Position paper

October 2022

Carbon sinks

What role should research play in accelerating their development in France?

In order to remove CO_2 from the atmosphere, carbon sinks are a solution that is currently being considered as a unavoidable. Increasing but also preserving carbon sinks and, in some cases, restoring them, are priority issues. Based on a study by a group of experts from the ANCRE alliance, six major categories of carbon sinks have been identified for the French context: three categories of natural CO_2 capture solutions in more or less anthropised environments, and three categories of solutions integrating technological developments. The state of play, challenges, barriers and research recommendations for each of the solutions were highlighted in 7 worksheets.

Worksheet 1.
Carbon storage in biomass and agricultural and forest soils

Worksheet 2.
Carbon storage in biomass and soils in urban and anthropised environments

Worksheet 3.
Carbon storage in aquatic environments and from rock weathering

Worksheet 4.
Technological solutions for capturing atmospheric CO_2 for geological storage

Worksheet 5.
Storage of CO_2 in materials via mineralisation

Worksheet 5bis.
Biogenic CO_2 capture and storage in bio-based materials

Worksheet 6.
Technological solutions for recycled carbon capture, utilisation, and long-term storage

The full report and each of worksheets are available on:
https://www.allianceenergie.fr/etudes-et-rapports/

ANCRE
Alliance Nationale de Coordination de la Recherche pour l'Énergie

Worksheet 2

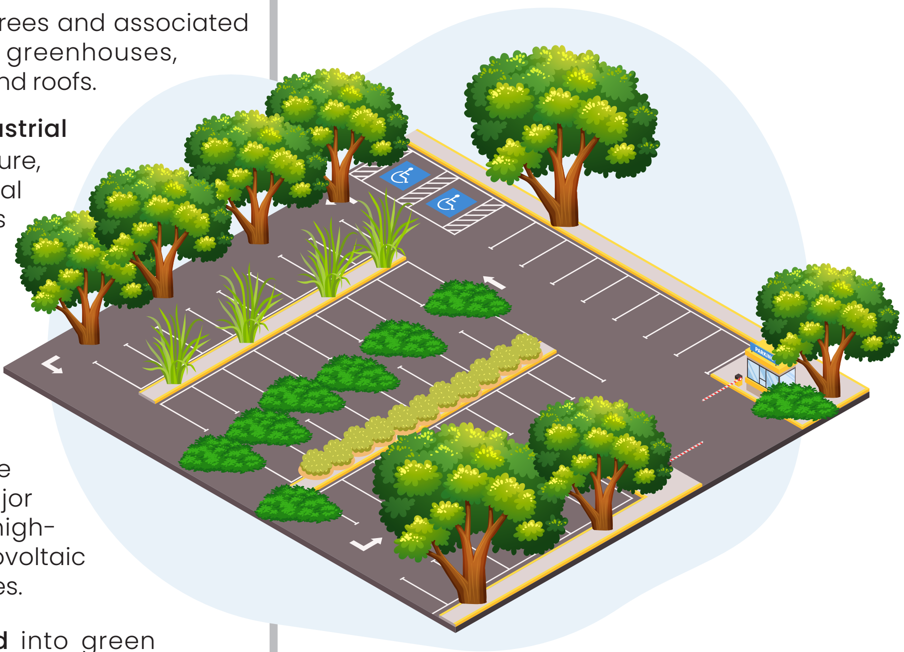
Carbon storage in biomass and soils in urban and anthropised environments

State of play

Urban areas and, more generally, highly anthropised areas cover a wide range of environments in which the capture and storage of CO_2 by biomass can constitute carbon sinks. In particular, the following can be distinguished:

Green Urban spaces: parks, gardens, line trees and associated soils and substrates; urban agriculture, greenhouses, especially shared gardens; green facades and roofs.

Recently or decades ago **abandoned industrial wastelands**, more or less reinvested by nature, or wastelands in the making (e.g. commercial areas). These include: industrial wastelands that have not been converted into housing (former industrial sites, railway wastelands); military wastelands; former mining sites; and commercial wastelands.



The areas disturbed by civil engineering operations around transport infrastructures, and which have been grassed over. Examples include peri-urban areas in the immediate vicinity and on railway embankments, major roads, airport areas, areas occupied by high-voltage lines, solar panels areas (e.g. photovoltaic farms) that do not allow agricultural practices.

Urbanised areas that can be converted into green spaces, such as car-free areas in cities where cars are to be removed. Abandoned highly anthropised environments are subject to the establishment of vegetation (spontaneous or not), which can evolve into a cultural, or grassland, or forest ecosystem, providing a wide range of ecosystem services, including carbon storage. They can result in the generation of carbon sinks, provided that appropriate practices are developed and applied. For example, brownfields that are reclaimed for landscaping, biomass production, heat island mitigation or renaturation purposes, or operations to restore soil functions can lead to additional carbon storage. Soil construction technologies exist for this purpose and already have enabled the renaturation of former industrial and mining sites.

Challenges

Old industrial sites may contain very old carbon (from mining and oil extraction), which can be found at depths of more than a metre. These situations show the existence of a storage potential that can be increased through appropriate management strategies. However, there is a lack of information on the surfaces concerned, as well as on the current practices that could be developed for storage on surfaces such as the edges of roads, railways, airports and also highly anthropised recreational areas such as golf courses. The land pressure on these areas also differs greatly depending on their location in relation to urban centres (e.g. brownfield in urban areas vs. isolated brownfield in rural areas) and therefore their potential for carbon storage varies greatly from one point to another. Urban management strategies are also a factor in assessing carbon storage potential (e.g. greening policy).

The conversion of urban wastelands into green spaces could be applied to a larger number of sites to be greened. They could also be optimised with a view to increasing the quantity and duration of storage, while ensuring their primary function. Some of these areas are also highly sought after (e.g. brownfield sites) for photovoltaic development, leading to trade-offs to ensure the widest range of ecosystem services.

As regards municipal parks/gardens, railways and urban agricultural plots, data enabling the surfaces concerned to be evaluated are not readily available on the scale of the entire metropolitan territory. Evaluations show a total additional storage potential for industrial wastelands of between 3.5 and 4.7 Mt of CO_2 equivalent by 2050 (with a 25% share of mobilised surfaces in 2050, with a total of 530 000 to 705 000 hectares). For airport areas, the total additional storage potential is around 0.65 Mt CO_2 eq. by 2050 with the implementation of renaturation, considering no increase in surface area. For green facades and green roofs, the potential is estimated at 0.13 Mt CO_2 eq. by 2050, considering no increase in surface area. For roads, the potential is of the order of kiloton of CO_2 eq.

In summary, while the potential exists, it is not really known nor quantified. Technologies are available but could be optimised with a view to increasing storage while ensuring the provision of essential ecosystem services such as biodiversity.

The challenge is to determine the existing and potential surfaces in urban and antropised environments that allow for the most effective carbon storage (in terms of quantity and durability) by integrating carbon storage into the decision-making process for the use of these surfaces in order to meet the objective of carbon neutrality in 2050, as this storage possibilities have not yet been demonstrated or used.

Barriers

LACK OR DIFFICULTY OF REALISTIC EVALUATIONS
of the areas concerned and the potential carbon storage in relation to the uses.

DYNAMICS OF THE PROVISION OF SURFACES
(e.g. commercial wasteland, temporary renaturation of wasteland before new use).

LAND USE COMPETITION
and complementarities with urbanisation/housing projects, renaturation, energy production.

SIMULTANEOUS CONSIDERATION
Of the coupling of carbon storage and the impact on biodiversity, particularly in sites that are not subject to building development.

LACK OF INFORMATION TO STAKEHOLDERS
- of transport infrastructure management and technological developments to adopt storage practices (roadsides, railways, airport areas, etc.).
- of building contractors, and technological developments allowing storage, especially when excavating soil for building construction.

Actions

Research recommendations

- Need to set up observatories or territorial statistical monitoring to quantify surface areas; mobilisation of spatial planning actors (e.g. Public Landholding Establishments).
- Need to set up observatories and systems to evaluate practices in order to quantify their impact on the evolution of carbon storage (for all potential storage areas - construction, cemeteries, landfills, etc.): this is a key issue for the European Union.) :
  (i) inventory of practices,
  (ii) assessment of the impact in terms of storage,
  (iii) implement the identified stocking practices to optimise these practices and/or their deployment.
- Carrying out emission balances vs. storage in parks, urban agriculture areas and shared gardens (focus on vegetated areas).
- Build functional soils capable of providing a wide range of ecosystem services (e.g. biodiversity, carbon storage, hydrology, oxygen production) pollution) :
  (i) Identify a few pilot sites to make comprehensive radiation balance measurements,
  (ii) monitoring cultivation practices in shared gardens or park maintenance,
  (iii) make a comparison between the urban and agricultural contexts in terms of practices, impact on carbon and biodiversity and their evolution.

Implementing recommendations

- Encourage the development of parks, gardens and forests in urban areas, green roofs and facades.
- Promote revegetation of brownfields and renaturation (biodiversity) by optimising carbon storage.
- Develop new storage strategies and practices during remediation of degraded and polluted sites.
- Implement tools to raise awareness among land-use planning actors of the need to change practices to increase carbon storage.
- Promote a better transfer of knowledge and innovative technologies concerning carbon storage to land-use planning actors (communication, exchanges...).
- Develop public policies that encourage (regulation, taxation, remuneration) the storage of carbon in these areas and preserve them over long periods.