that this quantity is compatible with the information inferable from the Forest Management Plan and that the commitments connected to the thirty-year permanence of the relative shares does not interfere with the correct management of the wood according to the regulations laid out in the forest management plan, and thus that they are compatible with the fulfilment of the right to civic use;

IN ACCORDANCE WITH the management manual for the local Carbon Market in the Region of Veneto and the relative application procedures;

IN ACCORDANCE WITH the content of the website of the Carbomark project, from which the average values of the Market of carbon credits generated from forest management are inferable;

IN ACCORDANCE WITH the list of Market participants present on the Carbomark project website, with particular reference to the list of potential carbon credit buyers, within which subjects participating in this auction must be identified and chosen;

LET IT BE KNOWN

that on _____ (date) at _____ (time) 10.30 at the office _____ of the Municipality of _____, before _____, the auction goes forth with a single and definitive sale for the sale of no. _____ of T. of CO_2 originating from the woods object of the forest plantation, conforming to the Regulation on General State Accounting 23.5.1924, no. 827, art. 73, in observance of all the regulations contained in the Management Manual of the Carbomark Project.

AUCTION METHOD

The auction will be held through the method of secret offers which will be compared with the auction starting price, established by this notice in the measure of € _____ per T. (the price excludes VAT at 20%) for an overall quantity of _____ T. up for sale.

In order to be admitted into the auction, competitors should be able to meet the following requirements:

- To have already formally joined the Carbomark Project and to participate for all purposes relative to the local Carbon Market, respecting the rules of that Market;
- To arrange for the purchase of a number of shares compatible with the rules of the Carbomark Market;
- Not to have been declared bankrupt and not to have ongoing insolvency proceedings;
- Not to have past criminal convictions which may impede contracts with public administrations and not to be subject to preventative measures;

METHOD FOR PRESENTING THE OFFERS

Offers drawn up on the relevant form, supplied with stamp duty of € 14.62, must be put in a closed envelope bearing the word “OFFER” and signed on the closing flap. A photocopy of a valid form of identity must be attached to the form, at the risk of exclusion.

This envelope must then be put in a second envelope which will again be signed on its closing flap, with the name of the sender and the words “AUCTION FOR THE SALE OF CARBON CREDITS”, and presented to the municipal protocol before and no later than _____ (time) on _____ (date).

Offers may also be sent via registered letter.

To ensure the validity of the offer within the pre-arranged terms, only the date of receipt of the envelope by the municipal offices will be taken into account, not the sent date on the postal stamp.

The delivery of the envelope remains the exclusive responsibility of the sender, thus it is the sender who bears the risk that it does not arrive within the final terms laid out, under penalty of exclusion.

DRAFTING OF THE OFFER

The offer will be expressed according to the pre-designed form, indicating:

- the quantity (only integers) of T. of carbon shares that are intended for purchase which may also be less than the total quantity put up for sale;

- the unit price of purchase of a T. of CO2 (VAT excluded) expressed in numbers and letters (in the event that the figures do not match, the figure expressed in letters will be used);

The offer must be signed by the legal representative of the Purchasing Company, under penalty of exclusion. The offer constitutes an implicit declaration that the price indicated is suitable for the company and inclusive of every other cost, excluding VAT.

The sales contract will be stipulated within 60 days from the date of the awarding of the shares.

AWARDING OF THE SHARES

The awarding of CO_2 shares put up for sale will take place as follows:

- the shares will be assigned to the company that has offered the best unit price, independently from the overall quantity declared;
- in the event that the most advantageous offer does not exhaust the credits available for sale, it is the faculty of the seller to assign the remaining credits to the second highest offer and thus, deduct the credits or offers until they are exhausted;
- the assignment of carbon credits will be decided only on the basis of the unitary price offered;
- if the prices are equal, credit will be assigned to the buyer that wishes to buy the largest number;
- in the event that the number of credits is also equal, the offer will be assigned to the buyer that is closest geographically to the site generating the carbon credits;
- the awarding of shares will also happen in the event that the shares put up for sale are lower than the overall purchasing capability of the winning company;
- the awarding of shares will occur also in the event the only a single valid offer is present.

The payments of the CO_2 share will occur via a single payment ____ days after the stipulation of the contract.

It is underlined that relative to Legislative Decree 196/2003 on privacy, the owner is the Municipality of _____ and the handling of information will be exclusively carried out in order to allow for the public auction and the drafting of subsequent acts to occur.

A copy of this notice must be able to be consulted at the site of the Municipality of _____ or at the Carbomark site.

The party responsible for proceedings is _____

For any further information, the reference person is Mr./Ms. _____

Annex H - Glossary

Additionality

Additionality represents the scenario in which a mitigation activity causes the additional sequestration of carbon compared to the baseline.

For example, in the case of forest management, additionality compared to a “business as usual” scenario is achieved insofar as the owners undertake to renounce a part of the usable increase or to improve the conditions of the forest, generating a surplus of carbon sequestration relative to the status quo.

Carbon dioxide (CO_2)

The main gas contributing to the green house effect; CO_2 emissions result from the combustion of fossil fuels, from change in land use and from industrial processes.

AFOLU

The acronym for Agriculture, Forestry and Land Use. It indicates the mitigation projects that concern activities of agro-forestry offsetting.

Audit

An audit is an evaluation or control of data or procedures.

An audit has the aim of verifying the correct progression of the Market and the correct implementation and maintenance of that Market by Regional Observatories, as well as the correct and updated management of the register of credits put on the Market and the object of exchange.

The activity of auditing is essentially aimed at verifying the respect for system requirements and the correct functioning of management mechanisms (assignment and purchase) for carbon shares, and consists of the control, for the most part of documentation, of the fluctuation of the Market and the correct operation of the Observatories.

Baseline

The baseline, or point of departure for the project, identifies the situation as it would have been had no project been established.

In the case of the foreseen agro-forestry projects, the baseline is represented by the existing carbon pools and by the carbon sequestration going on before the project is implemented.

Buffer

Represents the setting aside of carbon credits in order to guarantee against losses caused by disturbances that may compromise the sequestration and accumulation of carbon. In the case of forest management, losses are due to disturbances such as fires, phytopathologies and breakages which may cause the ecosystem to go from net absorber to net emitter of carbon. The buffer represents an “insurance policy” against credit losses and is thus a key element in guaranteeing their permanence.

Carbon offsetting

In general, by using the term carbon offsetting, one means the mechanism in which, instead of reducing greenhouse gas emissions at the source, a physical or legal person purchases a quantity of carbon credits equivalent to the emissions to be reduced. The fundamental principle of carbon offsetting is that a certain quantity of greenhouse gases produced in one place can be offset by reducing or sequestering the same quantity of carbon in another.

CO_2 equivalent (CO_{2eq})

It is a measurement method for green house gases which considers the heating potential of each greenhouse gas in relation to that of CO_2. The measurement may also be expressed as carbon equivalent (C): 1 Kg of $CO_{2\,eq}$ = 0.27 Kg of C.

Confine of the project

The confine of the project is indentified by the geographical confine of the project generating the carbon credits and by the carbon reserves considered for the purposes of the project, identified in the arboreal epigeal biomass. For example, in the Carbomark project, the carbon pools counted are represented only by arboreal biomass.

Carbon credit

By carbon credit, we mean the unit of offset of greenhouse gas generated by the project, expressed in t/CO2 eq.

Greenhouse gases (GHG)

They are those gases present in the atmosphere, both from natural origins and anthropic origins which absorb and emit infrared rays. The six greenhouse gases stemming from anthropic origins, acknowledged by the Kyoto Protocol, are carbon dioxide (CO_2), methane (CH_4), nitrogen oxide (N_2O), fluorocarbons and sulphur hexafluoride (SF_6, PFC, HFC).

Global warming potential (GWP)

Global warming potential (GWP) is the measure of how much a given greenhouse gas (GHG) contributes to the greenhouse effect. This index is based on a relative scale which compares the gas concerned with an equal mass of carbon dioxide CO_2, for which GWP is by definition equal to 1. Every GWP value is calculated for a specific time interval.

Global Warming potential of greenhouse gases considered by the Kyoto Protocol for an interval of time considered equal to 100 years (Climate Change 1995).

Greenhouse gas	Chemical formula	Pre-industrial concentration (ppbv)	Concentration in 2002 (ppbv)	Anthropogenic sources	Global warming potential
Carbon dioxide	CO_2	278.000	370.000	Combustion of fossil fuels, conversion of land use, production of cement	1
Methane	CH_4	700	1.721	Fossil fuels, rice fields, dumping, enteric fermentation in livestock	21
Nitrogen oxide	N_2O	275	311	Combustion, fertilisers	310
CFC-12	CCl2F2	0	0,503	Coolants and foams	6200
HCFC-22	CHClF2	0	0,105	Coolants	1300
Perfluoromethane	CF6	0	0,070	Production of aluminium	6500
Sulphur hexafluoride	SF6	0	0,032	Dielectric fluids	23900

Global Warming potential of green house gases for three different time intervals.

Source: Climate Change 1995, The Science of Climate Change: Summary for Policymakers and Technical Summary of the Working Group I Report, page 22.

Species	Chemical formula	Lifetime (years)	Global Warming Potential (Time Horizon)		
			20 years	100 years	500 years
CO_2	CO_2	variable §	1	1	1
Methane	CH_4	12±3	56	21	6.5
Nitrous oxide	N_2O	120	280	310	170
HFC-23	CHF3	264	9100	11700	9800
HFC-32	CH2F2	5.6	2100	650	200
HFC-41	CH3F	3.7	490	150	45
HFC-43-10mee	C5H2F10	17.1	3000	1300	400
HFC-125	C2HF5	32.6	4600	2800	920
HFC-134	C2H2F4	10.6	2900	1000	310
HFC-134a	CH2FCF3	14.6	3400	1300	420
HFC-152a	C2H4F2	1.5	460	140	42
HFC-143	C2H3F3	3.8	1000	300	94
HFC-143a	C2H3F3	48.3	5000	3800	1400
HFC-227ea	C3HF7	36.5	4300	2900	950
HFC-236fa	C3H2F6	209	5100	6300	4700
HFC-245ca	C3H3F5	6.6	1800	560	170
Sulphur hexafluoride	SF6	3200	16300	23900	34900
Perfluoromethane	CF4	50000	4400	6500	10000
Perfluoroethane	C2F6	10000	6200	9200	14000
Perfluoropropane	C3F8	2600	4800	7000	10100
Perfluorobutane	C4F10	2600	4800	7000	10100

Species	Chemical formula	Lifetime (years)	Global Warming Potential (Time Horizon)		
Perfluorocyclobutane	c-C4F8	3200	6000	8700	12700
Perfluoropentane	C5F12	4100	5100	7500	11000
Perfluorohexane	C6F14	3200	5000	7400	10700

Leakage effect

Also called “loss effect”, which occurs when there is an increase in CO_2 emissions within a country due to a reduction in emissions in another country with a rigorous climate policy. For example, the promotion of the use of wood as a carbon pool, when that wood is the result of deforestation in another country in which the sustainable management of forest resources is not enforced.

Regulated Carbon Credit Market

One speaks of the Regulated Credit Market, aimed at the reduction of green house gases, when the characteristics and operation of that Market are defined by an international, European and/or national regulation. The main example of this type of Market is that which is provided for by European Directive 2003/87 (ETS, System of emission exchange), specified by the Kyoto Protocol. In this Market, emitting companies that, according to national emission reduction plans, are classified as “large-scale emitters”, must participate”.

Voluntary Carbon Credit Market

The voluntary Carbon Credit Market, aimed at the reduction of green house gases, is a market where carbon credits that have been generated by mitigation projects are exchanged on a voluntary basis. Mitigation activities and emission reduction objectives are not defined by a regulated and compulsory body, conversely from what happens in the regulated market. The characteristics and operation of this Market are defined according to standards and protocols defined by the bodies/companies which promote and manage them.

Mitigation

The ensemble of actions aimed at reducing the concentration of greenhouse gases in the atmosphere by reducing emissions and increasing carbon sequestration capacity in the biosphere.

Monitoring

Verification of the development of the project according to what is specified by the adopted protocols and furthermore, the verification ex-post of carbon sequestration, realised according to the ex-ante calculation.

Period of validity

Is the period in which the project operates. In the case of an agro-forestry project, this corresponds to the temporal duration within which the CO_2 is absorbed and this sequestration is measured and verified.

Permanence

Permanence refers to the continuing sequestration of CO_2 created by activities proposed by the project during its lifecycle. This concept is very significant, for example in the case of forest management, considering eventual losses linked to disturbances such as fires, plant diseases and breakages which may turn the ecosystem from a net absorber to a net emitter of carbon.

Carbon share

By carbon share, one means the quantity of carbon credits, expressed in t/CO_2eq generated by the project which will be exchanged and sold on the Market.

Register

In the Carbon Market, the registers monitor the issue, exchange and withdrawal of carbon credits.

Sequestration

Sequestration refers to the absorption of carbon dioxide such that the carbon is not released into the atmosphere for a specific period of time.

Voluntary Carbon Standard (VCS)

Is one of the certification standards for carbon credits applied to the international voluntary market. The VCS has developed specific guidelines for the certification of AFOLU credits.

Annex I – Bibliography

- Climate Change 1995, The Science of Climate Change: Summary for Policymakers and Technical Summary of the Working Group I Report, page 22.
- CNEL (2001): Utilizzo del legno nell'industria edile. Rapporto di ricerca. Roma. 179p.
- Corona, P., 2000. Introduction al Rilevamento Campionario delle Risorse Forestali. CUSL Firenze.
- Corona, P., Pompei, E., Scarascia Mugnozza, G., 2005. Stima probabilistica del tasso di espansione annua e del valore al 1990 della superficie forestale nella regione Abruzzo. Forest@ 2(2), 178-184.
- CRA-ISAFA, CFS, 2006. Procedure di posizionamento e di rilievo degli attirbuti di terza fase con istruzioni per l'impiego degli applicativi NAV3 e RAS3. In, Inventario Nazionale delle Foreste e dei Serbatoi Forestali di Carbonio (INFC).
- De Natale, F., Gasparini, P., Puzzolo, V., Tosi, V., 2003. Stima del grado di copertura forestale da ortofoto e applicazione della definizione di bosco negli inventari forestali. L'Italia Forestale e Montana 4, 289-300.
- De Natale, F., Gasparini, P., Carriero, A., 2007. A Study on Tree Colonization of Abandonend Land in the Italian Alps: Extent and Some Characteristics of New Forest Stands in Trentino. In: Reynolds, K.M., Thomson, A.J., Shannon, M.A., Khöl, M., Ray, D., Rennolls, K. (Eds.), Sustainable Forestry: from monitoring and Modelling to Knowledge Management and Policy Science. CAB International pp. 269-284.
- INFC, 2007. Inventario Nazionale delle Foreste e dei Serbatoi Forestali di Carbonio. In, Le stime di superficie. Ministro delle Politiche Agricole, Alimentari e Forestali, CRA - Istituto Sperimentale per l'Assestamento Forestale e per l'Apicoltura, Corpo Forestale dello Stato - Ispettorato Generale, Trento.
- IPCC, 2006. Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston HS, Buendis L, Miwa K, Ngara T, Tanabe K (eds). Published: IGES, Japan.
- IPCC/OECD/IEA, 1997. IPCC Guidelines, revised 1996 versions. Reference manual, IPCC/OECD/IEA, Working Group I, Technical Support Unit. In, United Kingdom.
- ISAFA, 1998. 2° Inventario Forestale Nazionale. St udio di fattibilità. In. Istituto Sperimentale per l' Assestamento Forestale e per l' Alpicoltura. http://mpf.entecra.it/?q=node/604, Trento.
- La Marca, O., 1999. Elementi di dendrometria. Patron Editore, Bologna.
- Lamedica, S., Dalla Valle, E., Pilli, R., Anfodillo, T., 2007. Variazione di superficie boscata e fissazione di carbonio in foresta nel territorio montano della Regione Venento in riferimento all'applicazione. Forest@ 4, 283-297.

- Philip, M.S., 1994. Measuring trees and forests. CAB International, New York.
- Salvadori, I., Pilli, R., Anfodillo, T., 2006. Proposta di una metodologia di analisi della variazione di superficie boscata tramite foto aeree per l'applicazione del protocollo di Kyoto: il caso della Comunità Montana del Grappa (TV). Forest@ 3, 339-350.
- Tabacchi, G., 2001. Note su alcuni schemi di campionamento impiegabili nell'inventariazione delle risorse forestali di ampi territori. Comunicazioni di ricerca dell' ISAFA 2001/2, Trento. Disponibile al sito: http://www.isafa.it/scientifica/pubblicazioni/pubblicazioni.htm.
- UN-ECE/FAO, 2000. Forest resources of Europe, CIS, North America, Australia, Japan and New Zealand. Geneva Timber and Forest Study papers No 17. In. United Nations Economic Committee for Europe, Food and Agricultural Organisation, Geneva, Switzerland, p. 445.
- UNFCCC, 1997. Protocollo di Kyoto della Convenzione Quadro delle Nazioni Unite sui Cambiamenti Climatici.
- VCS, 2008.Voluntary Carbon Standard Guidance for Agriculture, Forestry and Other Land Use Projects. Disponibile al sito: http://www.v-c-s.org/policydocs.html