INTERNATIONAL SURVEY

WP 3 Studies and training

Activity 3.1 International Surveys

Activity Title	International survey
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Premises

This document is an overview at international level of the existing carbon credits market and related issues.
The document is shared into two parts.
The first part deals with the problem of climate change and its relations with agriculture and includes an historical analysis of carbon markets development: the main international economic trends that influence the development of the carbon market (Smart Agriculture and Circular Economy); the role of Kyoto and Paris Agreement and the Europe Union policies.
The second part explores the different types of credits markets and their working mechanism: the compliance market; the voluntary market.

1. Introduction

Climate change and agriculture are interrelated processes; they take place on a global scale, with the adverse effects of climate change affecting agriculture both directly and indirectly. Increases in temperature and carbon dioxide (CO_2) change nutrient levels, soil moisture, water availability change agriculture. Animal husbandry also contributes towards climate change through greenhouse gas emissions.
Climate changing trends can be summarised as follows:

1. Changing precipitation patterns. Rainfall patterns have already begun shifting across the Europe and such changes are expected to intensify over the coming years. This is likely to mean more intense periods of heavy rain and longer dry periods, even within the same regions.
2. Changing temperature patterns. Rising average temperatures, more extreme heat throughout the year, fewer sufficiently cool days during the winter, and more frequent cold-season thaws will likely affect farmers in all regions and Countries.

Climate change effects:

1. Floods: floods devastate crops and livestock, accelerate soil erosion, pollute water, and damage roads, bridges, schools, and other infrastructures.
2. Droughts: severe droughts have taken a heavy toll on crops, livestock, and farmers in many parts of the country, most notably Mediterranean countries, over the past decade—and science tells us that rising temperatures will likely make such droughts even worse, depleting water supplies and, in some cases, spurring destructive wildfires.
3. Changes in crop and livestock viability. Farmers choose crop varieties and animal breeds that are well suited to local conditions. As those conditions shift rapidly over the coming decades, many farmers will be forced to rethink some of their choices—which can mean making new capital investments, finding newmarkets, and learning new practices.
4. New pests, pathogens, and weed problems. Just as farmers will need to find new crops, livestock, and practices, they will have to cope with new threats.

Those effects risk to be amplified by extensive conventional practices in plant and animal farming causing the following consequences:

1. Degraded soils. Typical monoculture cropping systems leave soil bare for much of the year, rely on synthetic fertilizer, and plow fields regularly. These practices leave soils low in organic matter and prevent formation of deep, complex root systems. Among the results: reduced water-holding capacity (which worsens drought impacts), and increased vulnerability to erosion and water pollution (which worsens flood impacts).
2. Simplified landscapes. Industrial agriculture treats the farm as a crop factory rather than a managed ecosystem, with minimal biodiversity over wide areas of land. This lack of diversity in farming operations exposes farmers to greater risk and amplifies climate impacts such as changes in crop viability and encroaching pests.
3. Intensive inputs. The industrial farm's heavy reliance on fertilizers and pesticides may become even more costly to struggling farmers as climate impacts accelerate soil erosion and increase pest problems. Heavy use of such

chemicals will also increase the pollution burden faced by downstream communities as flooding increases. Farmers may also increase irrigation in response to rising temperature extremes and drought, further depleting precious water supplies.

The response is reducing damage by making farms more resilient, using a system of agriculture methods and practices. In September 2019, the European Union's Chief Scientific Advisors stated that transitioning to a sustainable food system should be a high priority for the EU[1].

In January 2020, the EU put the transition to a sustainable food system at the core of the European Green Deal. The European Commission's 'Farm to Fork strategy for a sustainable food system', due to be published in spring 2020, is expected to lay out how European countries will reduce greenhouse gas emissions, protect biodiversity, reduce food waste and chemical pesticide use, and contribute to a circular economy [2]

In April 2020, the EU's Scientific Advice Mechanism delivered to European Commissioners a Scientific Opinion on how to transition to a sustainable food system, informed by an evidence review report undertaken by European academies [3].

Innovative agricultural practices and technologies can play a role in climate change mitigation and adaptation.

[1] Group of Chief Scientific Advisors (25 September 2019). "Scoping paper: Towards an EU Sustainable Food System" (PDF). EU Scientific Advice Mechanism. https://ec.europa.eu/info/sites/default/files/research_and_innovation/groups/sam/ec_rtd_scoping-paper-sustainable-food-system.pdf

[2] Binns, John (10 December 2019). "Farm to Fork strategy for sustainable food". Food Safety – European Commission. Retrieved 14 April 2020. https://ec.europa.eu/food/horizontal-topics/farm-fork-strategy_en

[3]"The shift to a more sustainable food system is inevitable. Here's how to make it happen | SAPEA". https://www.sapea.info/the-shift-to-a-more-sustainable-food-system-is-inevitable-heres-how-to-make-it-happen/ Retrieved 14 April 2020.

Among the best experimented policies in adaptation and mitigation is important to cite:

1. Expand conservation programs that make it easier for farmers to adopt sustainable practices that will make their farms more climate-resilient.
2. Strengthen safety nets (and make them drivers of resilience). Regardless of what science and forward-looking policy can do, farms will be challenged—andsome more than others. It's essential that we provide farm families and communities with the support they need to survive the climate crisis and become more resilient. This includes better crop insurance programs, health care access for farmers and farm workers, and effective, responsive disaster relief programs.
3. Achieve net zero emissions. It is need to prioritize policies to drastically reduce agriculture climate emissions and moving to net zero emission.

These policies have brought to the implementation of some interesting adaptation and mitigation measures:

A. breeding more resilient crop varieties, and diversification of crop species
B. using improved agroforestry species
C. capture and retention of rainfall, and use of improved irrigation practices
D. Increasing cover crops, permanent meadows, forest cover and Agroforestry
E. use of emerging water harvesting techniques (such as contour trenching, …).

Carbon Market is one of the instruments proposed and used in order to put in place effective actions and policies having as objective the achievement of zero net emission.

Geco2 project is focused in the implementation of a voluntary market based on CO2e credits in agriculture.

Introduced with the approval of the Kyoto Protocol, carbon credits represent afinancial mechanism aimed at offsetting emissions that would not have been

otherwise reduced, thus allowing the adoption of ad hoc climate change mitigation strategies.
In general terms, a carbon credit consists of a financial unit that represents the removal of a ton of carbon dioxide equivalent from the atmosphere, i.e. the emission of greenhouse gases (GHG) that has been avoided, reduced or seized through a project and that can be purchased to offset emissions.
A carbon offset is a reduction or removal of emissions of carbon dioxide or other greenhouse gases made in order to compensate for emissions made elsewhere.

There are two types of markets for carbon offsets, compliance and voluntary. In compliance market like the European Union (EU) Emission Trading Scheme companies, governments, or other entities buy carbon offsets in order to comply with mandatory and legally binding caps on the total amount of carbon dioxide they are allowed to emit per year. Failure to comply with these mandatory caps within compliance markets results in fines or legal penalty. The original compliancecarbon market was initiated by the Kyoto Protocol's Clean Development Mechanism (CDM). Compliance markets for carbon offsets comprise both international carbon markets developed through the Kyoto Protocol and Paris Agreement, and domestic carbon pricing initiatives that incorporate carbon offsetmechanisms. Within the voluntary market, demand for carbon offset credits is generated by individuals, companies, organizations, and sub-national governments who purchase carbon offsets to mitigate their greenhouse gas emissions to meet carbon neutral, net-zero or other established emission reduction goals. The voluntary carbon market is facilitated by certification programs (e.g. Puro Standard, the Verified Carbon Standard, the Gold Standard, and the Climate Action Reserve) which provide standards, guidance, and establish requirements for project developers to follow in order to generate carbon offset credits. These programs generate carbon offset credits provided that an emission reduction or removal

activity meets all program requirements, applies an approved project protocol (also called a methodology), and successfully passes third party review (also called verification). Once carbon offset credits are generated, any buyer may purchase them; for example an individual may purchase carbon offsets to compensate for the emissions resulting from energy use or from travelling4.
Carbon removal offsets include methods based on net-negative products and processes, such as biochar in soil, increasing of soil stocks and plant biomass stored carbon.

2. Strategic pillars for carbon markets development

2.1 Climate and agriculture

Climatic change could affect agriculture and food supply[5] in several ways[6], including:

- productivity, in terms of quantity and quality of crops
- agricultural practices, through changes of water use (irrigation) and agricultural inputs such as herbicides, insecticides and fertilizers

[4] Wikipedia contributors. (2021, December 11). Carbon offset. In Wikipedia, The Free Encyclopedia. Retrieved 19:42, December 12, 2021, from https://en.wikipedia.org/w/index.php?title=Carbon_offset&oldid=1059693756

[5] Smith M.R., Myers S.S. (2018). Impact of anthropogenic CO2 emissions on global human nutrition. Nature Climate Change. 8 (9): 834–839.

[6] Challinor, A. J.; Watson, J.; Lobell, D. B.; Howden, S. M.; Smith, D. R.; Chhetri, N. (2014). A meta-analysis of crop yield under climate change and adaptation. Nature Climate Change. 4 (4): 287–291.

- environmental effects, in particular in relation of frequency and intensity of soil drainage (leading to nitrogen leaching), soil erosion, reduction of crop diversity
- rural space, through the loss and gain of cultivated lands, land speculation, land renunciation, and hydraulic amenities.
- adaptation, organisms may become more or less competitive

In the report published in 2014 the Intergovernmental Panel on Climate Change, the most qualified intergovernmental UN agency at international level on climate change issues, says that the world may reach "a threshold of global warming beyond which current agricultural practices can no longer support large human civilizations." by the middle of the 21st century. In 2019 it published reports in which it says that millions already suffer from food insecurity due to climate change and predicted decline in global crop production of 2% - 6% by decade[7]
A 2021 study estimates that the severity of heatwave and drought impacts on crop production tripled over the last 50 years in Europe – from losses of -2.2 during 1964-1990 to -7.3% in 1991-2015[8].

Climate change and agriculture are interrelated processes, both of which take place on a global scale, with the adverse effects of climate change affecting agriculture both directly and indirectly.

[7] Smith, K.R.; Woodward, A.; Campbell-Lendrum, D.; Chadee, D.D.; Honda, Y.; Liu, Q.; Olwoch, J.M.; Revich, B.; Sauerborn, R. "Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Chapter11: : Human health: impacts, adaptation, and co-benefits. Section: 11.8.2 (Limits to Food Production and Human Nutrition). P. Intergovernmental Panel on Climate Change. Intergovernmental Panel on Climate Change, https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap11_FINAL.pdf Retrieved 29 October 2019.

[8] Brás, T. A., Seixas, J., Carvalhais, N., Jägermeyr, J. (2021). Severity of drought and heatwave crop losses tripled over the last five decades in Europe. Environmental Research Letters. 16 (6): 065012.

Agriculture contributes towards global warming through anthropogenic greenhouse gas emissions and by the conversion of non-agricultural land such as forests into agricultural land.
Climate change is already affecting agriculture, with effects unevenly distributed across the world[9].

In 2020, the European Union's Scientific Advice Mechanism estimated that the food system as a whole contributed 37% of total greenhouse gas emissions, and that this figure was on course to increase by 30–40% by 2050 due to population growth and dietary change[10]
A range of policies can reduce the risk of negative climate change impacts on agriculture and greenhouse gas emissions from the agriculture sector for a more sustainable food system[11] using a wide set of instruments.

Ecosystem services are one key instrument. Environmental services and agriculture ecological services are attracting growing interest as a mechanism to translate non-market values of the environment into real financial incentives. Thescientific discussion on mechanisms to perform those payments is still incipient.
In many cases, payments for environmental services seem to be used randomly for market-based mechanisms of conservation, charging entrance fees to tourists or eco-certification.

[9] Porter, J.R., et al., Executive summary, in: Chapter 7: Food security and food production systems (archived 5 November 2014), in IPCC AR5 WG2 A 2014, pp. 488–489, https://web.archive.org/web/20141105194138/https://ipcc-wg2.gov/AR5/images/uploads/WGIIAR5-Chap7_FINAL.pdf

[10] Science Advice for Policy by European Academies (2020). A sustainable food system for the European Union Berlin: SAPEA. p. 39. doi:10.26356/sustainablefood. ISBN 978-3-9820301-7-3. https://www.sapea.info/wp-content/uploads/sustainable-food-system-report.pdf Retrieved 14 April 2020.

[11] idem: https://www.sapea.info/wp-content/uploads/sustainable-food-system-report.pdf

Among the ecosystem services, carbon sequestration in agricultural ecosystems has an high impact on global climate change and food security[12].

Regenerative agriculture (RA) systems develop greater ecosystem services, increasing of soil carbon and profitability for farmers.

The goal of RA is to apply the concept of more from less [13] .The strategy is to spare land and resources for nature and increase carbon soil stock.
Regenerative fields, for example, can have 29% lower production but 78% higher profits over traditional corn production systems. Profits are positively correlated with the increase of organic matter of the soil, not with yield. [14]

In this framework it is important to cite the "4 per 1000" initiative, launched by France on 1 December 2015 at the COP 21,). Its aim is to demonstrate that agriculture, and in particular agricultural soils can play a crucial role where food security and climate change are concerned. This initiative invites all partners to state or implement some practical actions on soil carbon storage and the type of

12 Lal R.(2004). Soil carbon sequestration impacts on global climate change and food security Science, 304 , 1623-1627
Lal, R. (2016). Beyond COP21: potential and challenges of the "4 per thousand" initiative. J. Soil Water Conserv. 71, 20A–25A.

13 (McAfee 2019) to agriculture and produce more from less (Lal 2013): less land area, less input of chemicals, less use of water, less emission of greenhouse gases, less risk of soil degradation, and less use of energy-based inputs .

14 LaCanne and Lundgren show that regenerative Corn fields has 29% lower grain production but 78% higher profits over traditional corn production systems. LaCanne CE, Lundgren JG. 2018. Regenerative agriculture: merging farming and natural resource conservation profitably. PeerJ 6:e4428 https://doi.org/10.7717/peerj.4428

Regenerative agriculture: merging farming and natural resource conservation profitably https://doi.org

Lal, R. 2013. Food security in a changing climate. Ecohydrology & Hydrobiology 13(1):8-21.

McAfee A. 2019. More from Less: The Surprising Story of How We Learned to Prosper Using Fewer Resources—And What Happens Next. New York: Scribner

practices to achieve this (e.g. agroecology, agroforestry, conservation agriculture, landscape management, etc.)[15]. Initiative will be analysed in the following chapters.

2.2 Potentials for carbon sequestration in agriculture

Freibauer et al. (2004) analysed technical and economically viable potentials for carbon sequestration in the agricultural soils of Europe by 2008–2012, against a business-as-usual scenario, providing a quantitative estimation of the carbon absorption potential per hectare and the surface of agricultural land that is available and suitable for the implementation of those measures, their environmental effects as well as the effects on farm income. Realistically, agricultural soils in EU-15 can sequester up to 16–19 Mt C $year^{-1}$ during the first Kyoto commitment period (2008–2012), which is less than one fifth of the theoretical potential and equivalent to 2% of European anthropogenic emissions. They identified as most promising measures: the promotion of organic inputs on arable land instead of grassland, the introduction of perennials (grasses, trees) on arable set-aside land for conservation or biofuel purposes, to promote organic farming, to raise the water table in farmed peatland, and—with restrictions—zero tillage or conservation tillage. Many options have environmental benefits but some risk of increasing N_2O emissions. For most measures it is impossible to determine the overall impact on farm profitability. Efficient carbon sequestration in agricultural soils demands a permanent management change and implementation concepts adjusted to local soil, climate and management features in order to allow selection of areas with high carbon sequestering potential. Some of the present agricultural policy schemes have probably helped to maintain carbon stocks in agricultural soils.
Furthermore, West & Post (2002) stated that Changes in agricultural management can potentially increase the accumulation rate of soil organic C (SOC), thereby sequestering CO_2 from the atmosphere. Their study was conducted to quantify potential soil C sequestration rates for different crops in response to decreasing

[15] https://www.4p1000.org

tillage intensity or enhancing rotation complexity, and to estimate the duration of time over which sequestration may occur. Analyses of C sequestration rates were completed using a global database of 67 long-term agricultural experiments, consisting of 276 paired treatments. Results indicate, on average, that a change from conventional tillage (CT) to no-till (NT) can sequester 57 ± 14 g C m^{-2} yr^{-1}, excluding wheat (Triticum aestivum L.)-fallow systems which may not result in SOC accumulation with a change from CT to NT. Enhancing rotation complexity can sequester an average 20 ± 12 g C m^{-2} yr^{-1}, excluding a change from continuous corn (Zea mays L.) to corn-soybean (Glycine max L.) which may not result in a significant accumulation of SOC. Carbon sequestration rates, with a change from CT to NT, can be expected to peak in 5 to 10 yr with SOC reaching a new equilibrium in 15 to 20 yr. Following initiation of an enhancement in rotation complexity, SOC may reach a new equilibrium in approximately 40 to 60 yr. Carbon sequestration rates, estimated for a number of individual crops and crop rotations in this study, can be used in spatial modeling analyses to more accurately predict regional, national, and global C sequestration potentials.

Peter et al. (2016) analysed how the estimations of greenhouse gas (GHG) field emissions from fertilization and soil carbon changes are challenges associated with calculating the carbon footprint (CFP) of agricultural products. At the regional level, the IPCC Guidelines for National Greenhouse Gas Inventories (2006a) Tier 1 approach, based on default emission factors, insufficiently accountsfor emission variability resulting from pedo-climatic conditions or management practices. However, Tier 2 and 3 approaches are usually considered too complex to be practicable. In this paper, we discuss different readily available medium- effort methods to improve the accuracy of GHG emission estimates. They presented four case studies—two wheat crops in Germany and two peach orchards in Italy.

Montanaro et al. (2012), conducted a field trial over a seven-year period, in Mediterranean peach orchard. The aims were (i) to explore the effects of alternative soil-management practices (A_{mng}) on soil and litter carbon (C) reserves, (ii) to monitor the seasonal and (iii) spatial variations of soil CO_2 flushes. The alternative management included no tillage, retention of all aboveground biomass and application of imported organic amendments (15 t ha^{-1} y^{-1} fresh weigh). Locally conventional management (L_{mng}) served as the control: i.e. tillage, mineral fertilisation, removal of prunings. The mean total annual C inputs were 4.2 and 2.4 t ha^{-1} in A_{mng} and L_{mng}, respectively. Spatial and temporal variations in CO_2 soil emissions over a 20 m^2 plot (×2) were assessed (Li-6400, LI-COR, USA) on the assumption that root topography and microbial activity declined systematically with distance from the row line. Under A_{mng} practices soil C significantly increased up to 1.78% against 1.38% at L_{mng} block. The C stored as litter and dead wood in A_{mng}, was 16-times that in L_{mng}. On a whole-season basis, CO_2 losses were 20% higher in A_{mng} than in L_{mng}. Soil CO_2 emissions were mostly from the in-row, with the inter-row emissions being lower, especially due to reduced soil-water content during the drier months. It is concluded that despite a higher CO_2 soil emissions, alternative management techniques will partially offset atmospheric CO_2 rise through increased soil C reserves, and that spatial variability of emissions must be taken into account if the accuracy of estimates of large-scale emissions are to be improved.

They examined the effect of 7-year of sustainable practices on carbon reserves; changed management practices increased soil and litter carbon reserves (and yield). They report the seasonal pattern of CO_2 soil emission in a peach orchard and found that distance from row affects CO_2 soil emission rate. Spatial variability of CO_2 emissions shows that these concentrate along the row.

2.3 Climate Smart Agriculture

The concept of Climate-Smart Agriculture (CSA) was originally developed by FAO and officially presented and at the Hague Conference on Agriculture, Food Security and Climate Change in 2010, through the paper "Climate-Smart Agriculture: Policies, Practices and Financing for Food Security, Adaptation and Mitigation"[16].

Climate Smart Agriculture and the Global Alliance for Climate Smart Agriculture (GACSA)[17] were developed whiten this idea.

CSA is an approach to developing the technical, policy and investment conditions to achieve sustainable agricultural development for food security under climate change. The magnitude, immediacy and broad scope of the effects of climate change on agricultural systems create a compelling need to ensure comprehensive integration of these effects into national agricultural planning, investments and programs.

The CSA approach is designed to identify and operationalize sustainable agricultural development within the explicit parameters of climate change. However, achieving the transformations required for CSA and meeting these multiple objectives requires an integrated approach that is responsive to specific local conditions. Coordination across agricultural sectors (e.g. crops, livestock, forestry and fisheries) as well as other sectors, such as with energy and water

[16] http://www.fao.org/3/i1881e/i1881e00.htm

[17] As to the GASCA, Italy is a member while Croatia is not. http://www.fao.org/gacsa/en/

sector development is essential to capitalize on potential synergies, reduce trade-offs and optimize the use of natural resources and ecosystem services.

FAO has developed a number of materials to guide stakeholders on the issues of climate smart agriculture (CSA).

The three pillars of CSA are:

1. to sustainably increase agricultural productivity and improve the

incomes and livelihoods of farmers;

2. to build resilience and adaptation to climate change;

3. to reduce and/or remove GHG emissions, where possible.

Over three-quarters of the world's poor people live in rural areas and many of them depend on agriculture for their livelihoods. Climate change is expected to hit developing countries the hardest. Its effects include higher temperatures, changes in precipitation patterns, rising sea levels and more frequent extreme weather events. The agricultural sectors in developing countries absorb around 22 percent of the economic impact caused by medium-/large-scale natural hazards and disasters. Regardless of whether climate change impacts are experienced over the course of several years or suddenly through an extreme weather event, these case studies demonstrate that the agricultural sectors can be better equipped to face these threats in the future by implementing a CSA approach. Showing successful results from projects on the ground is essential if farmers, national policy makers, international organizations and donors are to be persuaded to make CSA a priority. Coordination and integration across all agricultural sectors dealing with climate change, agricultural development and

food security – at the national, regional and local levels – is a prerequisite for creating an enabling policy environment.

Global Alliance for Climate Smart Agriculture is an inclusive, voluntary and action-oriented multi-stakeholder platform on Climate-Smart Agriculture (CSA). GACSA aims is to improve food security, nutrition and resilience in the face of climate change and aims to catalyze and help create transformational partnerships to encourage actions that reflect an integrated approach to the three pillars of CSA[18].

[18] Website: http://www.fao.org/gacsa/en/

2.4 Climate policies and Carbon issues

The **Kyoto Protocol was an international treaty which extended the 1992 United Nations Framework Convention on Climate Change** (UNFCCC) that commits state parties to reduce greenhouse gas emissions, based on the scientific consensus that (part one) global warming is occurring and (part two) that human-made CO2 emissions are driving it[19]. The carbon market mechanism was formalized in the Kyoto Protocol[20].

The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005[21]. There were 192 parties (Canada withdrew from the protocol, effective December 2012) to the Protocol in 2020. The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change. The IPCC prepares comprehensive Assessment Reports about knowledge on climate change, its causes, potential impacts and response options. The IPCC also produces Special Reports, which are an assessment on a specific issue and Methodology Reports, which provide practical guidelines for the preparation of greenhouse gas inventories.
Under the Kyoto Protocol, the 'caps' or quotas for Greenhouse gases for the developed Annex 1 countries are known as Assigned Amounts and are listed in Annex B.

[19] Source: https://unfccc.int/kyoto_protocol
[20] United Nations Framework Convention on Climate Change, UNFCCC, https://unfccc.int/process-and-meetings/the-convention/what-is-the-united-nations-framework-convention-on-climate-change
[21] The mechanism adopted was similar to the successful US Acid Rain Program to reduce some industrial pollutants.

The original compliance carbon market was initiated by the Kyoto Protocol's Clean Development Mechanism (CDM). Signatories to the Kyoto Protocol agreed to mandatory emission reduction targets, enabled (in part) by carbon offset purchases by higher-income countries from low- and middle-income countries, facilitated by the CDM. The Kyoto Protocol was to expire in 2020, to be superseded by the Paris Agreement. The Paris Agreement determinations regarding the role of carbon offsets are still being determined through international negotiation specifying the "Article 6" language.[6] Compliance markets for carbon offsets comprise both international carbon markets developed through the Kyoto Protocol and Paris Agreement, and domestic carbon pricing initiatives that incorporate carbon offset mechanisms.

The global carbon market is dominated by the **European Union**, where companies that emit greenhouse gases are required to cut their emissions or buy pollution allowances or carbon credits from the market, under the European Union Emission Trading Scheme (EU ETS)[22].
Patrick Bayer and Michaël Aklin, in a 2021 paper, show that EU ETS, which initially regulated roughly 50% of EU carbon emissions from mainly energy production and large industrial polluters, saved more than 1 billion tons of CO2 between 2008 and 2016. This translates to reductions of 3.8% of total EU-wide emissions compared to a world without the EU ETS[23].

The **world's top economics organisations** including the International Monetary Fund, the World Bank[24] and the Organisation for Economic Co-operation and Development[25] **continue to call for expanded use of carbon pricing**[26]. Nature

[22] Source: https://ec.europa.eu/clima/policies/ets_en
[23] Bayer, P, M. Aklin, 2020. The European Union Emissions Trading System reduced CO2 emissions despite low prices. Proceedings of the National Academy of Sciences Apr 2020, 117 (16) 8804-8812; DOI: 10.1073/pnas.1918128117
[24] https://www.worldbank.org/en/news/press-release/2021/05/25/carbon-prices-now-apply-to-over-a-fifth-of-global-greenhouse-gases
[25] https://www.oecd.org/env/cc/carbonmarkets.htm
[26] https://www.oecd.org/environment/effective-carbon-rates-9789264260115-en.htm

conservancy define carbon markets and offsetting as a near-term solution to closing the emissions gap[27].

Best and colleagues[28] made a study in analysed data for 142 countries over more than two decades, 43 of which had a carbon price of some form by the end of the study period. The results show that countries with carbon prices on average have annual carbon dioxide emissions growth rates that are about two percentage points lower than countries without a carbon price, after taking many other factors into account. The average annual emissions growth rate for the 142 countries was about 2% per year.
This size of effect adds up to very large differences over time. It is often enough to make the difference between a country having a rising or a declining emissions trajectory. Generally speaking study shows that emissions tend to fall in countries with carbon prices. On average, carbon dioxide emissions fell by 2% per year over 2007–2017 in countries with a carbon price in 2007 and increased by 3% per year in the others.
If countries are keen on a low-carbon development model, the evidence suggests that putting an appropriate price on carbon is a very effective way of achieving it.

Carbon markets and their function were criticized. In last ten years voluntary carbon markets have come under scrutiny, particularly nature-based offset projects, side effects and environmental impacts. **Criticisms** of the general practice of emissions trading and carbon markets are made in both scientific[29] and social arenas[30]. A joint investigation into the offsetting schemes used by some

[27] https://www.nature.org/en-us/what-we-do/our-insights/perspectives/carbon-markets-for-faster-climate-action/
[28] Best, R., P. J. Burke & F. Jotzo, 2020. Carbon Pricing Efficacy: Cross-Country Evidence, Environmental and Resource Economics, 77, 69–94.
[29] Blok, A., 2010. Topologies of climate change: actor-network theory, relational-scalar analytics, and carbon-market overflows. Environment and Planning D: Society and Space. 28 (5): 896–912.
[30] see for example:
Greenfield, P. 2021. Carbon offsets used by major airlines based on flawed system, warn experts. The Guardian 4 may 2021, https://www.theguardian.com/environment/2021/may/04/carbon-offsets-used-by-major-airlines-based-on-flawed-system-warn-experts

of the world's largest airlines was carried out by the Guardian and Unearthed, Greenpeace's investigative arm. Results show that although many forest projects were doing valuable conservation work, the credits that they generated by preventing environmental destruction appear to be based on a flawed and much-criticised system[31].

On 14 July 2021, the European Commission adopted a series of legislative proposals
setting out how it intends to achieve climate neutrality in the EU by 2050, including the intermediate target of an at least 55% net reduction in greenhouse gas emissions by 2030[32].

The Land Use, Forestry and Agriculture (LULUCF) Regulation (EU) 2018/841 implements the agreement between EU leaders in October 2014 that all sectors should contribute to the EU's 2030 emission reduction target, including the land use sector.
On 14 July 2021, the European Commission adopted a series of legislative proposals
setting out how it intends to achieve climate neutrality in the EU by 2050, including the intermediate target of an at least 55% net reduction in greenhouse gas emissions by 2030[33].

Telegraph serie on Carbon Markets: https://www.telegraph.co.uk/business/2021/05/15/polluting-companies-pushed-clean-act/; https://www.telegraph.co.uk/environment/2020/02/21/consumers-risk-ripped-wild-west-carbon-offsets-market/https://www.telegraph.co.uk/business/2021/03/14/europes-carbon-regime-control-just-like-vaccine-procurement/;

VERRA, ICROA and GOLD STANDARD reply: https://verra.org/icroa-gold-standard-and-verra-respond-to-the-telegraph-series-on-carbon-offsetting

[31] Greenfield, P. 2021. cit.

[32] Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law') (OJ L 243, 9.7.2021, p. 1).

[33] Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law') (OJ L 243, 9.7.2021, p. 1).

The Commission is proposing as part of the Fit for 55 legislative package, Delivering the European Green Deal[34] to increase the carbon removals to -310 million of tonnes CO2 equivalent by 2030 and to achieve climate neutrality in the combined land use, forestry and agriculture sector by 2035 at EU level.
The policy address and the package propose to revise several pieces of EU climate legislation, including the EU ETS, Effort Sharing Regulation, transport and land use legislation, setting out in real terms the ways in which the Commission intends to reach EU climate targets under the European Green Deal.

Under current EU legislation adopted in May 2018, EU Member States have to ensure that accounted greenhouse gas emissions from land use, land use change or forestry are balanced by at least an equivalent accounted removal of CO2 from the atmosphere in the period 2021 to 2030. The EU climate legislation on LULUCF accounting and Effort sharing decision should be more clearly detailed as well as their implication for the eventual setting of a market for voluntary soil C sequestration. Also, the legislative framework allows compensations between sectors that are interesting for the LULUCF sector and thus for landowners[35].

[34] https://ec.europa.eu/clima/eu-action/european-green-deal/delivering-european-green-deal_enhttps://ec.europa.eu/clima/eu-action/european-green-deal/delivering-european-green-deal_en

[35] Coderoni S., Vitullo M (2018). Un nuovo quadro normativo per la riduzione delle emissioni di gas serra agricole e forestali, Agriregionieuropa anno 14 n°54, Set 2018, Associazione Alessandro Bartola, Ancona, ISSN: 1828-5880. https://agriregionieuropa.univpm.it/it/content/article/31/54/un-nuovo-quadro-normativo-la-riduzione-delle-emissioni-di-gas-serra-agricole-e

Coderoni S., Vitullo M (2018). L'agricoltura e le foreste italiane nel quadro delle politiche di riduzione delle emissioni di gas serra: aggiornamenti normativi e questioni aperte, Agriregionieuropa anno 14 n°54, Set 2018, Associazione Alessandro Bartola, Ancona, ISSN: 1828-5880. https://agriregionieuropa.univpm.it/it/content/article/31/54/lagricoltura-e-le-foreste-italiane-nel-quadro-delle-politiche-di-riduzione

Coderoni S., Vitullo M. (2014), Crediti di carbonio dal settore agroforestale: problematiche di contabilizzazione e di governance, Agriregionieuropa, 10(38), Settembre 2014, ISSN: 1828-5880. https://agriregionieuropa.univpm.it/en/node/9029

2.5 Risk management in agriculture practices for adaptand mitigate

As another issue to deepen the analysis of the Geco2 project, risk management refers to plans, actions, strategies or policies to reduce the likelihood and/or magnitude of adverse potential consequences, based on assessed or perceived risks. Insurance and early warning systems are examples of risk management, but risk can also be reduced (or resilience enhanced) through a broad set of options ranging from seed sovereignty, livelihood diversification, to reducing land loss through urban sprawl. Early warning systems support farmer decision making on management strategies, and are a good example of an adaptation measure with mitigation co-benefits such as reducing carbon losses. Primarily designed to avoid yield losses, early warning systems also support fire management strategies in forest ecosystems, which prevents financial as well as carbon losses. Where available and affordable, insurance can buffer farmers and foresters against the financial losses incurred through such weather and other (fire, pests) extremes. Decisions to take up insurance are influenced by a range of factors such as the removal of subsidies or targeted education. Enhancing access and affordability of insurance in low-income countries is an important objective of the UNFCCC; a global mitigation co-benefit of insurance schemes may also include incentives for future risk reduction.

2.6 Economics of land-based mitigation pathways

The overarching societal costs associated with GHG emissions and the potential implications of mitigation activities can be measured by various metrics (cost-benefit analysis, cost effectiveness analysis) at different scales (project, technology, sector or the economy) (IPCC Report). The Social Cost of Carbon (SCC), measures

the total net damages of an extra metric ton of CO2 emissions due to the associated climate change.
Both negative and positive impacts are monetized and discounted to arrive at the net value of consumption loss. As the SCC depends on discount rate assumptions and value judgements (e.g., relative weight given to current vs. future generations), it is not a straightforward policy tool to compare alternative options. At the sectoral level, marginal abatement cost curves (MACCs) are widely used for the assessment of costs related to GHG emissions reduction. MACCs measure the cost of reducing one more GHG unit and are either expert based or model-derived and offer a range of approaches and assumptions on discount rates or available abatement technologies. In land-based sectors, short term static abatement costs are reported for afforestation, soil management and livestock management. MACCs are more reliable when used to rank alternative options compared to a baseline (or business as usual) rather than offering absolute numerical measures. The economics of land-based mitigation options encompass also the "costs of inaction" that arise either from the economic damages due to continued accumulation of GHGs in the atmosphere and from the diminution in value of ecosystem services or the cost of their restoration, where feasible. Overall, it remains challenging to estimate the costs of alternative mitigation options owing to the context- and scale specific interplay between multiple drivers (technological, economic, and socio-cultural) and enabling policies and institutions (IPCC Report). The costs associated with mitigation (both project-linked such as capital costs or land rental rates or sometimes social costs) generally increase with stringent mitigation targets and over time. Sources of uncertainty include the future availability, cost and performance of technologies, or lags in decision making, which have been demonstrated by the uptake of land use and land utilisation policies. There is growing evidence of significant mitigation gains through conservation, restoration and improved land management practices, but the mitigation cost efficiency can vary according to region and specific ecosystem. Several model developments that treat process-based, human environment interactions have recognised feedbacks that reinforce or dampen the original stimulus for land use change. For instance, land mitigation interventions that rely on large-scale, land use change (i.e.,

afforestation) would need to account for the rebound effect (which dampens initial impacts due to feedbacks) in which raising land prices also raises the cost of land-based mitigation. Indirect assessments strongly point to much higher costs if action is delayed or limited in scope. Quicker response options are also needed to avoid loss of high-carbon ecosystems and other vital ecosystem services that provide multiple services that are difficult to replace (peatlands, wetlands, mangroves, forests). Delayed action would raise relative costs in the future or could make response options less feasible.

3. Circular economy issues

3.1 Circular economy

The Circular Economy is the new paradigm which introduces the question of efficiency, not simply energetic, but in the rational and appropriate use and reuse of all resources, thanks to a sustainable and circular product design (durability, modular and decomposable parts, biodegradability, renewable and non-toxic resources production) upstream and a correct management of waste downstream; replacement of virgin raw materials with secondary raw materials and from fossil sources with biomaterials; control and management of the return flows of products at the end of their life and of the left; choice and creation of a sustainable supply chain; involving social inclusion, favoring the inclusion of subjects in difficult conditions and the redevelopment of dismissed spaces.
As a new production model, the Circular Economy would have a greater density of work than the current one, creating worthy and quality employment; it could also favor policies of job reconversion through professional requalification and training of workers. In fact, it is part of the new opportunities given by green jobs, i.e. all

those jobs in the industrial, construction, artistic and services sectors which use eco-sustainable solutions and production techniques (re-use of materials, renewable energies, green building, redevelopment of old industrial plants, etc.).
2015 Circular Economy Package, establishing a holistic approach towards resource efficiency across value chains. Based on an Action Plan, a series of legislative and non- legislative actions were proposed and implemented, for example in the fields of waste management, plastics, fertilisers, marine litter, critical raw materials and indicators. Consequently, the circular economy has also been identified by the European Commission's (2018a) Long-term Strategy on climate neutrality as one of the 'key enablers'.
It is therefore logical that the circular economy is taken up in the Political Guidelines for the period 2019-2021 of Commission President-elect Ursula von der Leyen. The Guidelines integrate the circular economy into climate change – her first priority – and into the 'European Green Deal' to be proposed in her first 100 days in office. The circular economy will be a key cornerstone of future EU industrial policy and for ''developing Europe's future economic model''. 'Circular economy' and 'clean technologies' are mentioned side by side as areas where Europe should become a ''world leader''. A "new Circular Economy Action Plan focusing on sustainable resource use, especially in resource- intensive and high impact sectors such as textiles and construction'' has been announced[36].

[36] Ellen MacArthur Foundation (2019), ''Completing the Picture: How the Circular Economy Tackles Climate Change ''(https://tinyurl.com/yyzjzxa3).

European Commission (2017), ''Study on the review of the list of Critical Raw Materials – Critical Raw Materials Factsheets''.

European Commission (2018a), ''A Clean Planet for all – A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy'', Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank, COM(2018) 773 final.

European Commission (2018b), ''In-Depth Analysis in Support of the Commission Communication COM(2018) 773 ' –A Clean Planet for all – A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy''.

A ‘circular agriculture economy’ proposes a viable model for the current linear economy “take-make-waste” approach by minimizing the number of external inputs for agricultural production, closing nutrient loops and reducing negative impacts to the environment by eliminating discharges (i.e. wastewater) and surface runoff. Under the lens of the circular economy, agriculture can offer a multitude of opportunities from primary production using precision agriculture techniques, to the recycling and utilization of agricultural wastes and materials (i.e. reuse of plastic containers)[37].

3.2 The 10 Criteria of Circular economy

The 10 dimensions and the relative criteria are described below, valid for the measurement / validation of the dimension under examination. The dimensions are divided into two macro-categories: the dimensions useful for detecting the criteria of circularity and the dimensions relating to the evaluation of the aspects of the social and environmental sustainability, in which the aspect of economic performance results according to the qualification of the social impact of the activity taken into consideration.

The Circular Economy as a new production model would have a greater density of work than the current one, creating worthy and quality employment, it could also favor policies of job reconversion through professional requalification and training

European Commission (2019), ''EU SDG Indicator set 2019 – Result of the review in preparation of the 2019 edition of the EU SDG monitoring report''

[37] FAO, 2020. https://www.fao.org/land-water/overview/covid19/circular/fr/

of workers. It is in fact part of the new opportunities given by green jobs, that is all those jobs in the industrial, construction, artistic and services sectors that use eco-sustainable solutions and production techniques (re-use of materials, renewable energies, green building, redevelopment of old industrial plants etc.).

3.2.1 Circularity criteria

1 eco-design (circular design)
Design of products that can last long, whose dismantling is simple, so as to easily allow the repair and / or reuse and / or recovery of the products in their entirety or in their splits (circular design, design-out waste, etc.).
In this respect, account will be taken of:
1.1 Production design for the purpose of: 1.1.1 extending product life (durability and repairability of the product and / or its components, availability of spare parts);
1.1.2 ensuring a second life to the products (re-usability and regeneration of the product and / or its components, availability of refills) considering them flexible and adaptable (modularity, decomposition, disassembly of the products into individually reusable components);
1.1.3. recovering products at the end of their life (recyclability, biodegradability, composting capability of the product and / or of its components) (disassembly of the products in individually recyclable single-material components);
1.1.4 eliminating, reducing, designing a second life of packaging;
1.2 Support to the transition from the sale of products to the provision of services for the use of products;
1.3 Planning in a systemic perspective of logistics and return flows (supply, collection, reverse-logistics systems, return placement in secondary markets, planning of re-manufacturing, re-use, repair);

1.4 Use of tools to support the design in terms of cycle, such as LCA.
2 supply of materials and resources (virgin or second raw materials)
Environmental impact of supply of materials and energy and choice of renewable and sustainable materials and sources.
In this respect, account will be taken of:
2.1 Replacement of virgin raw materials (also with reference to materials being exhausted - critical row materials -), non-renewable and coming from fossil sources with: secondary raw materials; biomaterials;
2.2 Substitution of substances and polluting substances, toxic or dangerous for the health and their environmental impact;
2.3. Replacement of energy (electric and thermal) and fuels derived from fossil fuels with energy and fuels produced from renewable sources (including self-production, also considering the achievement of Green Certificates).
3 consumption of natural resources and Materials
Efficient use of resources at all stages of production. Energy efficiency or optimization of energy consumption through targeted reduction policies.
In this respect, account will be taken of:
3.1 Energy efficiency through:
3.1.1 reduction of energy consumption (electricity and heat) and fuel, also linked to the achievement of White Certificates (or Energy Efficiency Certificates);
3.1.2. presence of an energy manager who follows actions to improve the overall energy performance of the organization;
3.2 Water efficiency;
3.3. Efficiency in the use of materials for the same production (use of production optimization systems; dematerialization, etc.).
4 waste and emissions management
The environmental impact of managing production waste, waste and end-of-life products. Return logistics (also called reverse logistics) is the process of planning,

implementing and controlling the efficiency of raw materials for semi-finished products, finished products. Related information flows from the point of recovery (or consumption) to the point of origin with the purpose of regaining value from products which exhausted their life cycle.

In this respect, account will be taken of:

4.1 Prevention of waste and waste production (through production control and optimization systems);

4.2 Recovery of material and energy from waste and scrap (internally or externally to the company production cycle);

4.3 Improvement of the management of the waste produced (which cannot be avoided), increasing the amount of waste and scrap materials transferred in a differentiated manner and sent for recycling;

4.4 Prevention and reduction of polluting emissions: in water; in the atmosphere;

4.5 Measurement, prevention, reduction of climate-changing emissions and compensation for those which cannot be avoided (for example by purchasing green certificates).

5 transport and distribution

Environmental impact of transport connected to the various phases of the production process and logistics.

In this respect, account will be taken of:

5.1 Distribution optimization (better routes, full load, sharing of transport vehicles, etc.);

5.2 Consideration of the externalities deriving from transport throughout the production cycle (procurement, shipping, etc.) in the construction of productprices. These externalities depend on the distance, the means of transport used and the characteristics of the packaging necessary according to the vehicle, from the times required and their flexibility, by the method and rules for collection at the end of life;

5.3 Modal shift towards long-range / urban sustainable distribution systems (railway, cargo bike);
5.4 Adherence to transport and logistics certification systems, such as the Sustainable Logistics protocol.
6 promotion of sustainable life styles
In this respect, account will be taken of:
6.1 Promotion of virtuous behavior of employees / members / volunteers of organizations through the use and dissemination of tools to support:
6.1.1 sustainable mobility - for example to encourage the habit in the home-work journeys of employees (carpooling and company car sharing, services for cycling, connection with the pedestrian and bicycle network and with the TPL network, etc.); 6.1.2 a typical example is the presence in the company of the figure of mobility manager;
6.1.3. reduction of waste production and their correct management;
6.1.4. reduction of energy and water consumption;
6.2 Promotion of virtuous consumer behavior through the use and dissemination of tools (mostly communication and information) for:
6.2.1 accompanying measures towards more sustainable purchases;
6.2.2. support for the correct re-use, recycling, transfer of assets at the end of life;
6.2.3. improving awareness of the social, environmental and economic benefits of sustainable consumption;
6.2.4. support for the exchange and re-use of unused goods (for example by encouraging the creation of communities and networks).
7 circular supply chain
Construction of the supply chain based on environmental compatibility criteria.
In this respect, account will be taken of:
7.1 Selection of suppliers based on sustainability criteria, through:

7.1.1 the use of an environmental and social supplier pre-qualification system which can support the selection (sustainable vendor rating);
7.1.2. the use of environmental and social criteria for "characteristic purchases" (purchases entering the products sold, e.g., for a textile company the weaving machinery, the textile material, etc.);
7.1.3. the use of environmental and social criteria for "ordinary purchases" (purchases that do not enter the products sold, e.g.: office paper, canteen service, car rental, energy for offices, etc.);
7.2 Support for the formation of local commercial networks, through:
7.2.1 the selection of local suppliers, also included in stable networks;
7.2.2. priority sale on the local market (inclusion in distribution networks of 0 km products, direct sales, agreements with a network of local merchants);
7.3 Support for industrial symbiosis mechanisms, through the activation of partnerships and agreements for stable collaboration between subjects aimed at the exchange of resources, such as: materials, by-products, energy waste, services, expertise, etc.
B) Environmental and social sustainability criteria 8
SHARED VALUE and TERRITORIAL COMMUNITIES
Impact on other connected realities (supply chains or non-supply chains) in terms of maximizing the environmental compatibility creating shared social value; development of other economic forms, organized in plural forms (pluralism of organizational forms) which can enter the economic fabric.

In this respect, account will be taken of:
8.1 Increasing environmental compatibility and / or the social value of the supply chain and stakeholders, through:

8.1.1 the support and / or the sponsor to the actors of the supply chain with the organization of training days, workshops, conferences, targeted communications to the actors;
8.1.2. the selection of its own financial intermediaries towards subjects who are attentive to promoting employment in areas of promotion of sustainability / social responsibility;
8.2 Increase in economic biodiversity, through:
8.2.1 the creation of new professional figures connected to the Circular Economy (Green Jobs);
8.2.2. the creation of economic / social / cultural realities linked to the company mission;
8.3 Creation of local wealth, through:
8.3.1 employment of local staff;
8.3.2. the implementation of initiatives aimed at the enhancement of communities and territorial heritage.
9 social inclusion
Increase in the rate of economic inclusion of disadvantaged groups and those at risk of social exclusion through the support and strengthening of social economy experiences linked to the territory. Creation of social as well as economic value according to a shared value approach, with particular attention to the involvement of disadvantaged subjects.
In this respect, account will be taken of:
9.1 Improvement of the quality of life and well-being of the worker and his family through welfare company initiatives: flexibility in hours / place of work, services / facilities for the family, monetary benefits, etc.;
9.2 Promotion of equality and gender integration (equal opportunities);
9.3 Promotion of inclusion, work and social integration of subjects who live in complexity or with a fragile past, through:

9.3.1 employment of subjects considered to be disadvantaged individuals in shares above the legal limit;
9.3.2. employment of workers belonging to protected categories in shares above the legal limit;
9.3.3. employment of migrant workers.
10 references to environmental standards and acknowledgments obtained
Existence of reporting activities that analyze / qualify / certify environmental rating, transparency in labels and instruction booklets, etc.
10.1 Adherence to environmental management systems (EMAS, ISO14001) and / or energy (ISO50001);
10.2 Use of tools for information and communication of the environmental and social qualification of the company and of its products and services, including:
10.2.1 environmental product certification according to the existing schemes (Type I - Ecolabel -, Type II - Environmental self-declarations - and Type III - EDP -);
10.2.2. ecological certification for tourist services (Tourism Ecolabel);
10.2.3. drafting the sustainability report;
10.3 Mentions, awards, acknowledgments, quotations in articles and printing of products and / or services with circular economy content.

The concept of circularity in agriculture originates from industrial ecology whose aim is to use byproducts, reduce resource consumption and emissions by closing the loop of materials and substances. Under this paradigm, losses of materials and substances should be prevented, and otherwise be recovered for reuse, remanufacturing and recycling. In line with these principles, moving towards a circular food system implies searching for practices and technology that minimize the input of finite resources, encourage the use of regenerative ones, prevent the leakage of natural resources (e.g. carbon, nitrogen, phosphorus, water) from the

food system, and stimulate the reuse and recycling of resources in a way that adds the highest possible value to the food system.[38]

4. Analysis of international policies and legislation about climate change and carbon credit market

Carbon markets exist under both mandatory (compliance) schemes and voluntary programs. Compliance markets are created and regulated by mandatory national, regional, or international carbon reduction regimes. Voluntary markets function outside of compliance markets and enable companies and individuals to purchase carbon offsets on a voluntary basis with no intended use for compliance purposes. Compliance offset market credits may in some instances be purchased by voluntary, non-regulated entities, but voluntary offset market credits, unless explicitly accepted into the compliance regime, are not allowed to fulfill compliance market demand[39].
The concept of carbon offsetting arose in the late 1980s, as policymakers first began to seriously grapple with how to mitigate climate change. Although the first demonstrations of carbon offset projects involved voluntary arrangements, the idea evolved into a tool for controlling costs within broader "market mechanisms" for addressing GHG emissions, including emissions trading systems. The first and largest carbon offset program was the CDM, established under the Kyoto Protocol

38

Imke J.M. de Boer1 and Martin K. van Ittersum (2018) "Circularity in agricultural production"https://library.wur.nl/WebQuery/wurpubs/fulltext/470625

39 https://www.offsetguide.org/understanding-carbon-offsets/carbon-offset-programs/mandatory-voluntary-offset-markets/

as a mechanism to allow developed countries to cost-effectively meet emission reduction obligations by investing in mitigation in developing countries. As the comparison of offset programs suggests, a number of other regulatory emissions trading systems have also incorporated carbon offset credits as a compliance tool.

4.1 The Kyoto protocol

The concept of carbon market came into existence as a result of increasing awareness of the need for controlling emissions. The mechanism was formalized in the Kyoto Protocol[40].

The **Kyoto Protocol was an international treaty which extended the 1992 United Nations Framework Convention on Climate Change** (UNFCCC) that commits state parties to reduce greenhouse gas emissions, based on the scientific consensus that (part one) global warming is occurring and (part two) that human-made CO2 emissions are driving it[41]. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005[42]. There were 192 parties (Canada withdrew from the protocol, effective December 2012) to the Protocol in 2020. The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change. The IPCC prepares comprehensive Assessment Reports about knowledge on climate change, its causes, potential impacts and response options. The IPCC also

[40] United Nations Framework Convention on Climate Change, UNFCCC, https://unfccc.int/process-and-meetings/the-convention/what-is-the-united-nations-framework-convention-on-climate-change

[41] Source: https://unfccc.int/kyoto_protocol

[42] The mechanism adopted was similar to the successful US Acid Rain Program to reduce some industrial pollutants.

produces Special Reports, which are an assessment on a specific issue and Methodology Reports, which provide practical guidelines for the preparation of greenhouse gas inventories.

Under the Kyoto Protocol, the 'caps' or quotas for Greenhouse gases for the developed Annex 1 countries are known as Assigned Amounts and are listed in Annex B.

The global carbon market is dominated by the **European Union**, where companies that emit greenhouse gases are required to cut their emissions or buy pollution allowances or carbon credits from the market, under the European Union Emission Trading Scheme (EU ETS)[43].

Patrick Bayer and Michaël Aklin, in a 2021 paper, show that EU ETS, which initially regulated roughly 50% of EU carbon emissions from mainly energy production and large industrial polluters, saved more than 1 billion tons of CO2 between 2008 and 2016. This translates to reductions of 3.8% of total EU-wide emissions compared to a world without the EU ETS[44].

[43] Source: https://ec.europa.eu/clima/policies/ets_en

[44] Bayer, P, M. Aklin, 2020. The European Union Emissions Trading System reduced CO2 emissions despite low prices. Proceedings of the National Academy of Sciences Apr 2020, 117 (16) 8804-8812; DOI: 10.1073/pnas.1918128117

The **world's top economics organisations** including the International Monetary Fund, the World Bank[45] and the Organisation for Economic Co-operation and Development[46] **continue to call for expanded use of carbon pricing**[47]. Nature conservancy define carbon markets and offsetting as a near-term solution to closing the emissions gap[48].

Best and colleagues[49] made a study in analysed data for 142 countries over more than two decades, 43 of which had a carbon price of some form by the end of the study period. The results show that countries with carbon prices on average have annual carbon dioxide emissions growth rates that are about two percentage points lower than countries without a carbon price, after taking many other factors into account. The average annual emissions growth rate for the 142 countries was about 2% per year.

This size of effect adds up to very large differences over time. It is often enough to make the difference between a country having a rising or a declining emissions trajectory. Generally speaking study shows that emissions tend to fall in countries with carbon prices. On average, carbon dioxide emissions fell by 2% per year over

[45] https://www.worldbank.org/en/news/press-release/2021/05/25/carbon-prices-now-apply-to-over-a-fifth-of-global-greenhouse-gases

[46] https://www.oecd.org/env/cc/carbonmarkets.htm

[47] https://www.oecd.org/environment/effective-carbon-rates-9789264260115-en.htm

[48] https://www.nature.org/en-us/what-we-do/our-insights/perspectives/carbon-markets-for-faster-climate-action/

[49] Best, R., P. J. Burke & F. Jotzo, 2020. Carbon Pricing Efficacy: Cross-Country Evidence, Environmental and Resource Economics, 77, 69–94.

2007–2017 in countries with a carbon price in 2007 and increased by 3% per year in the others.

If countries are keen on a low-carbon development model, the evidence suggests that putting an appropriate price on carbon is a very effective way of achieving it.

Carbon markets and their function were criticized. In last ten years voluntary carbon markets have come under scrutiny, particularly nature-based offset projects, side effects and environmental impacts. **Criticisms** of the general practice of emissions trading and carbon markets are made in both scientific[50] and social arenas[51]. A joint investigation into the offsetting schemes used by some of the world's largest airlines was carried out by the Guardian and Unearthed, Greenpeace's investigative arm. Results show that although many forest projects were doing valuable conservation work, the credits that they generated by

[50] Blok, A., 2010. Topologies of climate change: actor-network theory, relational-scalar analytics, and carbon-market overflows. Environment and Planning D: Society and Space. 28 (5): 896–912.

[51] see for example:

Greenfield, P. 2021. Carbon offsets used by major airlines based on flawed system, warn experts. The Guardian 4 may 2021, https://www.theguardian.com/environment/2021/may/04/carbon-offsets-used-by-major-airlines-based-on-flawed-system-warn-experts

Telegraph serie on Carbon Markets: https://www.telegraph.co.uk/business/2021/05/15/polluting-companies-pushed-clean-act/; https://www.telegraph.co.uk/environment/2020/02/21/consumers-risk-ripped-wild-west-carbon-offsets-market/https://www.telegraph.co.uk/business/2021/03/14/europes-carbon-regime-control-just-like-vaccine-procurement/;

VERRA, ICROA and GOLD STANDARD reply: https://verra.org/icroa-gold-standard-and-verra-respond-to-the-telegraph-series-on-carbon-offsetting

preventing environmental destruction appear to be based on a flawed and much-criticised system[52].

4.2 European Union strategies and policies related to agriculture and climate change

For the European Union to reach climate targets of a 55 percent greenhouse gas emissions cut by 2030 compared to 1990, and climate neutrality by 2050, it will need to carry out a fundamental regulatory overhaul. Among the initial steps will be plans to increase the cost of green- house gas emissions in different sectors by revising the EU emissions trading system (ETS) and possibly extending it to the transport and heating sectors, revising the energy taxation directive and taxing the carbon content of imports53.
Common Agricultural Policy and Land and Soil European initiatives are part of the Green Deal and Climate Policies.

The Common Agricultural Policy (CAP) is the agricultural policy of the European Union. The CAP is used to protect the rural environment. Farmers get more if they

[52] Greenfield, P. 2021. cit.

[53] See www.europarl.europa.eu/legislative-train/theme-a-european-green-deal/file-revision-of-the-eu-emission-trading-system-(ets).
See https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12656-Updating-Member-State-emissions-reduction-targets--Effort-Sharing-Regulation-in-line-with-the-2030-climate-target-plan.

sign up to agro-environment commitments – using fewer chemicals; leaving boundaries uncultivated; maintaining ponds, trees and hedges; protecting wildlife. Today's reformed CAP offers training for farmers, and assistance to young farmers starting up. Subsidies are increasingly orientated toward rural development.

The CAP total amount is 270 billion for the 2023-2027 period. The new multi-annual EU budget is supposed to run from 2021 to 2027, but as negotiations dragged on, the Commission was forced to extend the current CAP programme until the end of 2022. After that, the reformed CAP will enter into force.

The CAP is planned to be "fully integrate" with EU environmental and climate legislation and contribute to the targets of the Farm to Fork and biodiversity strategies.

Countries will have to allocate a minimum of 25 per cent of direct payments to eco-schemes (environmentally friendly initiatives such as organic farming or precision farming), while at least 35 per cent of rural development funds must go to projects that promote environmental, climate and animal welfare practices.

For the first time, the EU introduces "social conditionality" in the CAP to ensure that those who benefit from the subsidies comply social and labour regulations within their businesses.

The Farm to Fork Strategy is at the heart of the European Green Deal aiming to make food systems fair, healthy and environmentally-friendly.

The Farm to Fork Strategy aims to accelerate our transition to a sustainable food system that should:

- have a neutral or positive environmental impact

- help to mitigate climate change and adapt to its impacts
- reverse the loss of biodiversity
- ensure food security, nutrition and public health, making sure that everyone has access to sufficient, safe, nutritious, sustainable food
- preserve affordability of food while generating fairer economic returns, fostering competitiveness of the EU supply sector and promoting fair trade

Putting European food systems on a sustainable path brings new opportunities for operators in the food value chain. New technologies and scientific discoveries, combined with increasing public awareness and demand for sustainable food, will benefit all stakeholders.

European Commission will present in July 2021 proposals to revise the EU climate and energy legislation for the period 2021-2030[54]. This position paper addresses key issues for the revision of the EU Regulation on Land Use, Land Use Change and Forestry (LULUCF), please refer to our accompanying position papers with regards to our general demands on the overall EU climate policy architecture, the revision of the EU energy targets and carbon pricing .

Revision of the LULUCF Regulation is a chance to mitigate both the climate and biodiversity crises. The cheapest, most effective, and most readily available way to increase carbon sequestration is to protect and restore forests, peatlands, and other natural ecosystems. The current EU legislation far from incentivises this, leading to continuous loss of biodiversity and little to no climate crisis mitigation ambition in the sector. Urgent and far-reaching changes are needed, commensurate with the speed and scale of the climate emergency we face.

Main elements of the Climate Action Network Europe LULUCF position:

1. A LULUCF sector target that is separate and not fungible with emission reductions

Net removals by the LULUCF sector need be additional to emissions reductions in other sectors and kept under a separate target with no flexibility with the ETS and

[54] Following an agreement on a revised EU 2030 target of at least -55% net greenhouse gas emission reductions.

ESR sectors. This is critical because emission reductions and removals in the LULUCF sector are not equal to emissions in other sectors and the two cannot simply be considered fungible. Measuring emissions and removals in the land sector is less accurate and land-based carbon stocks cannot be considered permanent in the same way as reducing fossil fuel emissions and keeping fossil fuels in the ground can. The climate and ecological crisis requires all sectors to do their maximum effort without progress in one undermining progress in the other.

2. A separate target of -600Mt by 2030 to LULUCF sector
Climate Action Network Europe remains of the view that the EU should reduce its net greenhouse gas emissions to zero by 2040 and by 2030 to reduce its greenhouse gas emissions by at least 65% compared to 1990. In addition, we call on the EU to aim to increase the EU LULUCF sector's net contribution to -600 million tonnes (Mt) annually by 2030, through a rapid expansion of practices that are a win-win for climate and biodiversity, and for the Commission and Member States to undertake urgent work on how to achieve this goal collectively across the EU.

3. Account honestly of everything that the atmosphere sees
The current LULUCF Regulation fails to provide full transparency on how member states set their forest reference levels, which can lead to large amounts of unaccounted emissions. Setting an overall LULUCF target of -600 Mt by 2030, with individual targets at the national level, allows for accounting in relation to a future goal instead of an historical point in time or a constructed future baseline. We also call for an immediate start of accounting of wetland emissions rather than delaying to 2026 as foreseen under the current Regulation.

4. Ensure synergies and concrete links between the LULUCF sector and the EU's biodiversity strategy
Revision of the LULUCF Regulation is a chance to mitigate both the climate and biodiversity crises, but changes in the incentives for forestry and land use can have either negative or positive consequences for biodiversity. The revised

legislation must remain mindful of the impacts to biodiversity and ensure that concrete links will be drawn between the LULUCF Regulation and the European Union biodiversity objectives, including those set out in the European Union Biodiversity Strategy, in the EU Restoration Law and the Birds and Habitats Directive. CAN Europe calls for a development of a complementary carbon stock reporting system that allows to address these gaps, particularly with respect to monitoring biodiversity, resilience and the hence quality of carbon stocks and allows ensuring that the system does not incentivise conversion of biodiversity rich ecosystems.

Short analysis of the current LULUCF Regulation now under revision

The current EU Regulation for the Land Use, Land Use Change and Forestry was adopted in 2018 as part of the 2021-2030 EU's energy and climate policy framework that aimed to implement the EU's greenhouse gas emissions reduction target of at least -40% by 2030. The Regulation kept the LULUCF sector in its own pillar outside the -40% target with its own rules for accounting for emissions and removals, but allowed Member States to use the LULUCF sink to offset 280 Mt of emissions to cover their obligations under the Effort Sharing Regulation.

The core component of the Regulation is setting a "no-debit" rule, requiring Member States to ensure that accounted emissions (debits) from all land-use categories within the LULUCF sector do not exceed accounted removals (credits) from 2021 to 2030. However, the accounting rules for determining debits or credits still allow for significant loss of carbon sinks and stocks that are not visible in the accounting books by setting baselines that incorporate future harvesting levels that 'bake in 'past emissions and that exclude emissions from wetlands. While the no-debit rule is a central starting point, the Regulation neither prohibits Member States from reducing their carbon sink nor does it incentivise increasing it. What is more, the Regulation allows the EU sink to decrease. Forest lands, which contribute most to the sink, are accounted for through a complex process of setting Forest Reference Levels, and then comparing these projected levels to actual sinks. Member States play a key role in the process and have an incentive

to politically manipulate their reference levels in order to have more lenient LULUCF targets.

Integrating with this the measures of the European Common Agricultural Policy (CAP) include:
Greening actions[55]: or greening; this is governed by the following rules on direct payments under the CAP (EU regulation 1307/2013, EU delegated regulation 639/2014, EU implementing regulation 641/2014)greening, ecological areas. Farmers receive the green direct payment if they comply with three mandatory practices that benefit the environment (soil and biodiversity in particular).
The three actions[56] made in farms are:
Crop diversification: a greater variety of crops makes soil and ecosystems more resilient;
Maintaining permanent grassland: grassland supports carbon sequestration and protects biodiversity (habitats);
Ecological Focus Areas (EFA), dedicate 5% of arable land to areas beneficial for biodiversity: for example trees, hedges or land left fallow that improves biodiversity and habitats.

[55] Hart K., Baldock D., 2011. Greening, Cap: delivering environmental outcomes through pillar one, Institute for European Environmental Policy, Available at <https://ieep.eu/uploads/articles/attachments/1639ede9-590d-46f4-9695-b4c07c64badb/Greening_Pillar_1_IEEP_Thinkpiece_-_Final.pdf?v=63664509757>, last visited on Jun, 9, 2020.

[56] **Crop diversification:** Farms with more than 10 ha of arable land have to grow at least two crops, while at least three crops are required on farms with more than 30 ha. The main crop may not cover more than 75% of the land. There are exemptions to the rules, depending on the individual situation. For instance, farmers with a large proportion of grassland, which is in itself environmentally beneficial.
Maintenance of permanent grassland: The ratio of permanent grassland to agricultural land is set by EU countries at national or regional level (with a 5% margin of flexibility). Moreover, EU countries designate areas of environmentally sensitive permanent grassland. Farmers cannot plough or convert permanent grassland in these areas.
Ecological focus areas: Farmers with arable land exceeding 15 ha must ensure that at least 5% of their land is an Ecological Focus Area in order to safeguard and improve biodiversity on farms.

4.3 The Paris Agreement

4.3.1 Responsibilities and Commitments

The Paris agreement on climate change

On April 22nd, 2016, the Opening Ceremony for the signing of the Paris Agreement (http://unfccc.int/paris_agreement/items/9485.php) was held at the United Nations headquarters in New York. The document was approved at the end of COP21, i.e. the 21st session of the conference of countries which signed the United Nations Framework Convention on Climate Change (United Nations Framework Convention on Climate Change, or UNFCCC). The Agreement, approved by the 195 countries joining the summit in Paris, would remain open for signature until April 17th, 2017. In June 21st, 2016, 177 countries had already signed it. Countries will now have to adopt the Agreement within their legislative systems, through ratification (or acceptance, approval or accession). In order to reach the agreement, on the basis of Article 21, it must be ratified by at least 55 countries responsible for a minimum of 55% of global greenhouse gas emissions. So far, the agreement has been ratified by 18 countries, which are only part of the 0.2% of the total global greenhouse gas emissions.
The COP21 was the culmination of a negotiation process launched in Durban (South Africa) in 2011, with the objective of sanctioning an agreement for the post-Kyoto period, from 2020 onwards, and to restore vigor to the UNFCCC process that was bogged down with the failure in 2009 of the COP15 in Copenhagen.
In Paris the themes opened in Copenhagen were still present: the global efforts to mitigate and divide share among countries; the adaptation to the consequences of climate change; forests conservation (their destruction and degradation cause 15

percent of global greenhouse gas emissions); financial transfers to developing countries to fight the effects of climate change and to compensate for any losses or damages incurred not for their own responsibility; technological partnerships; the development of scientific skills and institutional strengthening at national and supranational level; agreements on transnational and climate protection market instruments.
The only new negotiating theme regarding the Copenhagen COP concerned the issue of losses and damages, introduced at the COP19 in Warsaw and related to how to compensate the poor countries for the damage suffered due to climate change. From the Copenhagen COP to the Paris one, many technical and scientific advancements had been made in many of these negotiating areas. In addition, from the COP Copenhagen the international climate policies had started a transition from a centralized top-down model of governance towards a decentralized 'hybrid' approach, able to combine national voluntary commitments, decided by the same countries, called to communicate their own Intended Nationally Determined Contributions (INDC), with internationally shared principles and methods of accounting and monitoring.

Responsibilities and Commitments

The first major issue was the respect of the principle of common but differentiated responsibilities (differentiation in the COP21 jargon) as regards the accumulation, since the Industrial Revolution (1750) until now, of greenhouse gas emissions, as well as the financial, institutional and technological capacities of the countries to reduce them. From the first COP to the Paris one, the issue of differentiation was one of the most controversial. The Kyoto Protocol had recognized this principle, requiring 38 industrialized countries (listed in Annex I of the same Protocol) to reduce the level of greenhouse gases excluding all other countries (non-Annex I) from emission-cutting commitments (as it could have affected its development).
In 2014, a bilateral climate agreement between the US and China added the formula "in the light of different national circumstances" to the principle of common but differentiated responsibilities and was also proposed for the final

agreement in Paris. However, developing countries considered the formulation too general and insufficient to meet their demands. Mediation was sought in the proposal to include an additional reference to the differentiation of commitment among rich and poor nations in specific articles of the agreement, for example, in those on mitigation and transparency.
In Paris, many developing countries intended to maintain this dichotomy also for the post-Kyoto period. Instead, the developed countries claimed that the concept of INDC contained a declaration of commitment, which implied a self-differentiation and that this was sufficient to establish a differentiation with respect to the developing countries.
The Paris agreement, in various passages, reaffirms that the responsibilities of developed countries remain distinct from those of developing countries and the commitments resulted in the various negotiation issues, from finance to transparency, prove this.
The level of ambition
The second major issue to be solved concerned the limitation of global warming and long-term decarbonisation. In the UNFCCC jargon the issue has been defined as ambition. In Copenhagen the countries shared the goal of limiting global warming to no more than 2.0 ° C compared to the pre-industrial era. During the negotiation at least 100 countries of the newly formed negotiation training (high ambition coalition), tried to push the agreement further, asking to limit global warming to 1.5 ° C, the threshold that scientists believe can give greater guarantees of survival to the most vulnerable nations, in particular islands and insular areas.
There was also widespread support for the idea of integrating this objective with that of de-carbonization from the medium to the long term, reaffirmed at the G8 meeting just before COP21. Many countries intended to include the goal of de-carbonization directly in the text of the Paris agreement or, alternatively, in a specific decision. This solution, while recognizing the objective a legal and political status, would not have been strong enough to reflect the indications of science.
As regards the theme of ambition, it is possible to affirm that the Paris agreement has the merit of recognizing climate change as an urgent and potentially irreversible threat to human society and the planet as a whole. Thanks to it, the

states recognized the need to act urgently and committed themselves to adopting measures to mitigate the greenhouse effect, to cooperate with each other and to provide an effective, appropriate and progressive international response. More specifically, COP21 has set the goal of "containing the increase in global average temperature well below 2 ° C compared to pre-industrial levels and continuing efforts to limit the increase in temperature to 1.5 ° C ", recognizing that this would significantly reduce the risks and impacts of climate change. The text also recalls the commitment to a "global peaking of greenhouse gas emissions as soon as possible" and to proceed towards the progressive reduction of emissions in the second half of the century "as science allows".

4.3.2 Core concepts (Ambition, Transparency, Finance,Adaptation, Losses and damages)

Transparency

Within the UN climate negotiations, having chosen to move from a centralized top-down model to a decentralized and bottom-up model, the need to guarantee the minimum transparency requirements for reporting and verification (transparency) has become an important negotiating issue. In Paris, developed countries tried to standardize transparency requirements, extending them to all UNFCCC signatories, but they found opposition from developing countries. These have always shown perplexity as regards reporting obligations and verification of the accounting of

emissions and respect of commitments (which, instead, apply to developed countries). Until Paris, attempts had been made to meet these requirements by establishing two different standards for reporting and verifying emission reduction commitments: a more stringent assessment system and international review for developed countries and a milder analysis (International Consultation and Analysis, ICA) for developing countries.

The text adopted requires all the Parties to evaluate their emission reduction efforts at five-year intervals and, consequently, raise the task bar. The agreement also includes the possibility that states may implement their INDCs in cooperation, for example, through international transfers of "mitigation results". In order to ensure international transfers not to compromise the environmental integrity of the agreement, the establishment of a credible and transparent mechanism is fundamental to secure emission reductions are not recorded twice (double counting).

Finance

Along with differentiation and ambition, the topic of financial aid (finance, article 6 of the agreement) by donor countries, was the most critical and most debated issue at the Paris conference. With the Copenhagen agreement the developed countries were committed to mobilizing 100 billion dollars a year by 2020, in favor of developing countries for the activities destined to combat climate change. A recent OECD report estimated that 62 billion dollars were mobilized in 2014 and 52 billion euros in 2013. Developing countries have tried to incorporate the "progression" principle into the agreement. The principle, which applies to many countries in the context of mitigation, should also apply to financing. In other words, at every subsequent round, climate finance should progressively be more ambitious (and generous). The final agreement renews the commitment of the developed countries to donate 100 billion dollars a year to developing countries and states that this sum is the basis (floor in the text of the agreement) which must be progressively increased.

Market mechanisms and cooperation

Market mechanisms, such as emissions exchange, were a central feature in the architecture of the Kyoto Protocol. The Paris agreement includes the possibility

that states can implement their INDCs in cooperation, for example, through international transfers of "mitigation results" (i.e. emission reductions). At the time of submitting their INDCs, many countries had envisaged international transfers of emission credits. The Paris agreement authorizes the use of transfers among countries in order to implement their INDCs. To ensure that international transfers do not compromise the environmental integrity of the agreement, the approved text refers to a mechanism that is as credible and transparent as possible, so as to ensure that emissions reductions declared by countries are demonstrable and have not been recorded twice.

Adaptation

The concept of adaptation, which the IPCC defines as "an adjustment in natural or anthropic systems in response to climatic stimuli already in place or expected or their effects, capable of moderating damage and exploiting positive opportunities" is based on the idea that, regardless the responses to the climate crisis, many nations and many communities will face the adverse impact of climate change in the short and long term.

Compared to adaptation, developing countries believed that it had been too long considered a 'poor relative' of mitigation, while the text of the UNFCCC Convention places it on the same level, hence the request to consider a global goal for adaptation, in parallel with what would have been adopted for mitigation.

The Paris agreement (article 7) establishes a global quality objective to "improve the ability to adapt, strengthen resilience to and reduce vulnerability to climate change ". This undoubtedly represents a novelty in the history of the UNFCCC, which had never contemplated a specific adaptation consensus.

Furthermore, it explicitly recognizes the synergy with the mitigation strategies, inviting to a "suitable adaptation response in the context of the objectives of containing the increase in temperature" and underlining that "greater levels of attenuation can reduce the need for further adaptation" and related costs. Article 7 also highlights the fundamental principles of adaptation, specifying what the targets should be (groups, communities, particularly vulnerable ecosystems, etc.), the type of approach to be followed and the need to resort to "the best scientific knowledge available and (...) traditional, indigenous and local knowledge systems

". In addition, the agreement calls on all nations to present and periodically update a specific adaptation communication (AC), inserted in a public register kept by the UNFCCC secretariat. In order not to create additional burdens for developing countries, the process was designed to be flexible, both in terms of form and timing: no specific format has been indicated for the CAs, nor have deadlines been set for their presentation.

Also, in its introduction, the Paris agreement considers the framework of the Sendai Framework for Disaster Risk Reduction1, thus recognizing a change in mentality, passing from the reduction of losses linked to climate disasters to minimizing the risks related to the climate catastrophe, so that not only the size of the impact of climate change is reduced but also the one related to disasters.

Losses and Damages

The theme of losses and damages (losses and damages, in the UNFCCC jargon) concerns the negative impact due to climate change and, specifically, to extreme climatic events (hurricanes, floods, prolonged droughts, etc.). In Paris, the African countries, the small island states and other countries particularly vulnerable to the effects of climate change have successfully demanded the inclusion of a specific paragraph in the final agreement on losses and damage, for many years never solved in the nodal negotiations. The agreement came after two weeks of intense debate, which involved in particular the representatives of the small islands on one side and of the United States on the other. A compromise was then reached, including a reference to the more ambitious goal of maintaining the temperature increase at 1.5 ° C required by the island states and with the insertion of a clause from the USA (point 52 of the decision), stating that Article 8 should not "involve or provide a basis for any liability or claim compensation".

The solution, however, caused a division among the developing countries. The Philippines expressed deep concern and Bolivia declared that "no clause can deny people and the rights of countries to seek fair compensation" and that "all the necessary institutional means will be used to guarantee climate justice.

4.3.3 The legal character of the Paris Agreement

In the aftermath of the Paris summit, one of the major topics of discussion concerned the legal nature of the Agreement. Many analysts expressed serious doubts. Trying to clarify this aspect, it is necessary to refer to COP17, held in Durban in 2011, when the Durban Platform for Enhanced Action was adopted in order to prevent a repetition result such as that of Copenhagen from being repeated in the future, which established, inter alia, that at COP21 there should be adopted “a protocol, another legal instrument or an agreed outcome with legal force under the Convention applicable to all parties ".

On the basis of this premise, the states had defined a path to reach an agreement with commitments to limit climate-altering emissions, not only for the industrialized countries, but also for the major emerging economies (primarily China, India, Brazil).

The procedure approved by COP19 to facilitate the writing of a text containing acceptable commitments by all stated that each country would send, within the first term of 2015, a communication containing information on the contribution (called INDC, Intended Nationally Determined Contribution) that each nation set out for a global climate change agreement.

Stated that a contract must have "legal force according to international law" implicitly refers to the Vienna Convention on the Law of Treaties of 1969. In particular, according to Article 2 of this Convention, a treaty is "an international agreement concluded in written form among States and governed by international law, contained both in a single instrument and in two or more connected instruments, and whatever its particular denomination. "The document adopted in Paris can therefore be defined as a treaty since it presupposes an international agreement stipulated in written form among States. Furthermore, it is governed by international law as it was adopted under the UNFCCC, pursuing the objectives of the same Convention.

The formula chosen in Durban in 2011 represents an attempt to compromise between the divergent interests of the single states. In particular, the EU and many

developing countries called for a legally binding treaty; the USA preferred an instrument which did not need a Senate ratification; China and India insisted that there should be no obligations for developing countries.
However, the fact that the Paris agreement is considered a treaty does not mean that it must be totally binding, or that every part of it is a source of international obligations for the contracting parties. A treaty can in fact contain both legally binding and non-binding elements.
To understand which parts of the agreement create legal constraints, it is necessary to interpret the treaty, analyzing the content of the agreement and the circumstances in which it was adopted. More specifically, according to Article 31 of the Vienna Convention on the Law of International Treaties, a treaty must be interpreted, bona fide, (i) examining the intention of the parties, i.e. the circumstances in which the treaty was concluded, the object and purpose of the treaty; (ii) following the ordinary meaning to be attributed to the terms of the treaty itself, or, literally, analyzing the text.
The purpose and object of the treaty have been described in the preceding paragraphs. The literary analysis of the adopted text allows to discover the obligatory language present in the treaty, identifying the terms that could lead to greater legal obligations. The use of the modal shall, for example, creates a greater constraint for the states than should, since the former implies specific behaviors that must be undertaken to achieve a certain result.
In the Paris Agreement, the term shall is used more frequently particularly in relation to the concept of mitigation, transparency, adaptation and finance. Simplifying, as mentioned before, the agreement provides that the parties must adopt internal mitigation measures in order to achieve the objectives indicated by the voluntary contributions determined at national level. Each party must communicate national contributions every five years. Furthermore, the Agreement establishes that all countries must undertake ambitious efforts in order to achieve the objectives defined in Article 2 of the Agreement and that these efforts must progress over time, with the recognition of the need to support developing countries in the actual implementation of the agreement. This means that the parties are obliged to establish, communicate and update the nationally

determined contributions they intend to reach and undertake efforts through national mitigation measures to comply with this obligation; measures that will have to progress according to the highest degree of ambition, in the light of their common but differentiated responsibilities and their respective national capacities and circumstances.

The Paris agreement, therefore, welcomes the minimum objective of containing the global average temperature increase well below 2 ° C compared to pre-industrial levels and continuing efforts to limit the temperature increase to 1,5 ° C. The 2°C target is necessary to avoid the devastating effects of climate change, but - according to most of the scientific community - it will not be enough to save the most vulnerable countries in the world, including those of the small Pacific islands. And this is why a more ambitious target was included in the agreement.
Many analysts have expressed their doubts about its effectiveness and its strength to reverse the trend. While limiting the emission level within those limits that would allow to contain the global warming of 2 ° C above the pre-industrial levels, yet there would be no stabilization of the climate, as the Convention would like, and, in any case, there would be disastrous effects. Unfortunately, it should be emphasized that the greenhouse gas reduction promises that the 187 countries declared before Paris with their INDC will fall well below the 2 ° C target. In fact, assuming they are met, global warming would occur between 2.7 and 3.5 ° C. At the moment there has already been a heating of 1.0 ° C. To reach the 1.5 ° C target, many exponents of the scientific community believe that we should reduce the concentration of greenhouse gases in the atmosphere and pass from the current 400 parts per million of CO2 to no more than 350 parts per million of CO2. At the moment, apart from the natural carbon sinks (oceans and terrestrial plant ecosystems), there are no mature carbon sequestration and storage technologies capable of removing greenhouse gases from the atmosphere.
Some studies estimate that to realize the goal of keeping the heating below 2 ° C it is necessary that the global level of greenhouse gases reaches a peak of 54 billion tons of CO2eq by 2030 and declines up to 21 billion tons of CO2eq by 2050. This means that by 2050 a completely de-carbonized energy sector must mature. To

begin with, every coal plant will have to be closed within five years. By 2050 at least three quarters of the energy will have to be produced from zero-emission sources. The remainder must be covered by fossil and biomass sources, but associated with carbon capture and storage (CCS) techniques.

The Paris Agreement, as a whole, sends a strong message to companies, investors and citizens: the era of the dependence of economies on fossil energy sources is behind us, while for the future the energy that fuels economic growth can be only renewable and clean.

Since 2014, consumption and carbon emissions related to energy production have fallen for the first time in decades. On a global scale, we are experiencing a solar and wind energy boom. In recent years, the pace of growth of renewable energy in developing and recently industrialized countries has been higher than in industrialized countries, mainly due to the sharp drop in the cost of solar and wind energy. The prices of solar modules, for example, have fallen by 70 percent in the last ten years. In general, dependence on renewable energy is becoming an economically attractive proposition for companies, from every point of view. Furthermore, the agreement stimulates investments for trillions of dollars on adaptation to the effects of climate change.

The inclusion in the agreement of both developed and developing countries, including those that base their economies on gas, coal and oil production, demonstrates a unity of intent never seen before.

We can believe, as Minister Galletti said on the occasion of a lectio magistralis at the Master of Geo-Politics at the Sapienza University of Rome, "the Paris agreement is not the best agreement, but certainly the best possible agreement", an agreement that succeeded in the attempt to compose and reconcile the conflicting demands and expectations of the developed countries, of the developing countries, of the oil-producing countries, of the most vulnerable countries, and of the countries that defend the environmental integrity of the UN process on climate.

The Paris agreement can be considered a good starting point. The INDCs could encourage greater cooperation between the parties, considering that the states

commit themselves every five years to illustrate the efforts made and that they are subjected to periodic international control.
The practical reactions of the states and their commitment to implement the provisions of the agreement will therefore be fundamental to understand if the Paris agreement will have mandatory legal effects.
The credibility of an agreement is in fact given by the accuracy of the obligations and their consistency. In fact, as stated by the jurist Rosalyn Higgins "legal consequences can also flow from acts which are not, in the formal sense, binding. Not binding rules may have legal consequences because they shape states' s expectations as to what constitutes compliant behavior ". In essence, the less binding elements contained in a treaty can have legal effects if they are translated into adequate and consistent behavior by the states. Respect for the agreement therefore derives from the way in which the states communicate the determined contributions and take measures at national level to implement them. The international meetings in which these contributions will be communicated and reviewed - starting with the first meeting of the Ad-hoc Working Group on Paris Agreement (APA) and the 44th session of the subsidiary bodies of the UNFCCC, meeting at the end of May 2016 - could represent political moments in which pressure will be put on the states, urging them to a greater commitment.
This flexible strategy could be a good basis for building mutual trust and, based on this trust, strengthening the effort of each individual state to live up to its commitments. Since there is no specific mechanism for enforcing the agreement, what will happen once the minimum quorum of countries necessary to make it come into effect is reached, will be more important than the agreement itself.
Respect for the agreements is therefore in the hands of every single State and the way in which it will implement the Agreement at national level.
Civil society will play a very important role, also by exerting pressure on states so that they do not fail in their obligations, and make climate change and sustainable development an essential and recurring part of the political agenda.

4.3.4 The voluntary carbon market & the Paris Agreement

Many political entities like the EU, the UK or the state of California already have mandatory carbon markets covering specific industry sectors and gases. These form an important part of the effort to meet the Paris Agreement target of limiting global heating to 2 degrees Celsius above pre-industrial levels (with a more ambitious ideal of remaining within a 1.5 C increase), even though some of these markets predate the Paris commitments.
But other sectors have taken a cue from compliance schemes and pledged to offset their greenhouse gas emissions (GHG) by participating in carbon markets voluntarily.
Voluntary carbon markets allow carbon emitters to offset their unavoidable emissions by purchasing carbon credits emitted by projects targeted at removing or reducing GHG from the atmosphere[57].

"In November 2018, the COP24 held in Katowice, Poland, developed and adopted rules and guidelines (Paris Agreement Rulebook) for the implementation of the Paris Agreement, but the Rulebook lacks a fundamental part, that concerning the Article 6, which was postponed to COP25 (December 2019) due to the opposition of a small group of countries. Consequently, 2019 becomes a fundamental year for the future of the markets - voluntary and non-carbon[58]. The voluntary market has developed within the framework of the Kyoto Protocol, which means that there have been many opportunities to generate credits and avoid problems such as double counting. This picture changes significantly based on the Paris agreement when the 192 signatory countries begin to implement their own Nationally Determined Contributions (NDC). In particular, Article 6 of the Paris Agreement

[57] Favasuli , S. V Sebastian (2021). Voluntary carbon markets: how they work, how they're priced and who's involved, S&P global. https://www.spglobal.com/platts/en/market-insights/blogs/energy-transition/061021-voluntary-carbon-markets-pricing-participants-trading-corsia-credits

[58] https://www.ieta.org/About-IETA

established mechanisms to facilitate clearing between countries with emission targets, avoiding double counting. In a sense, the Paris agreement goes beyond the Kyoto Protocol and overturns its strategy. No longer binding targets imposed only on industrialized countries, objectives immediately deemed insufficient and for the vast majority of cases disregarded, but a strategy based on the participation of all states, on the basis of a common responsibility but which takes into account all the peculiarities. A mechanism is established on a voluntary basis, to contribute to the mitigation of greenhouse gas emissions and promote sustainable development, subject to the authority and direction of the Conference of the Parties (Article 6). The global character of the fight against climate change is finally sanctioned, taking into account the needs of developing countries, especially those that are most vulnerable to the negative effects of climate change. A climate finance is indeed promoted, as the richer countries are called to financially support the poorer countries in mitigation and adaptation actions.

When a company buys certified carbon credits, the credit is "tracked" (in jargon "canceled") on specific registers, managed by a third party, which ensure that a credit can be used for a single compensation activity and avoiding that the same carbon credit is sold several times. The main risk of "doubling" emission reductions from positively impacting projects in developing countries that generate carbon credits, has historically revolved around the risk that the same credit would be sold more than once. Through voluntary certification standards such as Verra (Verified Carbon Standard) or Gold Standard and public records such as APX and Markit, this risk has been significantly reduced by ensuring that the recorded and withdrawn credits have not been purchased before.

From 2018 there is also SustainCERT, the certification body for "Gold Standard for the Global Goals", a new generation standard to quantify, certify and maximize the impact on climate security and sustainable development for all.

As mentioned above, the Paris Agreement radically changes the frame of reference of the voluntary carbon market. Looking to the future, a question arises: what is the role of the voluntary market in a scenario in which each country has its own NDC and its own objective? Is there still room for voluntary actions? To have

concrete possibilities to contain global warming within the threshold levels, the voluntary market will have to play a fundamental role in the next 10-20 years. The IPCC report, mentioned above, insists on the urgency of the change to be undertaken; however, the sum of the commitments put on the table by the global community (the NDCs) puts the world on a trajectory that brings it closer to 3 degrees above pre-industrial levels, more than the 2 suggested as a maximum limit or even 1, 5 presented by the report itself. This gap of a degree, or a degree and a half, must therefore be filled in some way. The Paris agreement provides a mechanism to induce countries to develop more ambitious goals every 5 years but, given the gravity and urgency of the climate challenge, this may not be enough. Here, then, is the key role that the voluntary market can play in this process: it can make itself available to individuals and companies, to go beyond the objectives adopted by governments; it can be the tool to do more and do it faster; it can be the expedient by which companies can contribute to reducing the gap.

The mechanism of carbon credits was introduced for the first time with the approval of the Kyoto Protocol as a real financial mechanism capable of compensating for the effects of those emissions that would not have been otherwise reduced and that made adoption possible of ad hoc climate change mitigation strategies.
A Carbon credit is a real financial unit that represents the removal of a ton of CO2 equivalent from the atmosphere. It represents the emission of greenhouse gases (GHG) that has been avoided, reduced or seized through a project and that can be purchased as a means to offset emissions. A certified carbon credit, that is generated by a project developed according to specific requirements, is indicated with one of the following abbreviations:
VER (Verified Emission Reduction) A carbon credit, issued by an external verification system (typically Gold Standard), for use in the voluntary carbon market.

CER (Certified Emission Reduction) A carbon credit, issued by an external verification system (typically the Clean Development Mechanism (CDM) of the UNFCCC), for use in the regulated carbon market.
VCU (Verified Carbon Unit) A carbon credit, issued by an external verification system (typically VERRA-Verified Carbon Standard), for use in the voluntary carbon market.
A CER, a VER and a VCU represent the removal of a ton of CO2 equivalent from the atmosphere.
Carbon credits are a real economic incentive able to guarantee concrete and long-term benefits for companies, and are certainly part of a broader corporate strategy to reduce their emissions. A tangible economic benefit made possible by the sale of credits and an important reputational benefit as a company able to respect the Climate Agreements (Kyoto Protocol and Paris Agreement) and contribute concretely to the achievement of the Sustainable Development Goals.

5. Carbon credit markets

This chapter introduces an analysis of the two existing International carbon markets: the compliance market and the voluntary market.

Both the markets concern CO2e credits and they both can play a key role in reducing global greenhouse gas emissions cost-effectively.

5.1 Compliance markets

5.1.1 Kyoto compliance market

The Kyoto Protocol was ratified by 153 countries and entered into force on 16 February 2005. Under this agreement, 39 countries have committed themselves to limiting and / or reducing their greenhouse gas emissions. The commitment concerns in particular the period from 2008 to 2012, the year in which the objectives must be achieved. The Protocol assigns a certain amount of greenhouse gas emission rights to industrialized countries (an "emission ceiling"). This cap is defined as a percentage of each country emissions in 1990. Different countries have different goals. The European Union has set as its goal a reduction in greenhouse gas emissions by 8% compared to 1990 in the 2008-2012 period. Italy, which contributes to the European total, has established a 6.5% reduction in greenhouse gas emissions for the 2008-2012 period compared to 1990.
The Kyoto Protocol aims to reduce greenhouse gas emissions in each country thanks to appropriate measures and policies (such as the production of electricity from renewable sources, the issuing of thermal insulation standards for homes, the promotion of public transport, etc.). Compliance with the Kyoto commitments also makes use of the so-called flexibility mechanisms, which allow countries to meet the reduction targets in the most cost-effective way. The three mechanisms are:

Joint Implementation (JI): the joint implementation, which allows a country to invest in emission reduction projects in another industrialized country, benefiting from additional emission allowances
Clean Development Mechanism (CDM): the mechanism for clean development that allows investing in projects to reduce emissions in developing countries, obtaining additional emission credits
Emissions Trading (ET): the emission rights trading system that allows these credits to be traded to fulfill the reduction obligations. The element of the sale was introduced in this system to minimize the cost of reducing carbon dioxide emissions.
Kyoto units
The countries of Annex 1 can use the following Kyoto units to meet their reduction obligations, each corresponding to 1 ton of CO2 equivalent: AAUs, RMUs, ERUs, CERs, lCERS, tCERs.

AAUs (Assigned Amount Units): these are tradable units that derive from the quantities assigned to the countries of Annex 1, and which must be used by these countries to fulfill the reduction obligations.
RMUs (Removal Units): they are marketable units released on the basis of the absorption of greenhouse gases from the atmosphere through LULUCF activities according to Articles 3.3 and 3.4 of the Kyoto protocol, and can be used to fulfill the reduction obligations.
ERUs (Emission Reduction Units): they are marketable units generated following the implementation of JI projects in the countries of Annex 1, and can be used to fulfill the reduction targets.
CERs (Certified Emission Reductions): they are marketable units generated following the implementation of CDM projects in countries not included in Annex 1, and can be used to fulfill the reduction obligations.
lCERs (long term CER): CERs are issued for a project activity of afforestation or reforestation within a CDM project which, subject to the decisions adopted under the UNFCCC or the Kyoto protocol, expire at the end of the accounting period following the one in which they were issued.
tCERS (temporary Cer): CERs are issued for a project activity of afforestation or reforestation within a CDM project which, subject to the decisions adopted under the UNFCCC or the Kyoto protocol, expire at the end of the commitment period following the one in which they were issued.

5.1.2 The European Community ETS

The European Community did not wait for the official entry into force of the Protocol (16 February 2005) and has previously established, starting from 1 January 2005, a system that regulates the exchange of quotas in a similar way to the International Emissions Trading. of emissions among companies located in member countries. The European Emissions Trading System or EU ETS (European Emissions Trading Scheme) sets limits for carbon dioxide emissions to more than 11,000 plants across Europe, but allows the rights to emit carbon dioxide (which are called

carbon dioxide emissions allowances, EUA) can be marketed. The EU ETS system has two phases: The first phase begins on 1 January 2005 and ends on 31 December 2007.
To this end, Europe has adopted Directive 87/2003, which is part of the European Climate Change Program. The directive, which came into force on 25 October 2003, creates a quota market at Community level based on the idea that emissions are reduced where it is most convenient. During the first Kyoto period (2008-2012), the EU ETS will enter its second phase and will be integrated into the international Emissions Trading provided for by the Protocol: the EUAs (European quotas) will be converted into AAUs (Kyoto quotas). Article 25 of Directive 87/2003 / EC also provides for the connection to other emission trading schemes compatible with that of Kyoto.
The Directive 101/2004/CE (known as the Linking Directive) regulates the use of the credits deriving from the projects that are developed within the other two flexible mechanisms (CDM and JI), within the EU ETS, for the fulfillment of reduction obligations. In particular, the Linking Directive allows the use of CERs starting from 2005 and ERUs starting from 2008. the use of CERs and ERUs will be similar to that of quotas (EAUs). In the second phase of the EU ETS each Member State will have to set a limit on the use of CERs and ERUs in their National Allocation Plan. The use of project credits (CDM and JI) in order to fulfill the reduction obligations is allowed both in the pre-Kyoto period and in the first Kyoto period, but with rather complex rules compared to the possibilities of use.
The industrial sectors regulated by the ET directive
In the first three-year period (2005-2007), the ET scheme will cover carbon dioxide emissions from large combustion plants with a combustion heat output higher than 20 MW, with the exception of those for hazardous and urban waste. The scheme also includes oil refineries, coking plants, plants for the production and transformation of ferrous metals, the mineral products industry (cement, lime, glass, glass fibers, ceramic products) beyond a given capacity, and installations for the manufacture of pulp for paper, paper and cardboard.
How the ET directive works

In order to emit greenhouse gases into the atmosphere, the plants that are part of the ET scheme need an authorization issued by the National Competent Authority (ANC). The monitoring and reporting of emissions are obligations related to the authorization received, as is the obligation to return annually a quantity of quotas corresponding exactly to the CO2 emissions of the plant, calculated for the previous calendar year.
If an operator owns less than the declared emissions, he will have to buy shares on the market. If, on the contrary, the operator has a quantity of shares higher than the declared emissions, he can sell shares or keep them for the following years.
If the operator does not return the exact amount of allowances, it will irrevocably have to face the payment of specific penalties for each ton of CO2 not covered by the return of the quotas.
The advantages of the system
To have a sufficient number of allowances, Operators can choose between these two possibilities:

- not to issue to a greater extent than the quantity of allowances allocated to them (for example by investing in energy saving systems);
- buying shares in the market.

Emissions will be reduced in those companies where the reduction can be obtained at a lower cost. Companies that reduce their emissions will have a surplus of allowances that they can sell to those companies that cannot reduce emissions except at a high cost, for which it is cheaper to buy shares. Overall, the result is the same, but the total cost is lower, since the quota trade will balance the costs between the individual operators.
The European ET and the Kyoto Protocol
Starting from 2008, when the ET will be implemented globally according to the Kyoto protocol, the trading of quotas can take place not only between companies but also between countries.
The principle is the same: for some countries, the costs of reducing greenhouse gas emissions will be higher than elsewhere; these countries will therefore have the possibility of obtaining additional emission allowances, investing in projects aimed

at reducing emissions in other countries or simply buying shares on the international market. By contrast, a country that achieves a significant reduction in its greenhouse gas emissions through effective policies and measures can sell the surplus of shares to other countries that have exceeded the volume of emissions authorized by the Kyoto Protocol.
Also in this case, the emission quota exchange system allows efforts to be distributed in an economically efficient way: reduction targets are respected, but overall costs are lower.

The National Allocation Plan (NAP)

According to the ET directive, each EU Member State establishes the total amount of emission allowances it intends to use during the three-year period starting on 1 January 2005, and the consequent assignment of these quotas to the Operators of the various plants. This decision is published at least three months before the beginning of the three-year period and is based on the National Allocation Plan (NAP) of the quotas. As part of this decision, each Member State also takes into account the emission allowances that must be set aside as a reserve for new entrants.
The purpose of the ET Directive is that the emissions of the industrial sectors concerned remain within the limits of the total amount of emissions defined in the NAP.
The NAP is drawn up periodically: the first period is the three-year period 2005-2007; subsequently it will be drawn up every five years (2008-2012; 2013-2017; ...) for the periods of fulfillment of the Kyoto Protocol. By the 28th of February of each year, the competent Authority issues to the Operators of the different plants the portion of emission quotas assigned to them for that year, according to the NAP.

The Quota market, registers and trading platforms

From a legal point of view, the quota trading system does not establish how and when the exchange takes place. Companies bound by the directive can trade the allowances directly among themselves or use a broker, a bank or other

intermediaries. Markets can also be developed for this purpose. The price of the allowances is established on the basis of demand and supply as in any free market and, being a pan-European market, is influenced by many factors. The ET scheme, in fact, is based on political decisions, which can in turn significantly influence the price of the allowances. The development of emissions, for example, depends on general economic development in Europe, climatic conditions and the price of fuels.

First and necessary condition for the implementation of the European ET system (EU ETS), is the creation and management of an electronic system of Registers. This system is not linked to commercial operations. The Registers are electronic databases: each Member State establishes its own National Registry where the quotas are kept. The system consists of the national registers of the 25 Member States of the European Community interconnected with one another through a central register at European level (CITL)[59]. The CITL performs automatic checks on each transfer of allowances , to ensure compliance with the rules of the ET Directive. A list of national operational registers can be found on the European CITL website. A Register is similar to an online banking system, which leaves track of the ownership of money in the accounts but not of the agreements made in the market for goods and services, which are at the origin of the money transfer. The Registry is therefore not a market, but the allowances are exchanged on the basisof the decisions taken by the participants in the market.

The ANC opens an account in the National Register for each installation that refers to the ET Directive; subsequently it pays on each account the quotas established according to the NAP. The allowances can be transferred among the different accounts, within the same Register or among different Registers. The Register serves to monitor the issue, possession, transfer, return and cancellation of the allowances. The supervision of the ANC is above all concentrated on the compliance of the Operators with the conditions of their authorization, on the verification of their emissions, and on the restitution of the due allowances. In addition to the plants subject to reduction obligations, any person or other

[59] https://ec.europa.eu/clima/policies/ets/registry_en

organization interested in buying or selling allowances on the market, can open an account in the Register.
Emissions trading platforms are private initiatives that help users search and negotiate allowances sales transactions. Currently the platforms are not linked to the national registers, but in the near future there will be this possibility. The transactions, however, can be confirmed only through the Registry, which examines and guarantees that the transactions take place only according to the respective emission rights. Since the allowances are in fact a commodity, the transactions are subject to the general rules of transfer of goods. When an agreement is reached between the seller and the buyer about the goods and the price, and approval is obtained from the Registry, the transaction is recorded in the accounts of the interested parties in the form of credit and debt: in other words, any agreement between seller and buyer is conditioned by the approval of the Registry, and only after the transaction has been completed in the Register the emission quotas can be considered transferred and the buyer becomes the owner. The value of the quotas / allowances is estimated by the market value at the time of purchase. Current estimates indicate a price that fluctuates around 25 euros per ton of CO2.
Because of their market value, emission allowances must be included in industrial accounting as production costs. The quotas assigned free of charge represent opportunity costs in proportion to their market value, since it is possible to sell them if the company reduced its emissions. As a result, in the future profits will have to cover not only the costs of raw materials, actual production costs, and overheads, but also the value of the emission allowances the company needs.

5.1.3 Paris Agreement

In the Paris Agreement, countries agree to “achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases

(GHGs) in the second half of the century."[60] This is emphasized in the Intergovernmental Panel on Climate Change (IPCC) special report: "From a mitigation perspective, 1.5°C-consistent pathways require immediate action on a greater and global scale so as to achieve net zero emissions by midcentury, or earlier." It is first after reaching and sustaining net-zero GHG emissions, defined by the 100-year global warming potential, it will be possible to see a decline in surface temperature.

There are different ways to define net zero. The Paris Agreement refers to the notion of global net- zero carbon dioxide (CO2) emissions, which, according to IPCC, is "a requirement for stabilizing CO2-induced global surface temperature increase, with anthropogenic CO2e emissions balanced by anthropogenic removals of carbon dioxide."[61]

This is different from achieving net-zero GHG emissions, where metric-weighted anthropogenic GHG emissions equal metric-weighted anthropogenic removals. The second definition is typically used by governments and the private sector and can be defined as "achievement of a state in which an entity removes from the atmosphere as much GHGs as it causes."[62] Subnational and corporate actors typically plan to use natural sinks, such as reforesting land or adopting agricultural best practices, or technical solutions such as carbon capture and storage.

Carbon neutrality technically means net-zero emissions of only CO2, while climate neutrality includes all GHGs. Definitions of net zero, zero emissions, carbon and climate neutrality are often used interchangeably and there is no globally agreed definition. Typically, net-zero targets do not include the use of compensation or offsets, which carbon and climate neutrality can do. The target year for reaching net zero as well as the metrics and gases included to determine

[60] United Nations Framework Convention on Climate Change. 2015. The Paris Agreement.

[61] IPCC. 2021. The Sixth Assessment Report. https://www.ipcc.ch/assessment-report/ar6/

[62] New Climate Institute and Data-Driven Enviro-Lab. 2020. Navigating the Nuances of Net Zero Targets. https://newclimate.org/wp-content/uploads/2020/10/NewClimate_NetZeroReport_October2020.pdf

how net zero can be reached varies, and the pathways for reaching net zero may differ.

What is the relation between a carbon-pricing instrument and a net-zero target? First, starting with emissions trading systems (ETS), a net-zero target is a cap which means that there needs to be a gradual reduction of the cap of the ETS to zero. Such a zero-emissions cap could include the use of domestic or international offsets. The issue for carbon pricing is the level of price that will be required—if a carbon tax is to result in net zero, or what the price will be for regulated entities when approaching net zero. Identifying the highest marginal abatement costs in regulated sectors is one way of estimating what the maximum level of allowance prices could be.

One study looks at the United Kingdom and suggests that marginal abatement costs for the electricity sector reaches approximately $145 and for energy-intensive industrial sectors up to $195. The same study highlights that the marginal abatement cost in the European Union could reach €350 for reaching net zero by 2050. The study concludes that compared to current carbon prices in existing ETS, the prices would need to increase 10 times or more in the next 30 years to reach net-zero emissions[63].

5.2 Compliance market carbon pricing

Carbon pricing is an integral element of the broader climate policy architecture that countries can use to internalize the cost of emitting greenhouse gases (GHGs) and, thereby, enable transitioning to low-carbon economies[64]. The most widely

[63] S. F. Verde et al. 2020. Achieving Zero Emissions Under a Cap-And-Trade System. Florence School of Regulation Climate Policy Brief. No. 26. Florence: Robert Schuman Centre for Advanced Studies– European University Institute.

[64] Edenhofer, O., M.Kosch, M. Pahle and G. Zachmann (2021) 'A whole-economy carbon price for Europe and how to get there', Policy Contribution 06/2021, Bruegel , https://www.bruegel.org/wp-content/uploads/2021/03/PC-06-2021-090321.pdf

used carbon-pricing instruments (linked to carbon equivalent unit, in kg or tonnes[65]) include carbon taxes, emissions trading systems (ETS–domestic cap and trade), and international offset mechanisms. A predictable and clear carbon-pricing policy signal, regardless of the policy instrument used to achieve it, can help re-orient capital flows toward environmentally and socially sustainable investments, support innovation, and accelerate the deployment of advanced low-carbon technologies[66].

The major difference between carbon taxes and emissions trading is that in an ETS, the price of the permits varies—determined by supply and demand for those permits—but the maximum quantity of emissions is fixed, by the cap. With a tax, the opposite is true: the price is fixed, but the quantity of emissions is not. Under an ETS, a firm has options that it does not have if taxed: it may buy permits on the market if it anticipates being short at the end of the compliance period; or it may sell permits and gain revenue if it anticipates that it will have surplus permits. The choice between instruments depends on a jurisdiction's goals, needs, and preferences—and that designing the system well can be more important than the choice between systems[67].

[65] A carbon dioxide equivalent or CO2 equivalent, abbreviated as CO2-e is a commonly used metric measure used to compare the emissionsof various greenhouse gases on the basis of their global-warming potential by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential. See more at Eurostat. n.d. Glossary: Carbon dioxide equivalent. Eurostats Statistics Explained. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Carbon_dioxide_equivalent#:~:text=A%20carbon%20dioxide%20equivalent%20or,with%20the%20same%20global%20warming (accessed 15 september 2021).

[66] J.V.D. Bergh and W. Botzen. 2020. Low-carbon transition is improbable without carbon pricing. Proceedings of the National Academy of Sciences. 117(38). pp. 23219–23220.

[67] R.N. Stavins. 2019. Carbon Taxes vs. Cap and Trade: Theory and Practice. Harvard Project on Climate Agreements. https://www.belfercenter.org/ publication/carbon-taxes-vs-cap-and-trade-theory-and-practice.

Carbon pricing can stimulate action to achieve short-term climate mitigation targets (such as those expressed in nationally determined contributions (NDCs) and plays a key role in road maps for achieving longer-term targets toward net-zero emissions.
Carbon pricing can play a major role in mobilizing both and, thereby, create fiscal space for investment. Carbon pricing is a key element of the broader climate policy architecture to help countries reduce their emissions cost-effectively while mobilizing fiscal resources to drive green recovery and growth. It is therefore no surprise to see growing momentum in the use of carbon-pricing instruments[68].

The need to design carbon-pricing instruments could not be timelier as advanced economies globally are seeking to raise ambition within their carbon-pricing jurisdictions, particularly in the form of addressing carbon leakage. In fact, risks of carbon leakage can be addressed through policy design choices. While the State of California
is already using a form of Carbon Border Adjustment Mechanism (CBAM), where an adjustment is applied to certain imports of electricity, Canada, Japan, and the United States are also considering similar initiatives. The EU, which is a forerunner in using carbon- pricing instruments to achieve emission reductions, has recently

[68] J.E. Aldy and R.N. Stavins. 2012. The promise and problems of pricing carbon: Theory and experience. The Journal of Environment & Development. 21(2). pp. 152–180.

A. Baranzini et al. 2016. Seven reasons to use carbon pricing in climate policy. Centre for Climate Change Economics and Policy Working Paper. No. 253. United Kingdom: London School of Economics and Political Science. https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2016/02/Working-Paper-224-Baranzini-et-al.pdf.

R. Best, P.J. Burke, and F. Jotzo. 2020. Carbon Pricing Efficacy: Cross-Country Evidence. Environmental and Resource Economics. 77(1). pp. 69–94.

proposed a CBAM to prevent carbon leakage externally, which will provide an incentive for producers in non-EU countries to green their production processes[69].

The use of carbon pricing has steadily increased globally over the past decade. In 2009, 16 carbon-pricing initiatives had been implemented covering about 5% of global GHG emissions. By 2019, 57 initiatives had been implemented covering about 20% of global GHG emissions, with an estimated $45 billion in revenues raised[70]. As of July 2021, there were 64 carbon-pricing instruments in operation that cover approximately 22% of global GHG emissions, compared to 15% in 2010[71].

The European Union (EU) has adopted the European Green Deal which sets out a clear path toward realizing the
EU's ambitious target of a 55% reduction in carbon emissions (compared to 1990 levels) by 2030, and to become
a climate-neutral continent by 2050. To achieve this target, the EU Commission has proposed a Carbon Border Adjustment Mechanism (CBAM) to prevent the risk

[69] European Commission. 2021. Carbon Border Adjustment Mechanism: Questions and Answers. https://ec.europa.eu/commission/presscorner/ detail/en/qanda_21_3661

[70] World Bank. 2020. State and Trends of Carbon Pricing 2020. https://openknowledge.worldbank.org/handle/10986/33809. For more information, the World Bank annual report covers both emissions-trading and tax systems. The following annual reports, while valuable, cover only emissions trading: International Carbon Action Partnership. 2020. Emissions Trading Worldwide: Status Report 2020. https://icapcarbonaction.com/en/ icap-status-report-2020; and International Emissions Trading Association. 2020. 2050 Vision: 2020 Greenhouse Gas Market Report. https://www.ieta.org/GHG-Market-Report#Twenty_Twenty.

[71] World Bank. 2021. State and Trends of Carbon Pricing 2021.https://openknowledge.worldbank.org/handle/10986/35620

of carbon leakage. The CBAM will require European importers to treat the imported goods as if they were produced in the EU and buy carbon certificates corresponding under EU's carbon-pricing rules. If the non-EU producer has already paid a price for the carbon used in the production of the imported goods in another jurisdiction, the corresponding cost can be fully deducted for the EU importer. In doing so, the CBAM will help reduce carbon leakage and incentivize producers from non-EU countries to "green" their operations, setting a good stage for countries adversely impacted by the CBAM to set up a competitive price on carbon themselves.
According to the proposal, the CBAM is being phased in gradually to provided businesses and other countries with legal certainty and stability. In addition, the CBAM will initially apply only to a select few goods where there is a high risk of carbon leakage, which include iron and steel, cement, fertilizer, aluminum, and electricity generation.
Subsequently, a reporting system will apply from 2023 for the abovementioned products, with the overall objective to facilitate a smooth rollout as well as dialogue with the affected countries. It is expected that importers will start paying a financial adjustment in 2026. Lastly, despite some calls for the revenues from the CBAM to go toward affected countries to adjust to this transition, revenues are proposed to contribute to the EU's budget, as laid out in the December 2020 Interinstitutional Agreement on budget and own resources[72].

The Intergovernmental Panel on Climate Change has estimated that to reach peak temperatures below 1.5°C in the 21st century with 50%–66% probability, price ranges have to be between $135–$6,050/tCO2e in 2030 and even more later on[73].

[72] https://ec.europa.eu/commission/presscorner/detail/en/qanda_21_3661

[73] H. de Coninck et al. Forthcoming. Strengthening and Implementing the Global Response. In V. Masson Delmotte, et al, eds. Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C. above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.

A World Bank annual report provides an up-to-date overview of existing and emerging carbon pricing instruments around the world, including international, national and subnational initiatives[74].

Aiming to limit global temperature increases to 1.5°C, as called for in the Paris Agreement, requires decarbonisation by about mid-century[75]. Against this background, Effective Carbon Rates 2021 employs three carbon price benchmarks:
1. EUR 30 per tonne of CO2, a historic low-end price benchmark of carbon costs in the early and mid-2010s.7 A carbon price of EUR 30 in 2025 is also consistent with a slow decarbonisation scenario by 2060 according to Kaufman et al (2020)[76].
2. EUR 60 per tonne of CO2, a low-end 2030 and mid-range 2020 benchmark according to the High-Level Commission on Carbon Pricing[77] A carbon price of

[74]" World Bank. 2021. State and Trends of Carbon Pricing 2021. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/35620 License: CC BY 3.0 IGO." https://openknowledge.worldbank.org/handle/10986/35620

[75] Rogelj, J. et al. (2018). Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development. In V. Masson-Delmotte et al. (Eds.), Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C. IPCC

Rogelj, J. et al. (2015). Energy system transformations for limiting end-of-century warming to below 1.5 °C. Nature Climate Change, 5, 519-527.

[76] Kaufman, N. et al. (2020). A near-term to net zero alternative to the social cost of carbon for setting carbon prices. Nature Climate Change. 10, 1010–1014. https://www.nature.com/articles/s41558-020-0880-3

[77] High-Level Commission on Carbon Prices. (2017). Report of the High-Level Commission on Carbon Prices. World Bank, Washington, D.C. https://www.carbonpricingleadership.org/report-of-the-highlevel-commission-on-carbon-prices

Carbon Pricing Leadership Coalition. 2019. Report of the High-Level Commission on Carbon Pricing and Competitiveness. World Bank, Washington, DC. © World Bank.

EUR 60 in 2030 is also consistent with a slow decarbonisation scenario by 2060 according to Kaufman et al (2020).
3. EUR 120 per tonne of CO2, a central estimate of the carbon price needed in 2030 to decarbonise by mid-century under the assumption that carbon pricing plays a major role in the overall decarbonisation effort (low complementary policies[78]). EUR 120 is also more in line with recent estimates of overall social carbon costs.

6. Voluntary Offset Programs

Voluntary carbon offset programs started to develop after 2005, as the CDM became more established and the corporate social responsibility community began to recognize that there was a demand for these instruments beyond just regulated companies and countries to the Kyoto Protocol. There is now a variety of carbon offset programs primarily (or exclusively) serving the voluntary market comprised primarily of corporations wishing to make GHG emission reduction claims.
In some cases, voluntary carbon offset programs have influenced and interacted with compliance markets. In California, for example, the Climate Action Reserve (CAR) developed a series of voluntary offset project protocols that were subsequently adopted (with some modification) in the California Compliance Carbon Offset Program. Offset credits issued under these protocols by CAR prior to the start of California's cap-and-trade program were able to transition over and become eligible for compliance. Countries like Mexico and South Africa have also

[78] in Kaufman et al., 2020, cit.

recognized offset credits issued by voluntary programs as a means of complying with carbon tax obligations.

Compliance offset market credits may in some instances be purchased by voluntary, non-regulated entities, but voluntary offset market credits, unless explicitly accepted into the compliance regime, are not allowed to fulfill compliance market demand.

Because demand for compliance offset credits is driven by regulatory obligations, their prices tend to be higher than offset credits issued solely for the voluntary market.

6.1 Voluntary Offset Initiatives

A series of initiatives have been put in place in order to integrate agricultural production, feasible from an economic point of view, and soil protection and regeneration. They are cited as follows:
CAPRESE-SOIL, CArbon PREservation and SEquestration in agricultural soils[79].
LIFE HELPSOIL - (LIFE12 ENV / IT / 000578)

Improve soils and adaptation to climate change through sustainable Conservative Agriculture techniques

The LIFE HELPSOIL project aims to test and demonstrate Conservation Agriculture techniques combined with innovative practices of agricultural land management with the aim of:

[79] https://op.europa.eu/en/publication-detail/-/publication/cd486e15-27c7-11e6-914b-01aa75ed71a1/language-en/format-PDF

• enhance the ecological functions of soils (carbon sequestration, fertility increase and biodiversity, erosion protection);
• promote the efficiency of irrigation water use;
• increase the efficiency of fertilization, in particular in the use of livestock effluents;
• contain the use of plant protection products for the control of pests and plant diseases.

LIFE HELPSOIL promotes the dissemination of techniques and solutions to improve the sustainability and competitiveness of agricultural activity and at the same time - in order to adapt the territorial systems to the impacts of climate change - protect and ensure the sustainable use of soil, preserving its functions, preventing possible threats and mitigating the impacts of agricultural activity on the environment.

The project actions concern the Po Valley and the neighboring hilly areas of the Apennine and Alpine margins and are applied in 20 demonstrative farms.

At the end of the project, guidelines will be defined for the application and dissemination of Conservative Agriculture in order to be implemented in the context of Regional Rural Development Programs, identifying management practices considered as Best Available Techniques for the entire Padano-Veneto basin (best available techniques) for sustainable agriculture and capable of producing wider ecosystem services.

Regione Lombardia is the project leader.
The other partners are: Piedmont Region, Veneto Region, Emilia Romagna Region, Friuli Venezia Giulia Autonomous Region, Regional Agency for Agriculture and Forestry Services (ERSAF), Animal Production Research Center (CRPA), Veneto Agriculture. Cofinanced by Kuhn- Italia srl, and approved on 4th July 2013 by the European Commission.

6.1.1 The initiative 4×1000.org and soil organic matter

The "4 per 1000" initiative aims to increase the soil organic matter content and carbon sequestration, through the implementation of agricultural practices adapted to local environmental, social and economic conditions, as proposed in particular by the agro-ecology, agroforestry, conservation agriculture or landscape management.
Developed in France, this project aims at creating a network of private and public stakeholders to support sustainable agricultural practices.[80]
Since its launch, more than 250 organizations have already endorsed the initiative by signing the Paris Declaration, which sets its goals[81.]

6.1.2 American Carbon Registry

American Carbon registry is based on Winrock International organization founded by Winthrop Rockefeller. Winrock International is a nonprofit organization that works with people in the United States and around the world to empower the disadvantaged, increase economic opportunity, and sustain natural resources. Bearing the Rockefeller imprimatur, Winrock's non-profit American Carbon Registry (ACR) is a leading carbon offset program recognized for its strong standards for environmental integrity and its quest to innovate. Winrock believes that climate change will have a profound impact on the poorest populations and the most fragile ecosystems around the world and that markets are the most effective path to mobilize actions to reduce emissions.
Founded in 1996 as the first private voluntary offset program in the world, ACR has eighteen years of unparalleled experience in the development of rigorous, science-based carbon offset standards and methodologies as well as operational

[80] www.4p1000.org

[81] https://www.4p1000.org/4-1000-initiative-few-words

experience in carbon offset project registration, verification oversight and offset issuance.
ACR is also an approved Offset Project Registry (OPR) and Early Action Offset Program for the California Cap-and-Trade program, the first economy-wide Cap-and-Trade program in the U.S. In this role, ACR works with the Air Resources Board (ARB) to oversee the registration and issuance of California-eligible Registry Offset Credits developed using ARB's compliance or early action offset protocols. In fulfillment of Winrock's mission, ACR enhances confidence in carbon markets and catalyzes transformational emissions reduction opportunities. ACR is a pioneer in harnessing the power of markets to improve the environment and has set the bar for offset quality that is the market standard today".[82]

6.1.3 Climate, Community & Biodiversity Standards

The Climate, Community & Biodiversity (CCB) Standards identify projects that simultaneously address climate change, support local communities and smallholders, and conserve biodiversity. Use of the CCB Standards must be certified through a two-step process by independent, validation/verification bodies (VVB). The process is described in the CCB Program Rules v3.1, and can be summarized as follows:

- Validation demonstrates that a project is designed to generate significant climate, community and biodiversity benefits. Successful validation to the CCB Standards can help project proponents to build support among stakeholders and investors.
- Verification is a rigorous endorsement of the quality of project implementation and the delivery of multiple benefits during a certain time period. Successful verification of a project to the CCB Standards enables the

[82] https://americancarbonregistry.org/

addition of a CCB label to verified emissions reductions units, such as VCUs, generated during the CCB-verified period.

A VVB is a recognized, qualified and independent auditing organization that evaluates whether a project has met each of the CCB Standards criteria and any other requirements following the process defined in the CCB Program documents. To be approved, VVBs must meet the criteria set out in the CCB Program Rules v3.1. More than twenty VVBs in Asia, Europe, North and South America are currently approved.[83]

6.1.4 Green-e Climate Program

Endorsed Programs

Endorsed Programs are independent, third-party greenhouse gas (GHG) Project Certification Programs that ensure that GHG reduction projects are additional and result in real, verified, enforceable, and permanent reductions.

The specific principles and criteria that Endorsed Programs must meet are outlined in the Green-e® Climate Standard, available at Green-e Climate Documents. Sellers who seek Green-e® Climate certification for the sales of GHG emission reductions (carbon offsets) must source reductions from projects that are registered with one of the Endorsed Programs.

Project Type Categories

The following Project Type Categories should be used as reference for eligibility restrictions within Endorsed Programs where project protocols of the Programs do not de facto designate project types. Program participants may be more specific than, but must be at least as specific as these categories (left-hand column in the

[83] https://verra.org/project/ccb-program/

table below) when specifying project type on the Carbon Offset Content Label for a Fixed or Customized Mix of offsets.

Project Type	Description
Renewable Energy	• Renewable electricity generation • Fuel switch to or use of renewable energy sources for heating/cooling, hot water, and/or other processes • Production of biofuels
Energy Efficiency	• Energy efficiency improvements (reductions in use or consumption of electricity or fuel) for residential, commercial, or industrial components and/or systems that do not result from new uses of renewable energy • Improvements to efficiency of energy [generation,] distribution and transmission • Combined heat and power (CHP, cogeneration) or trigeneration • Reductions in consumption through recovery and/or recycling of waste, and/or self-generation • Recovery and reutilization of GHGs other than CH_4
Fuel Switching	• Fuel switch to a lower carbon, non-renewable fuel
Landfill Methane Capture	• CH_4 avoidance, destruction, capture, and/or reutilization at landfills
Livestock Methane Capture	• CH_4 avoidance, destruction, capture, and/or reutilization at livestock facilities (dairies and beef cattle facilities)

Project Type	Description
Coal Mine Methane Capture	• CH_4 avoidance, destruction, capture, and/or reutilization at coal mines
Agriculture, Forestry and Other Land Use (AFOLU)	Forestry • Afforestation, reforestation, and/or revegitation • Improved forest management • Reduced emissions from deforestation and degradation (REDD), avoided conversion Agriculture • Reduction of methane emissions from rice cultivation • Reduction of direct GHG emissions associated with cropping practices • Adjustment of tillage, rotation, and/or other soil and crop management practices to increase sequestration Land Use • Land restoration
Industrial Process Emissions	• Reduction of direct emissions of CO_2 or CH_4 associated with industrial activities • Electrification
Transportation	• Mass transit projects • Modal shift • Low-GHG vehicle fleets • Energy efficiency improvements in transportation
Industrial Gas Destruction	• Destruction, avoidance, or reduction of HFC, PFC, SF_6, N_2O gases from industrial processes

6.1.5 Endorsed Programs under Green-e® Climate

Currently, there are four Endorsed Programs under Green-e® Climate. The Endorsed Programs and any specific restrictions are the following:

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1. The Gold Standard

The Gold Standard Foundation offers a quality label to CDM/JI and voluntary offset projects. Renewable energy and energy efficiency projects with sustainable development benefits are eligible. The Gold Standard is endorsed by over 50 non-governmental organizations worldwide. The Gold Standard is a non-profit foundation under Swiss Law and funded by public and private donors.

All Gold Standard VERs are eligible with the following exceptions:

- Projects registered under methodologies that do not meet the additionality criteria in Section 5.1.c(g) of the Green-e® Climate Standard are not eligible. Substantiation from Seller is required that additionality requirements under the Green-e® Climate Standard have been met.
- Outside of the United States and Canada, hydropower projects must be under 10 MW in capacity in order to be eligible. For a "grouped" project, consisting of more than one instance of the project activity at multiple locations within a defined geographic boundary, which is certified as a group or program of activities, the total capacity of the grouped project may exceed 10 MW capacity; however, no single instance of the project within the group shall exceed the 10 MW capacity limit.
- In the United States or Canada, only GHG emissions reductions from new hydropower generation capacity on a non-impoundment or new generation capacity on an existing impoundment that meets one or more of the following conditions is eligible:
  - The hydropower facility is certified by the Low Impact Hydropower Institute (LIHI);

- For Canadian hydropower facilities only, the facility is EcoLogoM certified; or
- The hydropower facility consists of a turbine in a pipeline or a turbine in an irrigation canal.

For facilities falling under a. or b. above, only output generated during the period of LIHI certification or EcoLogo certification is eligible for Green-e® Climate Certified sale. In the United States and Canada, the Green-e® Governance Board will consider on a case-by-case basis GHG emissions reductions resulting from new incremental capacity on an existing dam, where the "new" output is equal to or less than 5 MW. The Program will not certify offsets sourcing GHG emissions reductions from new impoundments of water.

With the exceptions listed above, the following CDM Gold Standard project types are eligible:

- Energy Efficiency
- Renewable Energy

2. The Verified Carbon Standard (VCS)

The VCS provides a robust global standard for voluntary GHG emissions reduction and removal projects and their validation and verification. It ensures that carbon offsets that businesses and consumers buy can be trusted and have real environmental benefits. The VCS program is managed by the VCS Association which is an independent, non-profit organization registered under Swiss law. The founding partners of the VCS are The Climate Group, the International Emissions Trading Association (IETA) and the World Business Council for Sustainable Development.

All Verified Carbon Units (VCUs) are eligible as long as they are certified according to VCS 2007 or VCS version 3.0, with the following exceptions:

- Agriculture, Forestry and Other Land Uses (AFOLU) projects are eligible as long as the Seller provides proof that the native species requirements under the Green-e® Climate Standard are met.
- Projects validated under VCS 2007 that have qualified as additional using the VCS "Test 2 Performance Test" are not eligible, unless the performance standard used explicitly lists the eligible technologies.
- Projects certified according to previous versions of the VCS that are grandfathered in under VCS 2007 are not eligible under Green-e® Climate.
- The period of time for which GHG reductions/removals are verified (verification period) shall not exceed three years for non-sequestration projects, and shall not exceed seven years for sequestration projects.
- Outside of the United States and Canada, hydropower projects must be under 10 MW in capacity in order to be eligible. For a "grouped" project, consisting of more than one instance of the project activity at multiple locations within a defined geographic boundary, which is certified as a group or program of activities, the total capacity of the grouped project may exceed 10 MW capacity; however, no single instance of the project within the group shall exceed the 10 MW capacity limit.
- In the United States or Canada, only GHG emissions reductions from new hydropower generation capacity on a non-impoundment or new generation capacity on an existing impoundment that meets one or more of the following conditions is eligible:
  - The hydropower facility is certified by the Low Impact Hydropower Institute (LIHI);
  - For Canadian hydropower facilities only, the facility is EcoLogoM certified; or
  - The hydropower facility consists of a turbine in a pipeline or a turbine in an irrigation canal.

For facilities falling under a. or b. above, only output generated during the period of LIHI certification or EcoLogo certification is eligible for Green-e® Climate Certified sale. In the United States and Canada, the Green-e® Governance Board will

consider on a case-by-case basis GHG emissions reductions resulting from new incremental capacity on an existing dam, where the "new" output is equal to or less than 5 MW. The Program will not certify offsets sourcing GHG emissions reductions from new impoundments of water.

With the exceptions listed above, the following VCS project types are eligible:

- Agriculture, Forestry and other Land Uses (AFOLU)
- Energy Efficiency
- Livestock/Landfill/Coal Mine Methane Capture
- Renewable Energy
- SF6 Destruction

3. The Climate Action Reserve

The Climate Action Reserve is a national offsets program working to ensure integrity, transparency and financial value in the U.S. carbon market. It does this by establishing regulatory-quality standards for the development, quantification and verification of greenhouse gas emissions reduction projects in North America; issuing carbon offset credits known as Climate Reserve Tonnes (CRTs) generated from such projects; and tracking the transaction of credits over time in a transparent, publicly accessible system.

The following Climate Action Reserve project types are eligible:

- Coal Mine Methane
- Forest (v3.0 or newer)
- Mexico Forest
- Mexico Landfill
- Mexico Livestock
- Nitric Acid Production
- Nitrogen Management (v1.1 or newer)
- Organic Waste Composting (v1.1 or newer)

- Organic Waste Digestion
- Ozone Depleting Substances
- Rice Cultivation (v1.1 or newer)
- U.S. Landfill
- U.S. Livestock
- Urban Forest

4. American Carbon Registry

The American Carbon Registry (ACR), a nonprofit enterprise of Winrock International, is a leading carbon offset program recognized for its high standards for environmental integrity and transparency. Established in 1996 as the first voluntary GHG registry in the world, ACR has over 15 years of unparalleled voluntary carbon market experience in the development of rigorous, science-based offset methodologies and operational experience in the oversight of offset project verification, registration, offset issuance and retirement reporting.

Effective June 3, 2013, American Carbon Registry Emission Reduction Tons (ERTs) are eligible with the following exceptions:

- Eligibility is limited to projects approved and credits certified in accordance with standards and methodologies approved by ACR after v2.0 of the ACR Standard in 2010.
- Projects that have been operational for five years without becoming validated or producing verified emissions reductions according to ACR's or another Endorsed Program's requirements are not eligible.
- Outside of the United States and Canada, hydropower projects must be under 10 MW in capacity in order to be eligible. For a "grouped" project, consisting of more than one instance of the project activity at multiple locations within a defined geographic boundary, which is certified as a group or program of activities, the total capacity of the grouped project may exceed 10 MW capacity; however, no single instance of the project within the group shall exceed the 10 MW capacity limit.

- Eligibility of projects registered under the Afforestation and Reforestation of Degraded Lands methodology is limited to those registered under version 1.1 of the methodology or later.
- Eligibility of projects registered under the Conversation of High-bleed Pneumatic Controllers in Oil and Natural Gas Systems methodology is limited to those registered under version 1.1 of the methodology or later.

With the exceptions listed above, the following ACR project types are eligible:

- Agriculture, Forestry and Other Land Use (AFOLU)
- Energy Efficiency
- Industrial Process Emissions
- Renewable Energy
- Transportation

6.1.6 Clean Development Mechanism (CDM)

The CDM was an eligible Endorsed Program within Green-e® Climate between January 2008 and January 2014. However, due to a current lack of interest by carbon offset providers offering Green-e® Climate certified offsets, the Green-e® Governance Board has directed staff to defer endorsement of the CDM until sufficient commercial interest in the CDM warrants use of staff time to evaluate and monitor the CDM Program for compliance with the Green-e® Climate Standard. Accordingly, effective February 5, 2015, Green-e® Climate's endorsement of the CDM is suspended due to lack of use by program participants. The CDM must be reevaluated against the Green-e® Climate Standard in order for endorsement to be reinstated.[84]

6.1.7 Panda Standard

[84] https://www.green-e.org/programs/climate/endorsed-programs

Created in China[85], the nation on 2011 saw its first transaction of voluntary carbon credits piloted under the domestic Panda Standard. The credits – purchased from a bamboo reforestation project by a large Chinese real estate firm – signal Chinese companies 'willingness to pay for home grown carbon reductions[86].

6.1.8 Reduced emissions from Deforestation and Degradation, REDD +

Reduced emissions from Deforestation and Degradation (REDD+) are a set of international policies designed to compensate land owners for reductions in forest-based carbon emission. Unfortunately, in REDD projects, local communities usually play a marginal role however, there are many opportunities for such project to promote principles of social justice and local planning and control.
Forest credits are ineligible under the largest compliant trading scheme, the EU ETS. While forest credits are permitted by the Kyoto protocol, they have remained marginal. The failure of compliance market to account for forest emissions, has led to more than 90% of forest carbon projects pursuing certification under voluntary markets. 21% of global voluntary markets concerns A/R, REDD and avoided conversion projects and the private sector is responsible of almost the 70% of market activities. Voluntary markets allow to develop, test and implement new approaches to carbon accreditation and the best example is REDD+ which allows rapid payments to local people.
In 2011, REDD+ projects accounted for the 29% of credits transacted in the voluntary carbon market. Such schemes require the development of methodologies and approaches suited to each ecosystem. Sophisticated

[85] https://www.co2offsetresearch.org/policy/PandaStandard.html

[86] https://www.ecosystemmarketplace.com/articles/china-transacts-first-panda-standard-vers/

approaches to address the issue of non-permanence of forest ecosystems have been developed, including buffers and insurance products.
All carbon accreditation projects must have 3 characteristics:

1. Additionality
2. Permanence
3. Leakage

Leakage for instance, represent a key challenge for the establishment of REDD+ projects. A/R projects provide carbon benefits without displacing local communities, due to the fact that they are generally established on degraded land, while reduced deforestation prevent land-use change. An efficient mitigation strategy would be combined REDD+ and A/R practices to prevent the displacement of emissions. Key for addressing leakage is improving the governance and local ownership of a project. To address the uncertainty of leakage a possible action would be to allocate credits into a buffer or reserve account (acting as insurance for unforeseen losses of carbon stocks).
Natural resources rights and access underpin the livelihoods of the rural poor in developing countries therefore, the transformation of these rights through REDD+ and wider PES schemes are critical issues in shaping not only biodiversity but also environmental justice and poverty/well-being. Due to their location (collectively or state-owned land), local participation in mangroves PES schemes result to be complex. Methods to deal with this complexity could be privatization of land or benefits or mechanisms for collective sharing of benefits under the continuation of communal arrangements. Foster equitable, fair and sustainable programs for resources management. For instance, as we all know high transaction costs constitute the biggest hurdle to carbon program implementation. In this context to reduce those costs, it is recommendable to include the creation of appropriate community groups who can act as managers or intermediaries in the processes of implementation and supervision of projects. Communal resource management is key to develop PES projects and needs to be clearly established at the very beginning of the project. Matching needs and aspirations of local communities while responding to international markets is the key challenge of PES projects. Issues of governance, environmental justice and policy results to be very important

since in most countries governance at both national and local level is very weak and unstable.

New Zealand was the first country to build a carbon market integrating voluntary market schemes[87]. The New Zealand Emissions Trading Scheme (NZ ETS) is a partial-coverage all-free allocation uncapped highly internationally linked emissions trading scheme. On 6 December 2007, the New Zealand Emission Unit Register (NZEUR) was established. The NZEUR has the role of issuing, holding, transferring and retiring emission units in terms of the Kyoto Protocol. The NZ ETS was first legislated in the Climate Change Response (Emissions Trading) Amendment Act 2008 in September 2008 and then amended in November 2009 and in November 2012 by the Fifth National Government of New Zealand[88].

Australia has developed in 2012 a carbon market relates to the production and buying and selling of Australian Carbon Credit Units (ACCUs). Carbon credits are **purchased by the government, through the Emissions Reduction Fund**, or by **individuals and organisations wishing to voluntarily offset their emissions**.

Carbon credits can be produced by diverse range of carbon offset projects – from those rebuilding and protecting natural landscapes, biodiversity and agriculture. The Emissions Reduction Fund (ERF), formerly the Carbon Farming Initiaitve (CFI), is a government-run offsets program which allows landholders to implement carbon storage or emissions abatement activities to generate and sell carbon

[87] https://www.mpi.govt.nz/dmsdocument/5140/direct

[88] https://ieta.org/resources/Resources/CarbonMarketBusinessBrief/2021/CarbonMarketBusinessBrief_NewZealand2021.pdf

credits. These carbon credits ACCUs which represent one tonne of stored carbon dioxide equivalent (tCO2-e) or avoided emissions through approved management activities and methodologies.These units (or credits) are generated primarily from land restoration projects that re-establish native vegetation in the landscape and in turn remove carbon dioxide from the atmosphere[89].

Eligible activities that **landholders and farmers** can undertake to produce carbon credits include:

– changes to livestock management;

– protecting native vegetation at risk of clearing;

– regeneration or reforestation of native vegetation;

– improving soil carbon.

The carbon market relates to the production and buying and selling of Australian carbon credit (ACCU). Given the first compliance year (2012-2013) has a fixed price of $23 per carbon unit, the Carbon Market Institute (CMI) estimates the total value of the Australian carbon market at approximately $6.58 billion.

[89] http://www.cleanenergyregulator.gov.au/Infohub/Markets/Pages/About-Carbon-Markets.aspx

https://www.qld.gov.au/environment/climate/climate-change/land-restoration-fund/about/australian-market

California's cap and trade program, the US first economy-wide carbon market, was launched in 2013[90].

With the implementation of its cap-and-trade program, California stands as an international leader in the effort to reduce greenhouse gas (GHG) emissions. An important component is the Compliance Offset Program, which allows entities covered by the cap to satisfy a portion (up to 8%) of their regulatory obligations by buying and surrendering carbon credits generated by GHG reduction projects applying an Air Resources Board (ARB) Compliance Offset Protocol. These credits can provide businesses subject to California's emissions cap a cost-effective way to meet their carbon reduction obligations while also driving investment towards activities that reduce GHG emissions.

[90] The program sets a declining cap on greenhouse gas emissions that polluters — including oil refineries, power plants and manufacturers — can meet by buying and trading carbon credits or updating their facilities.The Cap-and-Trade Regulation establishes a declining limit on major sources of GHG emissions throughout California, and it creates a powerful economic incentive for significant investment in cleaner, more efficient technologies. The Program applies to emissions that cover approximately 80 percent of the State's GHG emissions. CARB creates allowances equal to the total amount of permissible emissions (i.e., the "cap"). One allowance equals one metric ton of carbon dioxide equivalent emissions (using the 100-year global warming potential). Each year, fewer allowances are created and the annual cap declines. An increasing annual auction reserve (or floor) price for allowances and the reduction in annual allowances creates a steady and sustained carbon price signal to prompt action to reduce GHG emissions. All covered entities in the Cap-and-Trade Program are still subject to existing air quality permit limits for criteria and toxic air pollutants. Sources: https://ww2.arb.ca.gov/our-work/programs/cap-and-trade-program; https://ww2.arb.ca.gov/our-work/programs/compliance-offset-program

Price is presented at: https://calcarbondash.org

Program Overview:
https://ww2.arb.ca.gov/sites/default/files/classic/cc/capandtrade/guidance/cap_trade_overview.pdf

The Cap-and-Trade Program is a key element of California's strategy to reduce greenhouse gas (GHG) emissions. It complements other measures to ensure that California cost-effectively meets its goals for GHG emissions reductions.

The federal government of **Canada** released draft regulations on march 2021 that will create a domestic market for trading carbon credits.

The state of **Quebec**[91] and **Ontario**[92] had a local carbon market. On 2017 was signed an Agreement on the **Harmonisation and Integration of Cap-and-Trade Programs for Reducing Greenhouse Gas Emissions** between **The Gouvernement du Québec, The Government of California and The Government of Ontario**[93]

Quebec program in 2020 price carbon credit 20.68 canadian dollars[94].

Singapore launched the Climate Impact X initiative on 2021 This is a carbon trading marketplace backed by its state investment firm, stock exchange and largest bank.

[91] https://www.environnement.gouv.qc.ca/changementsclimatiques/marche-carbone_en.asp

[92] https://www.ontario.ca/page/cap-and-trade

[93] https://news.ontario.ca/en/backgrounder/46294/agreement-on-the-harmonization-and-integration-of-cap-and-trade-programs-for-reducing-greenhouse-gas-emissions

[94] https://www.cbc.ca/news/canada/montreal/quebec-carbon-cap-and-trade-tax-1.5036044

The Climate Impact X initiative has two main platforms: a marketplace for nature-based projects, and an exchange where carbon credits can be freely traded in larger quantities[95].

6.2 Other related initiatives

6.3.1 Sustainable land management (SLM) and carbon sinks

In the context of the Geco2 project, it is fundamental to analyze agricultural, forest and soil management. Sustainable land management (SLM) describes "the stewardship and use of land resources, including soils, water, animals and plants, to meet changing human needs while simultaneously assuring the long term productive potential of these resources and the maintenance of their environmental functions" (IPCC Report), and includes ecological, technological and governance aspects. The choice of SLM strategy is a function of regional context and land use types, with high agreement on (a combination of) choices such as agroecology (including agroforestry), conservation agriculture and forestry practices, crop and forest species diversity, appropriate crop and forest rotations, organic farming, integrated pest management, the preservation and protection of pollination services, rain water harvesting, range and pasture management, and precision agriculture systems. Conservation agriculture and forestry uses management practises with minimal soil disturbance such as no tillage or minimum tillage, permanent soil cover with mulch combined with rotations to ensure a permanent soil surface, or rapid regeneration of forest following harvest. Vegetation and soils in forests and woodland ecosystems play a crucial role in regulating critical ecosystem processes, therefore reduced deforestation together with sustainable forest management are integral to SLM (IPCC Report and FAO

[95] https://news.mongabay.com/2021/06/singapore-launches-new-carbon-marketplace-for-nature-conservancy-projects/

2015b). In some circumstances, increased demand for forest products can also lead to increased management of carbon storage in forests; while precision agriculture is characterized by a “management system that is information and technology based, is site specific and uses one or more of the following sources of data: soils, crops, nutrients, pests, moisture, or yield, for optimum profitability, sustainability, and protection of the environment". The management of protected areas that reduce deforestation also plays an important role in climate change mitigation and adaptation while delivering numerous ecosystem services and sustainable development benefits, as it happens with peatlands, also known to provide numerous ecosystem services, as well as socio-economic and mitigation and adaptation benefits. Biochar is an organic compound used as soil amendment and is believed to be potentially an important global resource for mitigation. Enhancing the carbon content of soil and/or use of biochar have become increasingly important as a climate change mitigation option with possibly large co-benefits for other ecosystem services. Enhancing soil carbon storage and the addition of biochar can be practiced with limited competition for land, provided no productivity/yield loss and abundant unused biomass. Evidence is still limited and impacts of large scale application of biochar on the full GHG balance of soils, or human health are yet to be explored (IPCC Report).

6.3.2 Food losses and waste (FLW)

Approximately one third of losses and waste in the food system occurs between crop production and food consumption, increasing substantially if losses in livestock production and overeating are included. This includes on farm losses, farm to retailer losses, as well as retailer and consumer losses. Post-harvest food loss on farm and from farm to retailer is a widespread problem, especially in developing countries.

Losses of food cannot be realistically reduced to zero; nevertheless, advancing harvesting technologies, storage capacity and efficient transportation could all contribute to reducing these losses with co-benefits for food availability, the land

area needed for food production and related GHG emissions, in line with the goals of the Geco2 project. Increased climate variability enhances fluctuations in world food supply and price variability. “Food price shocks” need to be understood regarding their transmission across sectors and borders and impacts on poor and food insecure populations, including urban poor subject to food deserts and inadequate food accessibility. Trade can play an important stabilising role in food supply, especially for regions with agro-ecological limits to production, including water scarce regions, as well as regions that experience short term production variability due to climate, conflicts or economic shocks. Food trade can either increase or reduce the overall environmental impacts of agriculture, as embedded in trade are virtual transfers of water, land area, productivity, ecosystem services, biodiversity, or nutrients. Climate mitigation policies could create new trade opportunities (e.g., biomass), or alter existing trade patterns. The transportation GHG-footprints of supply chains may be causing a differentiation between short and long supply chains, that may be influenced by both economics and policy measures. In the absence of sustainable practices and when the ecological footprint is not valued through the market system, trade can also exacerbate resource exploitation and environmental leakages, thus weakening trade mitigation contributions. Ensuring stable food supply while pursuing climate mitigation and adaptation will benefit from evolving trade rules and policies that allow internalisation of the cost of carbon (and costs of other vital resources such as water, nutrients). Likewise, future climate change mitigation policies would gain from measures designed to internalise the environmental costs of resources and the benefits of ecosystem services.

6.3.3 Dietary change and Demand management

Demand-side solutions to climate mitigation are an essential complement to supply-side, technology and productivity driven solutions. The environmental impacts of the animal-rich “western diets” are being examined critically; for example, if the average diet of each country were consumed globally, the

agricultural land area needed to supply these diets would vary 14-fold, due to country differences in ruminant protein and calorific intake. Given the important role enteric fermentation plays in methane (CH4) emissions, a number of studies have examined the implications of lower animal diets. Reduction of animal protein intake has been estimated to reduce global green water (from precipitation) use by 11% and blue water (from rivers, lakes, groundwater) use by 6% (IPCC Report). By avoiding meat from producers with above-median GHG emissions and halving animal-product intake, consumption change could free-up 21 million km2 of agricultural land and reduce GHG emissions by nearly 5 Gt CO2-eq yr-1 or up to 10.4 Gt CO2-eq yr-1 when vegetation carbon uptake is considered on the previously agricultural land (IPCC Report). Diets can be location and community specific, are rooted in culture and traditions while responding to changing lifestyles driven for instance by urbanization and changing income. Changing dietary and consumption habits would require a combination of non-price (government procurement, regulations, education and awareness raising) and price incentives to induce consumer behavioral change with potential synergies between climate, health and equity (addressing growing global nutrition imbalances that emerge as undernutrition, malnutrition, and obesity). As to the mentioned FWL, food loss from supply chains tends to be more prevalent in less developed countries where inadequate technologies, limited infrastructure, and imperfect markets combine to raise the share of the food production lost before use. There are several causes behind food waste including economics (cheap food), food policies (subsidies) as well as individual behavior (Schanes et al. 2018). Household level food waste arises from overeating and overbuying. Solutions to FWL thus need to address technical and economic aspects. Such solutions would benefit from more accurate data on the loss-source, -magnitude and -causes along the food supply chain. In the long run, internalising the cost of food waste into the product price would more likely induce a shift in consumer behaviour towards less waste and more nutritious, or alternative, food intake. Reducing FWL would bring a range of benefits for health, reducing pressures on land, water and nutrients, lowering emissions and safeguarding food security. Reducing food waste by 50% would 40 generate net

emissions reductions in the range of 20 to 30% of total food-sourced GHGs (IPCC Report).

6.3 Local Voluntary Markets - Guidelines and operatingmethods

6.3.4 Ethics and guiding principles of the market

In recent years the role of forests, among the actions of mitigation of climate change, has acquired credibility mainly thanks to the efforts of the scientific community in the definition of a protocol of credit measurement and monitoring and political consensus on the need to reduce emissions in the shortest and most efficient possible way. However, if many buyers approach the agro-forestry credit market attracted by the "tangibility" that such projects offer, many others move away due to the complexity and the risks that these projects present. In response to the growing importance of mitigation projects in the international market with the aim of compensating for greenhouse gas emissions, the challenges that each project aims at are two: develop mitigation projects that offer durable and reliable carbon credits and therefore contribute to reduce emissions on a local scale; launch a local credit market. In this way it is possible to recognize the role played by forests, but also of other activities such as the urban forestation, climate mitigation and also offer opportunities to forest owners for the climate function carried out by their forests and by public authorities that adopt "green policies". Each project intends to develop quality carbon credits that not only guarantee an effective mitigation of emissions but also increase the investor’s confidence in the sector. Together with the definition of credible and lasting credits, each project introduces the concept of compensation of proximity. This principle responds to the need to take actions whose socio-environmental benefits as well as climatic conditions are perceptible and appreciable by the local community and by the people that invest

in the market. In this way the investor-emitter not only compensates for corporate issues but also contributes to improve the environment where he operates. The inspiring principles of each project can be summarized in the following points: harmonization; rigor and credibility; transparency of methodologies and information; innovation.

Harmonization

The voluntary market on a global scale, and in particular that of carbon credits from agro-forestry mitigation, is very diversified in terms of demand, credit supplyand their type and methodologies used for project development. In particular on the supply side of "Forest offsets", a sound project differ significantly as to the methods used for counting and the certification standards adopted.

Historically the market share of voluntary agroforestry carbon credits is significant and in 2009, in terms of total volumes, it represented 24% of total loans, more than doubled compared to 2008 when the exchange stopped at 11% of the total. The main feature of this market was and is not to be guided or ruled by specific regulations. The growth of certification forestry standards and specific protocols for agro-forestry compensation measures has certainly contributed to greater transparency and harmonization, without however leading to a system of standards and protocols universally recognized.

In particular in recent years, the offer of compensatory credits in the voluntary market has increased, in particular from afforestation and reforestation and from public green. In this context, each effective project has the objective of transparently defining the criteria of eligibility of the credits and the methodologies used to ensure that they are real, permanent, additional and unique.

The methodology proposed can help to unify and harmonize the various existing approaches for the development of credits on the Italian and international voluntary market and constitute a "benchmark" for those wishing to develop and adopt the types of forest credits resulting from the project.

Rigor and credibility

One of the most critical aspects of compensatory credits has often been to demonstrate the credibility of credits products and their effective contribution to long-term mitigation. Aspects like the permanence of credits from forest activities

or urban forestation and their potential reversibility, have contributed and still they contribute to reducing the confidence of investors, who opt for other credits with permanent mitigation guarantees in the long run, such as renewable energy projects or other projects that invest in clean technologies.

To increase and guarantee the credibility and reliability of the credits sold in the market, the following procedures and methodological approaches must be stated: careful selection of eligible credits in the market. Some credits that can be generated by activities such as afforestation and reforestation, although very popular in the voluntary market for their palatability on the part of the investor and issuer, have been excluded because it is difficult to prove their financial additionality, as the intervention would probably still have been supported without the credit incentive.

identification of a methodology that addresses the problem of non-permanence of credits in the case of unforeseen events, through a buffer or credit reserve instrument that guarantees possible losses and minor compensations. The portion of these "set aside" credits guarantees any carbon losses and is not returned at the end of the commitment period.

definition of purchase contracts between buyers and sellers that identify, for both subjects, long-term binding commitments.

Transparency and information

One of the crucial aspects of the global voluntary market is the information transparency. The absence of binding rules and regulations has meant that against credits certified according to the standard of recognized certification, many other credits, including many forest credits are traded on the market without offering guarantees of duration and above all transparency on the counting and monitoring of credits and therefore of real and lasting emission compensation.

Within each project, the criteria for the selection and eligibility of the credits must be identified, as well as the requirements and methodologies to address the crucial aspects of the projects such as the permanence of credits, the baseline, counting and monitoring. Finally, specific protocols are adopted for each type of credit that clearly and transparently defines, among the various aspects, the method of counting the credit, the monitoring over time and how to reduce the risk associated

with the occurrence of disorders and the duration of such credits. These protocols are accessible to anyone and can be consulted by everyone, buyers and sellers, but also market operators who want to deal with the procedures and the approach adopted. The transparency of the information is also guaranteed by an ad hoc site that makes it available to the public the project documents, in such a way as to encourage visitors, operators of the market, buyers and sellers to the comparison with other methodologies and types of credits. The site also represents a window on the forest offset market at the international scale, encouraging actions of mitigation.

Innovation

One of the strongest points of the voluntary market is the ability to experiment with innovative mitigation actions and to test new types of credits, which could then become mainstream and be adopted in the regulated market. The greater flexibility of the voluntary market makes it possible to adopt more flexible methodological approaches, to develop pilot and small-scale projects.

A sound project with a high innovative content, undertakes two highly innovative actions: the creation of a "local" credit exchange platform; the adoption of innovative mitigation measures for which protocols are defined for the count of carbon sequestration. Among these there is the use of wood products that can replace high energy intensity materials, urban forestry and biochar.

6.3.5 6.3.2 Demand and offer for Voluntary carbon credits(stakeholder perspectives and reasons to enter the market)

In general terms, a carbon compensation or carbon offsetting is amechanism according to which, in parallel with the reduction of greenhouse gas emissions at the source, an emitter buys from a third party an amount of carbon credits equivalent to the emissions to be reduced. The fundamental principle of

carbon offsetting is that a certain amount of greenhouse gases produced in one place can be compensated reducing or seizing carbon for the same amount elsewhere. In the voluntary market, compensation is paid on a voluntary basis and not because it is requested by one specific national or sector regulation that sets a "cap" or a roof-top on emissions. In order to generate an effective environmental impact, voluntary compensation must hopefully be accompanied by actions and efforts to reduce emissions at the source, by changes in the individual behavior or in the production process. According to a report by the McKinsey Institute the main opportunities for reducing greenhouse gases during the period from now until 2030 are offered by four categories of actions: energy efficiency, production of energy at low carbon output, agro-forestry measures and behavior change. The long-term objective is to achieve emission neutrality through measures of reduction of energy and waste consumption, measures of energetic efficiency and use of renewable energy, sustainable transport and finally also compensation.

Reasons to enter the market

The voluntary market is led by investors who buy credits for two main reasons: to act exclusively on a voluntary basis to compensate for emissions, and anticipate future rules and regulations which could introduce limits to the emissions. Inevitably without an obligation to reduce, the emphasis of the volunteer projects focuses on ethical, public relations and green marketing aspects. The motivations to invest in a voluntary market can be summarized in six main factors where, depending on the type of business and production activity of the emitter, each of these can take on a crucial and prevalent role in motivation.

- Corporate responsibility / environmental ethics. The adoption of a policy of emissions reduction is part of a general strategy for improving the environmental and social impact. Along with environmental objectives, the company, for ethical reasons, feels motivated to contribute to the reduction of greenhouse gas emissions.
- Image and public relations. The company benefits from the positive image resulting from the commitment to the fight against climate change in the relationships with investors, customers and commercial partners.

- Sale of carbon neutral products. This motivation is particularly relevant for companies and industries whose products have a high carbon footprint such as high intensity energy products but also consumer goods, where the consumer perceives the impact of the product and an emission reduction strategy per product can help to acquire shares of market.
- Anticipation of future regulations (pre-compliance). The provision of future regulations that limit and cap the emissions or where there is provision for a legislation that defines an emissions ceiling, can lead a company to adopt voluntary reductions to position itself in an area of more competitive economic and technological advantage.
- Business model influenced by climate change. Some service sectors such as insurance companies, infrastructure and services in tourist locations for example can be particularly vulnerable to the impacts of climate change. For these reasons these sectors voluntarily adopt actions of emission reduction and compensation.
- Pure investment. Some operators buy voluntary credits from a pure perspective market, in the expectation of selling them at higher prices in a regulated market or if the demand and the price for that type of credit increases.

If these are the general motivations for voluntary compensation actions, the specific interest of the investors in agro-forestry credits compared to other types of credits represents an important element to understand the reasons and opportunities for local emitters to enter the market.

As to the interest in investing in the credit market it has been found that among the main reasons there are the environmental benefits, and the ones on the community followed by the perception of the global forestation scale and its impacts. The recognition that forestry measures, above all avoided 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 guide the investor towards this category of projects. Also the proximity of the compensation project to the investor's productive activity

represents a motivational plus compared to an investment in another distant country or area, where environmental benefits are perceived elsewhere.

Strengths of the market

A sound project presents strengths that can be summarized in the following aspects: the marketed credits are project based. Of the 4 types of activities considered (forest management, wood species, urban forestry and biochar) only for forest management there is the problem of avoiding double accounting at national level, as wood products and biochar are excluded from the art. 3.3 and 3.4 of the Kyoto Protocol. For the activities of afforestation only those concerning the urban environment are included to avoid the risk of double accounting with the amount counted at national level (art. 3.3 KP). The count of the carbon sequestration from the forest management activity, in the calculation formula of the credits, provides that the seizure is generated by an additional activity with respect to the management forest business as usual. In other words, forest owners are expected to adopt strategies of forest management, binding for 30 years, involving an additional carbon sequestration compared to the current scenario or to the current management practices assessed locally or at the regional level. In addition, to avoid the risk of double counting, on the deductions for disturbances in the forest, it is fundamental to plan to introduce a coefficient, related to the disturbance assessed at national level or at the local level, establishing to use the one with greater value.

In the hypothesis that a national carbon credit register is created, the credit counted by each project would not affect the credits generated by the forestry management counted nationally. In fact, the credit is generated by assets of forest management even more virtuous, in terms of carbon sequestration, from those normally in force and currently counted in the national “cap”.

Each project aims to resolve in a credible and rigorous manner the issues of additionality for the four agro-forestry activities, even in the case of activities not considered in the Kyoto Protocol, of permanence (30-year constraint) and of baseline. Beyond that they are the foundations that are laid for a methodology for calculating "innovative" credits, such as wood products and the biochar. An

important aspect about the concept of additional policy is that "additionality" must be considered within the reduction system (forest-company) activated and not only in one of the sectors involved (e.g. forest). In fact, each project plans to create a binomial "Absorber-emitter" which together demonstrates a reduction in overall emissions compared to what the system's carbon balance was before it entered the market. This can happen because the carbon shares are not sold freely (as in other volunteer markets) but only to a group of companies that have previously declared their wish to reduce their carbon dioxide emissions during the project's commitment period. This actual decrease in emissions, associated with the forest owner's obligation to maintain a greater carbon stocks, proves to be additional to those policies the system forest-company carried out before entering the market. The market then generates, at the time of signing the contract by the issuers and a specific forest producer, a "unique" policy of reduction / mitigation of emissions. This unicum realizes, in the time of implementation of the commitments, an effective variation of politics compared to what, separately, forest owners and emitting companies would have been able to do before the market. Each project therefore becomes the promoter of the improvement of the environmental performance of the "forest-company" complex.

Entities involved are promoters of each project, collaborating with the actors of the market in the calculation of credits and emissions and establishing regional observatories that will be responsible not only for the credit register but also for market monitoring during and after the end of the project. This action should guarantee credibility and transparency to the exchange transactions in the market. The market allows to implement and replicate, even in other administrative situations, a credible reference standard. The aim is to improve policies towards carbon local and volunteers markets or climate change mitigation, offering a viable and solid alternative to the voluntary reduction measures in the forest sector, which also proliferate at the international scale and often include afforestation and reforestation actions of dubious additionality with respect to what is stated in art. 3.3 of the PK. Therefore the purchase of credits in the market does not interfere with the commitments undertaken by Governments at international level as, in any case, the availability of the CAP at a regional level is guaranteed.

With particular reference to sustainable forest management, it should be clarified that the receivables subject to buying and selling in the market should be understood, not as real carbon credits, but as an indirect indicator of the additional commitments voluntarily undertaken by the forest owners to demonstrate the voluntary implementation of forest management best practices associated with the related environmental benefits.
It is vital to demonstrate the possibility of monetizing one of the many externalities of the forest not directly related to the sale of timber. In this context, the market operates exclusively for the purpose of correlating one of the externalities of the forest, indeed the voluntary application of management practices better than the reference standards, to the possibility of acquiring a brand that can be spent in the "green marketing" business sector.
The market proposes an example for a possible future implementation of a real voluntary carbon credit market, to be activated if the full operating conditions are met and taking into account the new rules of the regulated market and theresulting national and international agreements.

Pull and Push Factors
Small landowners' willingness to accept certain carbon credit programs, varies according to several factors (evidence from forests in Vermont, USA). The most important factor results to be the revenue generated by the program while the least important factor seems to be the duration of the program itself. Shorter program duration, higher revenue and lower withdrawal penalties positively impact the willingness to accept carbon credit programs. Another important aspect is the fact small landowners seem to prefer carbon credit programs managed by non-profit organization instead of for-profit and government organizations. Through monetary estimates, studies suggest that aggregated carbon offset projects (incorporating small forest landowners) could be piloted successfully by non-profit organizations (in line with the Geco2 project approach). Forest and agricultural ecosystems play a pivotal role in mitigating GHGs emissions by acting as reservoirs that accumulate and store carbon. These reservoirs of carbon storage can be quantified and certified as carbon offsets under the requirements of

protocols and then be integrated within voluntary or compliance carbon offset markets. As an ecample, in the U.S the Californian Air Resource Board (CARB) manages the only compliance protocol that has granted emissions credits for forest carbon offsets. Under the CARB protocol, the offset is generated if carbon is stored above a regional baseline with the potential for additional offset generation with documented net carbon storage over time. Offset projects usually go through three steps: feasibility/baseline analysis --> verification/certification process --> monitoring of carbon stocks. CARB projects are costly and risky (length 100 years and cost between 250 and 500.000$) and if the project doesn't uphold its requirements, the offsets can be invalidated implying the payment of a withdrawal penalty. This process disincentivizes the small forest landowners to enter the program and their low participation removes large quantities of forests from offset markets.

Adverse factors (that hinder participation in the market):

· Management plans

· Long duration (people are willing to accept a 5-year program but even voluntary carbon offset protocols such as the VERIFIED CARBON STANDARD – VCS, have contract lengths of 20-years minimum)

· Withdrawal penalty

· Small property size (an aggregation of small parcels of land into projects of a larger size is necessary to allow widespread participation of small landowners)

As a consequence, it is possible to observe that carbon offset project aggregation is a viable way to engage small landowners in the carbon offset market. These programs could provide revenue to small landowners as well as promoting long-term management of forests and lands to sequester carbon. However, aggregated projects are allowed only if the land parcels aggregated have the same baseline and inventory for the project, have joint verification and do not cross more than two eco sections. Projects aggregation are managed by an aggregator, who is responsible of maintaining contracts with individual landowners (individual contracts agreeing on management strategies and length). Aggregated projects

lowers both upfront (baseline assessment) and transaction costs (certification and verification process).
Carbon offset projects are affected by a risk of reversal and a consequent invalidation of credits; project reversal occurs when the carbon that the project intended to store is released back to the atmosphere and generally, the more landowners are involved, the greater is the risk that one leaves the program. That's the reason why the aggregator sets the withdrawal penalty for each landowner based on perceived risk. This penalty aims at deterring voluntary reversal due to landowners withdrawal (it is possible to envisage a "conservation easement" of the land to ensure commitment to the program for the whole duration of the project). However, landowners compliance for the entire project duration is key for successful carbon offset projects, with particular reference to areas as the one in which the Geco2 project takes place.

6.4 Market mechanisms

The projects of carbon compensation and sequestration are carried out in the project regions. The market operates outside the regulated market and the obligations set forth in the Kyoto Protocol. Participation in the market takes place on a voluntary basis and the issuers that adhere to the market do not assume binding obligations in terms of reducing emissions over time even if it is desirable that the compensation be accompanied by a commitment to containment. The market, therefore, does not function as a "cap and trade" where the emitters are assigned a reduction ceiling of emissions. Adherence to the market, although of a voluntary nature, entails however for buyers and sellers obligations and commitments that mainly concern the duration of the bond, the respect of protocols for the agro-forestry credits and the commitment not to resell the

credits. The exchange of credits takes place in the form of a direct contract between buyers and sellers, where both assume binding obligations.

6.4.1 Market players

The pilot phase of market development foresees the operation of the subjects described below.

Buyers of credits

Market buyers are small and medium-sized businesses, multi-utilities and service companies that are not subject to the reduction obligations set by the Kyoto Protocol, i.e. they are not included in Annex I to Directive 2009/29 / EC which amends Directive 2003/87 / EC, which establishes a system at Community level for the exchange of CO2 emission allowances, called EUA (EU Allowances). In special cases also local public institutions can buy credits. Subjects belonging to all sectors can be buyers but also services such as finance (banks), energy (multi-utility), local transport, etc.

The market calls for a reduction commitment to buyers. The participation in the market leads companies not only to do carbon offsetting, but also and above all carbon insetting, or to undertake a partnership or an investment in a business of reduction of emissions within the sphere of influence and interest of the company itself. The companies involved explore actions that go beyond carbon offsetting and look at opportunities of emissions reduction within the boundaries of their own business.

Credit sellers

The sellers of credits generally speaking are represented by farmers, forest owners, local public bodies, private individuals who adopt forestry ,farming and agriculture measures that contribute to carbon sequestration. Market accession takes place subject to verification of the seller's eligibility requirements and the mitigation actions taken.

External auditors

Technicians with adequate preparation who carry out the audit of the market system and credits.

The project partners

In addition to the market players, the project partners who are in charge of the project also operate, and they play the role of defining the protocols for the implementation of projects, purchase contracts, structure and operation of the market as well as establishing the credit register and the monitoring of projects and transactions in a project and post-project phase.

These activities are ideally located within ad hoc observatories, each of which focuses its activities within a specific region.

6.5 Existing credits exchange methodologies and experiences

6.5.1 Analysis of the best practices (examples of applications and fieldworks): Forest management credits

In the case in which the subjects interested in selling carbon credits are forest owners, the purpose of the market is to allow these subjects to sell the credits generated by the woods' sustainable forest management and receive a payment for the climatic function created by the forests in favor of the community. To this end, the forest owner undertakes to allocate part of the increase available for cutting to the maintenance of the carbon stock, thus saving voluntary and additional wood growth compared to the obligations imposed by the forest legislation, to previous local and regional standards and consistent with regional forest policy lines. Alternatively, the commitment may concern the redevelopment

of low-density coverage forest areas. For a pre-committed joining to the market the drafting of the expression of interest must be completed on each project website, on the page dedicated to the market. Following the expression of interest, an assessment is made of the eligibility of the applicant and his property. If the outcome is positive, the project will be carried out that allows the quantification of potential carbon credits on the affected property. The credits that the forest owner decides to put on sale, once exchanged, are registered in the registers managed by special offices in the regions (Kyoto Observatories), after signing the commitments. Once the storage capacity in terms of credits of the property in question has been defined, it is possible to proceed with 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 places on the market the generated credits;
- in the case of first registration it corresponds to the date of accession to the market;
- the carbon shares sold are assigned a unique identification code. At the time of registration, the owner must sign a specification in which all the commitments are clearly defined, under penalty of exclusion from the market;
- the minimum residence time of the registered credits is 30 years;
- the duration of the stay starts from the date of accession to the market;
- the credits attributable to the market correspond to the annual quota for the number of years that are missing between adherence to the market and end date of the adjustment plan or equivalent instrument.

As a result of the specifications, the following notes are reported:

- for the sellers, the market accession date is the date of the signing of the commitments.
- for the purposes of the market, the seizure carried out internally is meant as "carbon credit" of a forest / urban green property / wood products / biochar

of a ton of CO2 equivalent while "carbon quota" means the market value expressed in € of this carbon credit.

- in the case of an adjustment plan, or an equivalent instrument, the quota available to the sale reviewed will refer to the data of the expired plan and the number of years to be counted to calculate the overall fee will be equal to one, without prejudice to the possibility of increasing the annual instalments up to the natural expiry of the newly approved plan.

At the time of sale a contract is stipulated between the seller and the buyer in which all terms of the operation are defined. The maximum number of saleable annual fees depends on the year of adhesion to the market and it is correspondent to the number of years elapsed from the adhesion until the expiration of the plan, while the commitment of the owner to keep the credits lasts for at least 30 years, more than the duration of the adjustment plan (generally 10 years). However, the owner undertakes in the future to maintain a utilization rate able to guarantee a credits generation in line with the ones that are deduced from the plan. Finally, if the plan is under review, the data will refer to the plan just expired in the absence of new consolidated data. In the case of joining the market, the owner undertakes to maintain a rate of use able to guarantee a credit generation in line with those deduced from the expired plan. The actual sale will concern the credits deductible from the data of the expired plan for a single annuity renewable, without prejudice to the possibility of increasing the annuity until the natural expiry of the new plan, once approved. The planned properties whose planning cycle is not significantly interrupted can generate credits. Therefore a plan expired and not yet under review, for the purpose of selling the credits, cannot generate carbon credits.

Within the sustainable forest management activity two different actions have been identified to which forest owners, either public or private, will be able to join to sell their own carbon credits eventually accrued: saving part of the wood increase, the owner undertakes to allocate part of the increase available for cutting to the maintenance of the carbon stock accumulated in forests; redevelopment of low-density forest areas. This measure concerns exclusively those forest areas already classified forests in the reference year for the Kyoto protocol, that is 1990; otherwise this action could no longer be considered a "redevelopment", but a

reforestation and would therefore be counted as an activity that must necessarily be reported in the national report of the emissions balance of GHG (ARD activity, art. 3.3 of the KP)[96].

Additionality

The actions proposed at forest management level offer additional measures with respect to a scenario of "business as usual", as the owners undertake to give up part of the usable increase as required by the Forest Management Plan[97] or by the practice in use at local or regional level, which represents the baseline or reference scenario, or to improve the conditions of the forest. The credits to be sold in each project are additional to what is counted at national level in the "National reduction plan of greenhouse gases". The aforementioned plan recognizes the role of forest management in CO2 absorption (art.3.4 of the Kyoto Protocol), and therefore its contribution to the achievement of the national targets set by the Kyoto Protocol, provided that this activity is induced by human activity and has begun after 1990. In particular the limits to the use of forest management in the national accounts of the greenhouse gases for each country adhering to the Kyoto Protocol have been established internationally. Calculation and counting of operating credits of the market take into account the calculation of the credits of the amount counted at national level, and saleable credit is calculated on additional activities with respect to forest management as usual. An important aspect about the concept of additional policy is that "additionality" must be seen within the whole reduction system (forest-company) activated by each project and not only in one of the sectors involved (e.g. forest), as already mentioned. In fact the project foresees to create a binomial "absorber-emitter" that, together, demonstrate to reduce overall emissions compared to what the carbon balance of the system was before entering the market. This can happen because the carbon shares are not sold freely

[96] https://climateanalytics.org/media/lulucfguide.pdf

[97] http://www.fao.org/3/w8212e/w8212e07.htm

(as in other voluntary markets) but only to a group of companies that have previously declared to want to reduce their carbon dioxide emissions in the commitment period of the project. This actual decrease in emissions associated with the forest owner's obligation to maintain a greater carbon stock proves to be additional compared with what the forest-company system implemented before entering the market. The market therefore generates, at the time of signing the contract by the issuing shares and by a specific forest producer, a "unicum" of emission reduction / mitigation policy. This unicum realizes, in the time of implementation of the commitments, an effective change in policy with respect to how, separately, forest owners and emitting companies could have done before the market. The project, therefore, promotes the improvement of the environmental performance of the "forest-company" complex.

Permanence

The concept of permanence is crucial in forest compensation projects, since forests can operate both as net/clean absorbers but also as net/clean carbon emitters. In order to maintain the long-term function of the forests as carbon absorber, it is essential to address the risks that can arise during the life cycle of the project which can generate carbon losses. In the case of forest management the risks are represented by disorders such as fires, parasitic attacks and crashes. The approach adopted to guarantee the permanence of carbon credits is based on the principle of the "buffer" also adopted by the international standard of certification of forest credits "Voluntary Carbon Standards" in the guidelines for AFOLU projects[98]. According to this approach, in each project a portion of non-saleable credits is set aside to cover unforeseen carbon losses due to forest disturbances. The amount of credits set aside is calculated on the quantification of the risk of these events on a regional scale, in turn deduced from the statistics of these events over the last 30 years, a return time that corresponds to the duration of the commitment to stay.

[98] https://www.oecd-ilibrary.org/docserver/5km975th0z6h-en.pdf?expires=1566683334&id=id&accname=guest&checksum=2B74619FE7833FE91E458C9120DD2FC1

The buffer is also calculated based on the risks per each forest type. The permanence of the generated credits is guaranteed through the analysis of the historical series of extreme disturbance events in each region.

6.5.2 Rangelands: a case study

Carbon uptake on arid and semi-arid rangelands is usually controlled by abiotic factors. Annual carbon fluxes (from atmosphere to soil) are small and unpredictable, varying primarily with precipitation but also with soils and vegetation. Despite there is scientific consensus that non-equilibrium ecological models (the ones that states that abiotic factors such as weather, soil structure, erosion are the dominant drivers of rangeland productivity) better explain the dynamics of arid rangelands, current carbon policies do not incorporate this understanding of rangelands dynamics. Rangeland livestock producers generally operate with low financial returns and thus, express considerable interest in diversifying income streams to include payments for carbon sequestration. Apart from what stated in the Kyoto treaty, the voluntary markets seem to be the main thrust of initiatives for incentivizing management for carbon sequestration domestically.

As we all know, terrestrial carbon sequestration is mainly focused on forests yet, in terms on long-term carbon storage, rangelands can be superior to forests because carbon is mainly stored in the soil being better protected from atmospheric release than carbon store in vegetation.

Policy principles for carbon sequestration (evidence from rangelands case study):

1. Policies should not require short term accounting (therefore high transaction costs) given the difficulty of measuring and monitoring carbon as well as the presence of low and variable flows of carbon.

2. Policies should not assume that changes in management always work as the primary basis for additional carbon storage. The ecological site is important since abiotic factors often overwhelm management actions.
3. Credits from carbon sequestration based on management should not be considered to offset emissions (the additional carbon is difficult to be measured).
4. Policies should seek to conserve rangelands and encourage restoration through conversion of marginal or degraded agricultural land back to rangelands. Over the long-term most rangelands, even the arid ones, could be significant sinks and additionally, if they used to be croplands, they will show an especially high capacity for sequestration because they are removed as a high soil carbon emission source.

Keeping in mind the importance of ecological science and the principle of ADDITIONALITY we can end up saying that:

Cap and trade programs are not consistent with the above mentioned principles. Carbon cannot be increased on arid rangelands purely through changes in management. To ensure additionality taking into account the presence of abiotic factors, trading schemes could require baseline flux measurement and only pay managers for the exceeded annual carbon sequestered above the baseline; however, carbon resulting from management action would be negligible and flows are inherently low.

Payments for ecosystem services can include payments for carbon sequestration. However, direct payments cannot overcome the problems of achieving additionality through management. PES rely on changes in management to increase carbon sequestration, however it suffers from the same lack of additionality issues as other flux and management-based policies schemes. However PES are more consistent than cap and trade schemes because the carbon sequestered cannot be used to offset increased emissions elsewhere.

Payments for avoided conversion or restoration could yield additional rangeland carbon storage and are consistent with the suggested policy principles. Even if slow, this process allow to accumulate carbon over time. The land conversion (into cropland for example) can lead to a valuable loss of carbon stocks hence, keeping lands as rangelands can at least prevent increases in emissions.

Carbon tax could generate ambiguous effects on rangelands. It might indirectly encourage conversion from cultivation back to rangelands, a move that would vastly increase the sequestration of carbon, both through avoided emissions and the high soil sequestration. However, effects are hard to predict. If the tax causes higher beef prices, then there could be unfavorable land use effect as the higher beef prices entice more people to use grain to feed those cattle or expand grazing area generating bad effects on carbon rich forests. The land use effect should be taken into account when designing a national carbon tax.

Attention to ecological site is fundamental to assess carbon sequestration potential on arid rangelands. Management actions cannot reliably increase carbon uptake, they could do it on more mesic areas but not on arid and semi-arid ones. On the other hand, protection of carbon stocks present is soils or conversion to rangeland from more intensive uses would make a significant contribution to global carbon capture.

6.6 Voluntary carbon credit market Standards

6.6.1 Market risk analysis

The market is a pilot action aimed at activating and encouraging voluntary actions linked to the fight against climate change. The contents and aims of the project fit

into the context of an innovative and experimental action, with two main objectives: the study, definition and application of innovative technical-scientific protocols for four types of carbon credits; the development of a local market to which local proprietors, public bodies and emitters adhere. The sensitivity analysis is aimed at identifying the critical issues and weaknesses related mainly to these two actions. Even if the objectives of the project will be achieved, the success of the market as a pilot and innovative action is linked to a series of external variables on which the impact depends as a tool to reduce the greenhouse gas emissions.

Risks related to the application of technical - scientific protocols

In the Voluntary market the scientific and technical protocols underpinning the definition of carbon credits have been internally defined according to the methodologies developed by researchers and policy makers, that is project partners. However, no consultation procedure has been undertaken with other entities at local, national and international level to discuss the contents of the adopted methodologies. Within the protocol, great attention has been paid to rigorously address two key issues linked to the exchange of carbon credits: the risk of non-permanence of credit and the risk of double count. Both problems have been tackled rigorously and, in particular, about the second one, every aspect that may give rise to some doubts on the superimposability of the credit resulting from the forest management traded locally and on the counting of forest management at national level, as required by Article 3.4 of the Kyoto Protocol. In fact, this measure provides that agroforestry activities at national level and, in particular, forest management will be counted in the national greenhouse gas balance. It is however desirable that in a second phase of the market a debate and / or consultation is held and enlarged to include different stakeholders, public and private entities, with regard to the technical-scientific protocols adopted. This comparison is particularly important in the context of the credit certification standards of carbon. Although the project logo or brand does not yet represent a credit certification standard but a methodological protocol validated only within the market, in the future should be impressed to open a discourse also with the currently internationally accredited standards for the certification of forestry credits, in order to highlight elements of weakness and strength compared to other

certifications. As for the risk of double counting of credit and, in particular, the possibility of a double sale by the credit owners, the management of the credit register set up by the Observers represents a guarantee to prevent this possible fraudulent use. However, in the future such function could be better exercised by a subject external to the Observatory to guarantee the impartiality with reference to those who develop projects and carbon credits, including Observers.

6.6.2 Risks and elements of market weakness

The characteristics of the market, in some ways, can be assimilated to those of the markets in general, as free trade platforms where demand and supply of goods meet. To work correctly some characteristics of the market can be summarized as follows: high transparency and information on traded assets and their characteristics; elasticity of demand and supply and a high number of market participants. Regarding the first requirement, the Voluntary Market represents an "innovative" trading platform as the traded good, the equivalent ton of CO2, does not physically enter the market but it represents an intangible commodity. In the case of some credits, such as those related to forestry management, the trading, in the form of a contract between buyer and seller concerns an asset, the ton of CO2 that will actually be generated in the future, once the transaction is completed, a feature that exposes the exchange to a margin of uncertainty. This type of transaction also involves a "waiting" cost for the buyer, who expresses the value of time in money, or "opportunity cost" to have to wait a long period varying from 10 to 30 years before the actual implementation of CO2 sequestration. At the moment, this waiting time, which can also be expressed in terms of interest rate, is not reflected in the ex-post credit price but it could represent a penalizing element compared to those credits which, at the time of the exchange, have already been gained and for which the buyer must not wait for. Furthermore, in the initial phase limited information on the carbon credit market and, in general, on the subject of the reduction and compensation of emissions could in some way curb the affirmation of the same and the number of subjects that participate in it. Another element of weakness in the initial stages is represented by the low number

of transactions that makes demand and / or supply less flexible. The exchanged credits, expression of a CO2 reduction at local level, are generated by projects negotiated on the basis of individual transactions. These transactions in the first phase of the market are limited as the minimum number is set at 10 transactions per region. Although it is desirable that a large number of buyers and sellers enter the market, at the moment there is uncertainty about the amount of transactions that will actually be completed. A limited number of exchanges would make inelastic demand and supply, and in particular, the price of the exchanged credit more than being the result of real market value, it would be a price agreed between the parties in the contract trade. On the contrary, a high number of transactions, as well as contributing to defining the real value attributed to the exchanged forest credit, it would represent a benchmark of reference, a real basic quotation.

6.6.3 ROLE OF OBSERVERS.

The Regional Observatories or "Kyoto Observatories" are structures having two main tasks:

- representing a reference point for market players;
- managing the market itself in accordance with the system manual and all technical documents prepared at a market creation stage.

Given the involvement of different regions in each project, Observatories are set up and located in the regional administrations involved with a structure equipped with adequate computer supports and appropriately trained personnel who specifically work on the project activities.

Regional observatories' technicians are supported by and actively cooperate with experts and partners of the project. The regional observatories carry out the following activities:

quantitative analysis of CO2 fixation and creation of a census of possible vendors of credits that can be placed in the four sectors of reference (sustainable management, urban green, wood products and biochar); in this context, the system will identify all useful procedures to monitor the objective and subjective access conditions as well as all dynamics affecting the amount of allowances the system can manage and the control of additionality guarantees and credit permanence as well as the implementation of the activities to carry out; quantitative analysis of

CO2 emissions in the start-up phase of the project – it means that the issuing companies create a census recording emissions amount and changes, guarantees of duration and implementation of the activities to be carried out; potentialanalysis of CO2 fixation and SME emissions through calculation protocols defined in the technical documents; preparation of standard forms of contract on mechanisms and dynamics to be applied to relevant parties in case of buying and selling carbon credits; development and maintenance of carbon credit registers fora correct and update management of carbon shares traded in the market, of their registration and withdrawal from market; support service to call for tenders to draft contracts, to carry out commitments taken by the parties, to organize audits, to manage commitments signed in the disciplinary to join the system, to promote the environmental communication among participants; use of project logo and management of project-related communication; collection and correct management of documentary material relating to the system; management and implementation of the website dedicated to the project, that can also represent a valid and an effective tool to communicate with market players and to promote the described model; communication and dissemination of project activities and of climate changes issue; preparation of technical notes, newsletters, reports on climate changes and carbon forestation at a regional, national and international level.

6.6.4 Carbon Credit Records

These records are managed and stored in electronic and paper form at the competent Regional Observatory. After the filling of expression of interest and subsequent adherence to the market, market players knowingly accept the specifications of the system manual and particularly the privacy procedure. The register is responsible for the assignment of a unique carbon share identification code traded and sold on the market, their registration and their withdrawal from the market. After this insertion, the database so created is integrated with data related to the CO2 fixing potential or to emissions through the calculation protocols defined in the technical documents. After having undersigned rules and regulations to join the market, data on the shares put up for sale, on the requests for shares submitted by the issuers and on any transactions occurred following the signing of

contracts between seller and buyer are entered in the register. A copy of sales contracts is also deposited at the Observatory. Data contained in the registers must allow the unambiguous identification of each market participant, an easy and quick communication with the Regional Observatory and a constant and correct control both of market players and of the shares exchanges carried out. Registers must be always updated and implemented with the aim to control and to manage the market.

6.7 Global overview of carbon pricing initiatives

From World Bank Report "As of 2018, 45 national and 25 subnational jurisdictions are putting a price on carbon...Carbon pricing initiatives implemented and scheduled for implementation would cover 11 gigatons of carbon dioxide equivalent (GtCO2 e) or about 20 percent of global GHG emissions, compared to 8 GtCO2 e or about 15 percent in 2017. This increase primarily due to the expected coverage of the China national ETS. While this trend brings the global coverage of GHG emissions closer to the Carbon Pricing Leadership Coalition's (CPLC's) target of 25 percent by 2020, further progress will be needed to reach this goal. Carbon prices vary substantially, from less than US$1/tCO2 e to a maximum of US$139/tCO2 e. Most initiatives saw an increase in their 2018 price levels compared to those in 2017. One substantial change was the growth in the European Union Allowance (EUA) price from €5/tCO2 e to €13/tCO2 e (US$7/tCO2 e to US$16/tCO2 e) as more certainty developed on the future of the European Union (EU) ETS in the post-2020 period. In addition, planned tax rate increases occurred, including the escalation of the France carbon tax rate from €30.5/tCO2e to €44.6/tCO2e (US$38/tCO2e to US$55/tCO2e) and the Switzerland carbon tax

rate from CHF84/tCO2e to CHF96/tCO2e (US$88/tCO2e to US$101/tCO2 e). Despite these developments over the past year, most jurisdictions have carbon prices that are substantially lower than those needed to be consistent with the Paris Agreement. Governments raised approximately US$33 billion in carbon pricing revenues in 2017, the source of which was allowance auctions, direct payments to meet compliance obligations and carbon tax receipts. This represents an increase of nearly US$11 billion compared to the US$22 billion raised in 2016. Reasons for this increase include auction revenues from the newly launched Ontario ETS and revenues from the new carbon taxes in Alberta, Chile and Colombia. Existing initiatives also contributed to this trend, including a larger number of allowances bought at auctions in the California ETS combined with higher auction sale prices, and an increase in the EUA price and the carbon tax rate in France. The EU ETS remains the largest source of carbon pricing revenues due to its size, followed by the carbon taxes in France, Sweden and Japan". The World Bank report covers developments from January 1, 2017 until April 1, 2018. "In 2018, the total value of ETSs and carbon taxes is US$82 billion, representing a 56 percent increase compared to the 2017 value of US$52 billion. About US$22 billion of this rise is attributed to the higher EUA price. Other substantial changes include increases in the carbon tax rates in Alberta and France".[99]

7. Conclusions

7.1 7.1 Adaptation measures and scope for co-benefits withmitigation

Adaptation and mitigation have generally been treated as two separate issues, both in policy and practice. Mitigation address cause and adaptation deals with the consequences of climate change. While adaptation (e.g., reducing flood risks) and

[99] https://openknowledge.worldbank.org/bitstream/handle/10986/29687/9781464812927.pdf

mitigation (e.g., reducing not CO2 emissions from agriculture) may have different objectives and operate at different scales, they can also generate joint outcomes with adaptation generating mitigation co-benefits. Seeking to integrate strategies for achieving adaptation and mitigation goals is attractive in order to reduce competition for limited resources and trade-offs. Moreover, determinants that can foster adaptation and mitigation practices are similar. These tend to include available technology and resources, and credible information for policy makers to act on. Four sets of mitigation-adaptation interrelationships can be distinguished: 1) mitigation actions that can result in adaptation benefits; 2) adaptation actions that have mitigation benefits; 3) processes that have implications for both adaptation and mitigation; 4) strategies and policy processes that seek to promote an integrated set of responses for both adaptation and mitigation. A high level of adaptive capacity is a key ingredient to developing successful mitigation policy. Implementing mitigation action can result in increasing resilience especially if it is able to reduce risks. Yet, mitigation and adaptation objectives, scale of implementation, sector and even metrics to identify impacts tend to differ, and institutional setting often does not enable an environment where synergies are sought. Trade-offs between adaptation and mitigation exist as well and need to be understood (and avoided) to establish win-win situations. Forestry and agriculture offer a wide range of lessons for the integration of adaptation and mitigation actions given the vulnerability of forest ecosystems or cropland to climate variability and change. Increasing adaptive capacity in forested areas has the potential to prevent deforestation and forest degradation; reforestation projects, if well managed, can increase community economic opportunities that encourage conservation, build capacity through training of farmers and installation of multifunctional plantations with income generation, strengthen local institutions and increase cash-flow to local forest stakeholders from foreign donors.

A forest plantation that sequesters carbon for mitigation can also reduce water availability to downstream populations and heighten their vulnerability to drought. Inversely, not recognizing mitigation in adaptation projects may yield adaptation measures that increase greenhouse gas emissions, a prime example of

'maladaptation'. Analogously, 'mal-mitigation' would result in reducing greenhouse gas emissions, but increasing vulnerability. For instance, the cost of pursuing large scale adaptation and mitigation projects has been associated with higher failure risks, onerous transactions costs and the complexity of managing big projects.

Adaptation encompasses both biophysical and socio-economic vulnerability and underlying causes (informational, capacity, financial, institutional, and technological), and it is increasingly linked to resilience and to broader development goals. Adaptation measures can increase performance of mitigation projects under climate change and legitimize mitigation measures through the more immediately felt effects of adaptation. Effective climate policy integration in the land sector is expected to gain from 1) internal policy coherence between adaptation and mitigation objectives, 2) external climate coherence between climate change and development objectives, 3) policy integration that favors vertical governance structures to foster effective mainstreaming of climate change into sectoral policies, and 4) horizontal policy integration through overarching governance structures to enable cross-sectoral coordination.

7.2 Climate change and sustainable development

Climate change and sustainable development are challenges to society that require action at local, national, transboundary and global scales. Different time-perspectives are also important in decision making, ranging from immediate actions to long-term planning and investment. Acknowledging the systemic link between food production and consumption, and land-resources more broadly is expected to enhance the success of actions. Because of the complexity of challenges and the diversity of actors involved in addressing these challenges, decision making would benefit from a portfolio of policy instruments. Decision making would also be facilitated by overcoming barriers such as inadequate education and funding mechanisms, as well as integrating international decisions into all relevant (sub)national sectoral policies. Governance to enable the response includes the processes, structures, rules and traditions applied by formal and

informal actors including governments, markets, organisations, and their interactions with people. Land governance actors include those affecting policies and markets, and those directly changing land use. The former includes governments and administrative entities, large companies investing in land, non-governmental institutions and international institutions. It also includes UN agencies that are working at the interface between climate change and land management, such as the FAO and the World Food Programme, that have inter alia worked on advancing knowledge to support food security through the improvement of techniques and strategies for more resilient farm systems. Farmers and foresters directly act on land (actors in proximate causes). Policy design and formulation has often been strongly sectoral. For example, agricultural policy might be concerned with food security, but have little concern for environmental protection or human health. As food, energy and water security and the conservation of biodiversity rank highly on the Agenda 2030 for Sustainable Development, the promotion of synergies between and across sectoral policies is important, as in the case of the Geco2 project.

This can also bring greater collaboration between scientists, policy makers, the private sector and land managers in adapting to climate change. Polycentric governance has emerged as an appropriate way of handling resource management problems, in which the decision-making centers take account of one another in competitive and cooperative relationships, and have recourse to conflict resolution mechanisms. Polycentric governance is also multi-scale and allows the interaction between actors at different levels (local, regional, national, and global) in managing common resources such as forests or aquifers. Implementation of systemic approaches has been achieved through socio-ecological systems (SES) frameworks that emerged from studies of how institutions affect human incentives, actions and outcomes (IPCC Report). Recognition of the importance of SES laid the basis for alternative formulations to tackle the sustainable management of land resources focusing specifically on institutional and governance outcomes. Adaptation or resilience pathways within the SES frameworks require several attributes, including indigenous and local knowledge (ILK) and trust building for deliberative decision making and effective collective action, polycentric and multi-layered institutions

and responsible authorities that pursue just distributions of benefits to enhance the adaptive capacity of vulnerable groups and communities. The nature, source, and mode of knowledge generation are critical to ensure that sustainable solutions are community-owned and fully integrated within the local context. Integrating ILK with scientific information is a prerequisite for such community-owned knowledge. ILK is context-specific, transmitted orally or through imitation and demonstration, adaptive to changing environments, collectivized through a shared social memory; ILK is also holistic since indigenous people do not seek solutions aimed at adapting to climate change alone, but instead look for solutions to increase their resilience to a wide range of shocks and stresses. ILK can be deployed in the practice of climate governance especially at the local level where actions are informed by the principles of decentralization and autonomy; it can complement scientific knowledge. The capacity to apply individual policy instruments and policy mixes is influenced by governance modes. These modes include hierarchical governance that is centralized and imposes policy through top-down measures, decentralized governance in which public policy is devolved to regional or local government, public-private partnerships that aim for mutual benefits for the public and private sectors and self or private governance that involves decisions beyond the realms of the public sector (IPCC Report). These three governance modes provide both constraints and opportunities for key actors that affect the effectiveness, efficiency and equity of policy implementation.

The possibility to create, in line with GECO2 project overall objectives, an innovative interregional system in the Adriatic area aimed at monitoring climate change, experimenting ecofriendly agricultural practices, and launching a new voluntary carbon credit market requires a set of specific actions to be carried out through an effective cross-border cooperation. Final results will possibly bring benefits to inhabitants such as "planning of innovative environmental measures, improving regional environmental management and policies, introducing more eco-friendly use of land, decreasing climate change risks, enjoying new environmental qualified products" (Geco2 official document).

As far as the specific scope of creating and testing, on a regional scale, a voluntary carbon credit market designed to offset CO2e emissions, the project will directly involve the agricultural sector, "urging it to adopt "sustainable" and environmentally friendly patterns of production" (Geco2 official document). Results and outputs durability will be assured by the long-term engagements signed by farmers and firms in the frame of the pilot project. The setup of an experimental carbon market,
in order to become economically sustainable. As to the content of the present document, it is vital to note how the project is innovative, with particular reference to the lack of real structured experiences in this field.

The project, as a consequence, is likely to be taken as a model for the development of future local credit markets and as a basis for further development projects.

8. Executive Summary

The concept of carbon market came into existence as a result of increasing awareness of the need for controlling emissions. The mechanism was formalized in the Kyoto Protocol, an international treaty which extended the 1992 United Nations Framework Convention on Climate Change (UNFCCC).

The sale and purchase of carbon credits enable companies in different sectors to pursue tangible economic benefits, together with important reputational benefits in terms of capacity to respect the Climate Agreements (Kyoto Protocol and Paris Agreement) and contribute concretely to the achievement of the Sustainable Development Goals.

The issue of carbon credits is strongly related to relation Agricolture climate and Climate Smart Agriculture (CSA). CSA three pillars can be summarized as follows: to sustainably increase agricultural productivity and improve the incomes and

livelihoods of farmers; to build resilience and adaptation to climate change; to reduce and/or remove GHG emissions, where possible.
The importance of CSA stems from the observation that the vast majority of the world's poor people live in rural areas and mostly depend on agriculture for their livelihoods. Climate change is expected to hit developing countries the hardest, as their agricultural sectors account for around 22% of the economic impact caused by medium/large-scale natural hazards and disasters. Research shows that the agricultural sectors can better face threats deriving from climate change by implementing a CSA approach. As a consequence, it is vital to foster coordination and integration across all agricultural sectors, policy makers and stakeholders, at national, regional and local levels, as a prerequisite for the implementation of effective policies.

Furthermore, the issue of Circular economy needs to be investigated as well, as the new paradigm which introduces the rational and appropriate use and reuse of all resources. This is a result of a sustainable and circular product design upstream and a correct management of waste downstream and, as to the context of the Geco2 project, it includes replacement of virgin raw materials with secondary raw materials and from fossil sources with biomaterials.
In view of the mentioned issues, both adaptation and mitigation (the latter addressing cause and the first dealing with the consequences of climate change) need to be taken into consideration, as they can generate joint outcomes with adaptation generating mitigation co-benefits.
As to the mentioned agreements, the Kyoto Protocol was ratified by 153 countries and entered into force on the 16th of February 2005. According to this agreement, and with relation to the period 2008-2012, 39 countries committed themselves to limiting and/or reducing their greenhouse gas emissions. Each country received a so called "emission ceiling", i.e. a certain amount of greenhouse gas emission rights, defined as a percentage of each country emissions in 1990. Within the Kyoto Protocol, three mechanisms can be identified: Joint Implementation (JI), which allows a country to invest in emission reduction projects in another industrialized country, benefiting from additional

emission allowances; Clean Development Mechanism (CDM), that allows investing in projects to reduce emissions in developing countries, obtaining additional emission credits; Emissions Trading (ET), that allows these credits to be traded to fulfill the reduction obligations (Part 1. Chapter 2.A).
The European Union did not wait for the official entry into force of the Protocol (16 February 2005) and established, starting from 1 January 2005, a system that regulates the exchange of quotas. The European Emissions Trading System or EU ETS (European Emissions Trading Scheme) sets limits for carbon dioxide emissions and, at the same time, allows the rights to emit carbon dioxide (which are called carbon dioxide emissions allowances, EUA) that can be marketed (Part 1. Chapter 2.B).
In the described context, at a global level, as stated by the World Bank Report with relation to 2018, 45 national and 25 subnational jurisdictions decided to put a price on carbon. These "carbon pricing initiatives...would cover 11 gigatons of carbon dioxide equivalent (GtCO2 e) or about 20 percent of global GHG emissions", although they resulted in carbon prices substantially lower than those needed to be consistent with the Paris Agreement (Part 1. Chapter 2.C).
As far as the specific context of the Geco2 project is concerned, it is fundamental to analyze agricultural, forest and soil management. According to the IPCC Report, Sustainable land management (SLM) describes the “use of land resources...to meet changing human needs while simultaneously assuring the long-term productive potential of these resources and the maintenance of their environmental functions”. It embeds ecological, technological and governance aspects; as a consequence, it is strongly related to the adoption of production practices in line with the mentioned CSA (Part 2. Chapter A). A crucial role is played by land use choices such as agroecology (including agroforestry), conservation agriculture and forestry practices, crop and forest species diversity, appropriate crop and forest rotations, organic farming and so on. In such a panorama, it is vital to note how, in recent years, the role of forests has gained attention from the scientific community for the definition of a protocol of credit measurement and monitoring. The so called agro-forestry credit market is attractive because of the "tangibility" that related projects offer, though

embedding a certain degree of risk. The challenges that each project faces are: develop mitigation projects that offer durable and reliable carbon credits and therefore contribute to reduce emissions on a local scale; launch a local credit market. The development of quality carbon credits not only guarantees an effective mitigation of emissions but also increases the investor's confidence in this sector, introducing as well the important concept of compensation of proximity. This principle responds to the need to take actions whose socio-environmental benefits as well as climatic conditions are perceptible and appreciable by the local community and by the people that invest in the market, as stated also in the context of the Geco2 project. The inspiring principles of each project can be summarized in the following points: harmonization; rigor and credibility; transparency of methodologies and information; innovation (Part 2. Chapter B).

When talking about voluntary carbon compensation, i.e. the mechanism according to which, in parallel with the reduction of greenhouse gas emissions at the source, an emitter buys from a third party an amount of carbon credits equivalent to the emissions to be reduced, the mentioned projects give birth to voluntary markets where compensation is paid on a voluntary basis, and not because it is requested by one specific national or sector regulation that sets a "cap" or a roof-top on emissions. In order to generate an effective environmental impact, voluntary compensation must be accompanied by actions and efforts to reduce emissions at the source, by changes in the individual behavior or in the production process. In general, the voluntary market is led by investors who buy credits for two main reasons: to act exclusively on a voluntary basis to compensate for emissions, and anticipate future rules and regulations which could introduce limits to the emissions.

The present document, in view of the analyzed issues, investigates the possibility to create, in line with GECO2 project overall objectives, an innovative interregional system in the Adriatic area aimed at monitoring climate change, experimenting ecofriendly agricultural practices, and launching a new voluntary carbon credit market. This requires a set of specific actions to be carried out through an effective cross-border cooperation. Final results will possibly bring

benefits to inhabitants such as "planning of innovative environmental measures, improving regional environmental management and policies, introducing more eco-friendly use of land, decreasing climate change risks, enjoying new environmental qualified products" (Geco2 official document), all directly involving the agricultural sector, "urging it to adopt "sustainable" and environmentally friendly patterns of production".

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