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BIOFUELS PRODUCTION AT LOW - ILUC RISK FOR EUROPEAN SUSTAINABLE BIOECONOMY

BIKE BRIEFING NOTE #10

BIKE is a Horizon 2020 project whose objective is to support uptake of the low ILUC-risk concept for biofuel feedstocks. This series of Briefing Notes seeks to explore issues in the EU policy sphere which may impact low ILUC-risk value chains, and identify opportunities for fostering an enabling policy environment.

Ecologically appropriate crops for restoration of unused and severely degraded lands

Miscanthus plants in central Greece.

The world is facing a scarcity of land necessary to secure the production of food: the FAO reports that "A series of [agricultural] land and water systems now face the risk of progressive breakdown of their productive capacity under a combination of demographic pressure and unsustainable agricultural practices"[i]. On top of this, there is an increasing competition from other land uses like biofuel feedstock production, as well as a global phenomenon of agricultural land abandonment driven by multiple factors[ii]. Restoring unused, abandoned, and severely degraded lands for low ILUC-risk biomass production offers a way of resolving these tensions and increasing overall productivity, while at the same time increasing the incomes and diversifying the activities of farmers (including smallholders) in rural areas.

This Briefing Note highlights some environmentally appropriate opportunities for bringing unused – and possibly abandoned – lands back into use, in ways that enhance agricultural output while restoring the land's productive potential. It gives an overview of some relevant land management policies, introduces some of the risks (such as pollution and water abstraction) arising from unused land conversions, and presents some recommendations in line with the principles of sustainable agriculture.

Demarcation of unused and severely degraded land

According to a Delegated Regulation of the European Commission[iii], production of low ILUC-risk biofuel feedstocks is possible either (i) through the improvement of agricultural practices leading to an increase in yields on existing agricultural land, or (ii) through cultivation on land which is unused, abandoned, or severely degraded.

The Delegated Regulation defines 'unused land' as an area that has not been used for the cultivation of food and feed crops, nor for the cultivation of other energy crops, nor for grazing, for at least five consecutive years. 'Abandoned land' appears in the same regulation as a subcategory of unused land, where past production of food and feed crops ceased due to biophysical or socio-economic barriers. 'Severely degraded land' is defined as land that "has either been significantly salinated or presented significantly low organic matter content and has been severely eroded"[iv]. Areas in the latter category may overlap with those of unused or abandoned land, as they generally lose some capacity for food and feed production during the degradation process; on the other hand, there may be significant areas of land which fit into the definition of 'severely degraded', which remain agriculturally active.

Production of biofuel feedstock from land designated as unused, abandoned, or severely degraded may be regarded as low ILUC-risk, provided certain other conditions on land use are met. These conditions include the RED II's generic feedstock sustainability rules[v] that the land not be identified as having high biodiversity value; not be classified as wetlands, peatlands, or forest; and be monitored for impacts on soil quality. Moreover, all biofuels must meet a threshold carbon intensity reduction, compared to a fossil fuel baseline. Once land use change emissions have been factored in to the LCA[vi], this effectively excludes feedstocks produced from (formerly) highly vegetated areas, or areas whose soil carbon stock significantly degrades under agricultural management.

Land abandonment

Farmland abandonment can be a complex and gradual process. A reduction in farming intensity (manifesting as lower stocking rates, concentration of management in a reduced area of the farm, or infrequent cultivations) may be temporary, or it may be the beginning of a progressive marginalisation, where land parcels transition from agricultural use to, for example, grass, scrub, or shrubland.

Given the pace and unpredictability of the process, and the small scale of fragmented management changes, recognising land abandonment in progress requires a combination of information on land use, land management and land cover from different time periods[vii]. However, the only unused land category for which data are collected systematically in the EU is fallow land. The CORINE Land Cover (CLC) inventory[viii] offers an alternative tool for land use monitoring: the CLC a uses satellite data to analyse land use change over time – between the broad land categories of artificial surfaces, agricultural, forest, wetland, and water bodies, as well as between land use sub-categories (e.g. agricultural areas are split between arable crops, permanent crops, pasture, and heterogeneous land use). However, CLC's coarse spatial resolution means it can only identify large-scale changes (> 5 ha).

Environmentally appropriate practices for agricultural use of unused and severely degraded lands

Restoration of land with natural constraints for cropping requires careful selection of species that are both adapted to the local conditions and exhibit high tolerance to prevailing biophysical challenges[ix]. On bare unused lands, the establishment of any crop that creates cover will help to stabilise the soil and provide habitats for small animals. Furthermore, as discussed in Briefing Notes #7 and #8[x], appropriately managed agricultural systems can have highly positive effects on soil carbon stocks[xi].

That being said, unused, abandoned, and severely degraded lands are often environmentally vulnerable, which means that those lands should only be brought into cultivation with careful attention to their ecological characteristics and constraints[xii]. This is illustrated in the following examples.

Perennials

Perennial crops and agroforestry systems are very effective in reducing soil erosion and building up soil carbon and fertility[xiii]. For example, willow (*Salix spp. L.*) can tolerate a great range of soils (e.g., wet sites, alkaline, saline, clay soils, etc.) and can remediate soil for land conservation practices, shelterbelts, and windbreaks. Additionally, it can be used for biofiltration, constructed wetlands, and wastewater treatment systems. Miscanthus is considered beneficial for the mitigation of soil erosion and allows high levels of carbon storage in soil due to high levels of plant residue from above and below ground. Switchgrass can be grown in different types of soils and ecological conditions, including land with natural constraints, because of its extensive root system and drought tolerance, enabling it to retain high productivity under drought conditions[xiv].

Deep rooting of perennial biomass crops and trees in agroforestry systems help to build below-ground biomass and facilitate access to water, particularly in arid circumstances[xv]. Some species (certain birds and small mammals) might also benefit from introduction of perennial crops or agroforestry which can bring improved structural diversity in the landscape.

Annuals

There are several annual oil crops that are drought tolerant and also able to grow on contaminated lands. For example, both rapeseed (*Brassica napus*) and Ethiopian mustard (*Brassica carinata L.*) are tolerant to water stress; they are also considered good crops for phytoremediation, offering a pathway for producing additional biomass from contaminated land and simultaneously rehabilitating said land (the suitability of certain contaminated-land biomass for biofuel production has been demonstrated in pilot projects and is the subject of ongoing research[xvi]). Safflower (*Carthamus tinctorius*) is also tolerant to prolonged dry periods and high temperatures, and can be grown on land contaminated with heavy metals. Castor (*Ricinus communis*) can grow on land with natural constraints due to its high tolerance to drought, heat, and saline soil conditions[xvii].

In relation to the above practices, crop rotation can be adopted as secondary practice as it has a number of environmental benefits. It improves soil health, optimises nutrients in the soil, and combats pest and weed pressure. Crop rotation plays a key role in reducing the risk of nitrate leaching into surface and groundwater, by improving the availability of soil nitrogen and reducing the need for extra fertiliser (which in turn has the added benefit of reducing greenhouse gas emissions[xviii]). Annual crop rotations allow for differences in the root structure on a land area over time. For crops having either tap or fibrous roots, the diversity in the root structure will enhance the chemical, physical, and biological structure of the soil. Improvement in soil condition and microbial communities enhances stability and water infiltration, and hence help to reduce soil erosion.

Environmental barriers

The above examples notwithstanding, there remain environmental stressors that must be anticipated and controlled when converting unused, possibly sensitive, land to agricultural use. Crop production implies soil disturbance (especially for annuals, but also perennials[xix]) and therefore higher risk for loss of nutrients and carbon through wind and run-off erosion. The effect on soil carbon is very much dependent on previous land uses: for example, clearing and tillage of long-abandoned grasslands, shrublands, or wetlands results in serious declines in carbon, both above and below ground.

In drought-prone areas, additional establishment of crops may increase dependence on unsustainable water use. A shift from vegetated abandoned lands to rotational arable will generally diminish shelter and breeding opportunities for wild animals, and diminish floristic diversity. Any shift from abandonment to cropping will generally lead to increases in input uses, more mechanisation and changes of landscape structure. This can potentially have negative implications for habitat quality, depending on the specific regional context.

Role of policy

A range of EU and national level policies play a role in a) maintaining land under agricultural production; b) bringing land back into active use; and c) stimulating biomass cropping for energy and other non-food purposes. At the Member State level, land use legislation promotes maintenance of agricultural land, promotes a diversity of farm types, addresses generational renewal, establishes financial instruments such as land taxes and loans, and creates land development and zoning policies.

While these measures have enabled specific initiatives for bringing land back into production, these are often localised efforts. The low ILUC-risk framework could therefore be positioned as a broad driver of agricultural renewal and soil regeneration. Moreover, low ILUC-risk legislation[xx] specifies that projects should not "compromise future growing potential by creating a trade-off between short-term output gains and mid/long-term deterioration of soil, water or air quality, [impacts on] pollinator populations, or homogenisation of the agricultural landscape". This provides a context for incorporating environmental safeguards into the low ILUC-risk framework, and bolsters its potential role in unused land conversion.

Recommendations

The Commission plays an important part in encouraging land management practices that are compatible with biodiversity and ecological conservation, and the low ILUC-risk certification system may be a useful tool for restoration of unused, abandoned, and severely degraded land. At minimum, the establishment of any crop that creates additional cover will help in stabilising the soil, while perennial crops and agroforestry systems can be highly environmentally and ecologically effective production systems when implemented with sensitivity to local conditions.

As such, we recommend that the Commission support low ILUC-risk field trials for the development of complex sustainable agrotechnical systems applicable in unused, degraded, abandoned, marginal lands, where biodiversity can also be increased.

The Commission may also consider the creation of precise demarcations for each category of unused land in public registers and land use maps. This would facilitate targeting the low ILUC-risk system as it scales beyond pilot projects, and would benefit other initiatives in sustainable land use.

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VI. RED II, Annex V, Part C, Paragraph 7.

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XVI. See for example the Horizon projects Phy2Climate (https://www.phy2climate.eu/), CERESiS (https://ceresis.eu/), and GOLD (https://www.gold-h2020.eu/).

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XIX. https://ec.europa.eu/eip/agriculture/sites/default/files/eip-agri_fg_soil_organic_matter_final_report_2015_en_0.pdf

XX. Commission Implementing Regulation (EU) 2022/996, Annex VIII. The excerpt has been edited for brevity.

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