CLIMATEORIENTED AGROFORESTRY FOR SHELTERBELT RECONSTRUCTION AND MAINTENANCE IN UKRAINE

TECHNOLOGY DESCRIPTION

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In Ukraine, agroforestry is mainly presented as linear field protection forest belts (called shelterbelts) which look like a mixture of perennial species planted in fields in a few rows, and aim to protect fields against different types of soil erosion. However, the adaptation potential of shelterbelts has not been fully counted yet. These agroforestry practices allow to protect crops from damaging winds, improve the microclimate of fields, preserve water-saving, regulate spring and stormwater runoff, improve biodiversity, etc. Moreover, agroforestry provides extra opportunities for production diversification and extension, engaging green goods such as berries, medical herbs and bio-energy plants into the production circle.

As a result, agroforestry builds resilience to climate change in agriculture due to reducing negative climate change consequences and increasing productivity. Besides, agroforestry is a win-win practice supporting climate change mitigation because of carbon sequestration and absorption.

In general, agroforestry is a complex technology implementation which depends on the country's particularities. Considering the Ukrainian land tenure specifics, the stages of shelterbelt establishment and reconstruction are envisioned as the following:

1. First stage – the registration of land ownership rights. At this stage the inventory of existing boundaries of shelterbelts and their further registration in the State Land Cadastre are foreseen.
2. Second stage – planting project preparation. The shelterbelt is a living construction, providing certain environmental effects, and caring for certain functions. Based on this, the establishment of the shelterbelt must follow the regulation (GOV-CM 650.2020) to maintain the shelterbelt's environmental functions. In addition, the shelterbelt owners will focus on the economic efficiency of shelterbelt plantations by combining plants to produce timber and non-timber goods. Through the planting project is the way to reach triple effects from agroforestry implementation, such as maximizing environmental and economic benefits and minimizing loss of crop production in fields through the shelterbelt under climate change.
   Designing a planting project consists of (I) pre-project assessment aimed to collect input data such as soil quality, climate, and precipitation conditions, etc.; (ii) selection of the most appropriate shelterbelt construction and placement; and (iii) species selection.
   The species selection should be performed at baseline with the climate-smart forestry recommendations (FAO 2020). When selecting a range of tree and shrub species for the shelterbelt, the species' biological characteristics should be considered and their interaction as well as natural and climatic conditions and land reclamation tasks.
3. Third stage – Planting the shelterbelt. The planting stage involves pre-planting trimming, logging, uprooting (if required), soil cultivation, planting, and cropping (if envisaged) on the basis of the requirements of relevant national legislation (GOV-SFA 2020) and on the basis of the received logging ticket.
   Shelterbelts should be planted by using seedlings, saplings, rooted cuttings, or by sowing seeds of not less than 2nd quality class (local collection from the best tree stands or collected in other areas provided by silvicultural zoning).

4. Fourth stage - Repair and maintenance work. The observed loss of newly planted seedlings could be up to 20-25% in the first year. The reconstruction and establishment of shelterbelts are foreseen as further maintenance actions. The second year-maintainance activities include the re-planting of lost or damaged plants, fertilizing, and pest management. Furthermore, the timing and cultivation aspects require following the planting project documents.

To manage different risks better and increase economic efficiency, the end-user can apply different agroforestry practices for shelterbelt reconstruction such as forest farming, alley cropping, etc.

At the beginning of the 1990's Ukraine had around 400 thousand hectares of shelterbelts, which means that the application of innovative agroforestry approaches has a strong background and plenty of space for development. Among other reasons, that was why national experts recommended agroforestry as a prior measure for agriculture adaptation.

A more detailed description of technology implementation is provided in Barriers Analysis and Enabling Frameworks.

CURRENT TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

In recent years, the issues of afforestation and shelterbelt reconstruction have been obtained the vital importance for farming in the South. In 2020, massive sand storms, snowless winter, and dry spring caused the 70% loss of winter crops in South oblasts. Farmers and local authorities empirically faced the forest protection shelterbelts are the only way to protect fields from the harmful weather events on the flat Steppe landscape. However, the growing demand for the shelterbelt is slowing down by the high cost of technology, insufficient technological readiness, unclear legislation procedures, and lack of professional sectoral advisory services.

The key role is state institutions to overcome the barriers and accelerate the agroforestry distribution to satisfy growing demand. In this regard, from 2020, the agroforestry issues were included as one of the headliners to the national forest sector reform and national policy of afforestation. The nursery infrastructure of the state forest enterprises (around 400 all over Ukraine) has been modernizing to increase the production capacity of seedlings. The first from 40 nurseries growing planting materials with a closed root system was built in 2021. It might help to cover needs in input materials for agroforestry development partly.

Other steps to improve the land tenure management under agroforestry are performed from the government side. To improve the processes of land tenure management under agroforestry, the State Geo Cadastr and State Forest Project Company have modernized the land inventory system and forest management services, respectively. This makes the land tenure and forest management processes more stable, clear, and transparent.

Following the national classification of economic activities, agroforestry is a sub-sector of agriculture. Thus, farmers practicing agroforestry can receive a reimbursement and other state support within the eight acting agriculture state support programs. Besides, agroforestry is a promising technology for investment under the developing market of forest carbon offsets. The draft of relevant regulatory was developed by the Ministry of Environmental Protection and is expected to be adopted in the next year.

CLIMATE RATIONALE OF THE TECHNOLOGY

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Practicing conventional agriculture in Ukraine has dramatic environmental impacts such as productive soil depletion, massive land degradation due to erosion processes, land and water contamination, biodiversity reduction and etc. This situation is significantly increasing the agriculture sector's vulnerability to climate change consequences such as water

scarcity, droughts, dust storms, fires, changes in precipitation. Beyond, the poor environmental conditions affect the rural communities' lives and decrease their resilience to climate change.

Agroforestry practices in general, and shelterbelts specifically, are sustainable land use practices with a wide range of environmental, social, and economic consequences. Regarding climate change adaptation, it is possible to distinguish direct and indirect effects from the technology implementation. Meeting the increasing appearance of droughts events, agroforestry provides land surface thermoregulation, thus decreasing the surface temperature and retaining soil moisture. Also, shelterbelts are a living barrier against sand storms and heavy rainfall, increasing the soil resilience against wind and water erosion. In this way, crop production on the fields surrounded by shelterbelts has more chances under climate change. Moreover, agroforestry is a way to preserve and improve biodiversity by providing additional benefits against the spread of atypical diseases or pests.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

Considering the official declared available land resources and increasing interest in agroforestry practice from farmers and local communities, shelterbelts might cover about 440 thousand hectares of arable land in the long term. And local communities, shelterbelts might cover about 440 thousand hectares of arable land in the long term.

However, the existing barriers are a lack of appropriate planting materials, shortages of relevant technologies, insufficient financial resources, competition for land use with crop production, and the absence of efficient regulation. These barriers might slow down agroforestry development in the next decade. However, the approaches developed under the Technology Acting Plan allow strengthening the enabling environment for agroforestry and providing shelterbelt reconstruction as a mix of climate-orientated agroforestry practices at least on the 85 thousand hectares over all of Ukraine with a focus in south oblasts by 2030.

EXPECTED IMPACTS OF THE TECHNOLOGY

Diminished production on parts of fields along the shelterbelt is one of the main complaints raised by the farmers. Most often, this is due to wrongly chosen agroforestry practices. According to national experts, knowledgeable applications of optimally selected shelterbelts might increase crop efficiency by 20-33 percent. Furthermore, additional non-timber green goods production can provide extra revenue of about $60 thousand per hectare. Thus, the spreading of agroforestry could stabilize crop production under increasing climate change impacts in the south oblasts such as Kherson, Kirovograd, Mykolaiv, and increase production levels in oblasts with favorable climate change forecasts (such as Poltava, Cherkasy oblasts, etc.). Moreover, the southern regions of Ukraine face the highest threat of soil degradation. It may be possible that agroforestry can replace traditional crop farming in cases where fields lose their fertility. It will allow keeping job positions in rural areas and sources of livelihood, while preventing an increase in poverty and social inequality. Beyond, promoting region-specific by structure and functionality agroforestry belts, based on locally produced eco-types of plants will increase climate resilience of existing crop production and take control over pest diseases with a high contribution towards stopping land degradation and improved use.

Also, agroforestry caused mitigation effects, changing land use from crop production to agroforestry will lead to the reduction of GHG emissions from land degradation and will enhance GHG removal.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

Shelterbelt reconstruction is a mutually intersecting interest of farmers, local authorities, and the current environmental and governmental policies. In recent years, the relevant regulation towards strengthening the enabling environment for afforestation and shelterbelt reconstruction has been actively developing, engaging the intersectoral authorities and government. Moreover, afforestation issues were defined as a top national priority due to the adoption of The Presidential Order #111 from March 26, 2021, based on the decision of the National Security and Defense Council of Ukraine of March 23, 2021, "On challenges and threats to the national security of Ukraine in the environmental sphere and priority measures to neutralize them".

The Cabinet Ministry Order “About the statement of Rules of the maintenance and preservation of the field protective forest strips located on the agricultural lands" (2020) has been developed, and further legislation is being developed to enhance investment attractiveness of forestry via implementation of carbon offset mechanisms. In combination with positive changes towards improving land tenure under decentralization reform, it stimulates farmers and local authorities to invest in the inventory, registration and scaling up of shelterbelts. A significant complimentary incentive is that farmers can receive financial support for agroforestry development from agricultural state subsidiary programs, which would partially compensate cpsts for planting material for fruit trees, berry plants, grapes and hops (after planting) and for purchasing equipment for processing home-grown fruits, berries and grapes into juices, wine materials and etc.

PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

There are a set of prior institutional, investment, and technological measures to enhance policies for achieving the above-defined ambitions for agroforestry by 2030. Strengthening the institutional and regulatory environment for agroforestry is required **via improving land tenure as part of land consolidation**, **completing the national shelterbelt inventory and registration, and strengthening the institutional capacity for constant shelterbelt monitoring and management**. Along with increasing institutional capacity, it is necessary to enhance the financial affordability of agroforestry dissemination. Considering the government's interests, **developing carbon offset models for agroforestry on specified sites might** be used as a ground for further development of carbon market regulatory mechanisms. On the other hand, **setting the ecosystem payments** might be the source of funds for village communities for shelterbelt reconstruction and to continue applying different agroforestry practices. Considering the shelterbelts’ importance for national environmental security, the **separate line of state support on their establishment and maintenance might be foreseen** in the state budget. It will make agroforestry more affordable for farmers and other landowners.

Increasing demand for agroforestry could face a lack of planting materials and other input supplies. In this regard, it is crucial **to improve the technical potential of the nurseries and other input production and supply**.

In developing further policies on scaling up agroforestry, possible gender issues must be accounted for. Agroforestry implementation is gender-neutral, however, female representatives could have a very active position in further developing agroforestry. Usually, women are more focused on additional social and environmental benefits, while men are focused on economic efficiency. This issue should be counted as there are many females delegated in the local authorities.

COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

The approximate cost of implementing priority measures to stimulate agroforestry development and achieve the goal in 86 thousand hectares of replanted shelterbelts lies between 91-117 million USD by 2030. The approximate cost of

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Among them, the first place of attention requires the strengthening institutional capacity to improve the systems of monitoring, inventory, and evaluation for agroforestry management to relieve current sophisticated and time-consuming bureaucracy processes. Strengthening management mechanisms and simplifying bureaucracy will immediately boost agroforestry development, even though this is only twelve percent of the required investments. The strengthening technological capacity and developing financial support mechanisms are the most financially consuming share. It counts needs in modernization and partial covering of direct investment in shelterbelt establishing and reconstruction at $940 - $1197 per hectare.

USEFUL INFORMATION

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LINKS TO TNA REPORTS

Report	Year	Link
TECHNOLOGY ACTION PLAN. ADAPTATION. UKRAINE (in progress)	2021	https://tech-action.unepdtu.org/country/ukraine/
BARRIER ANALYSIS AND ENABLING, FRAMEWORK REPORT. ADAPTATION.UKRAINE	2020	https://rb.gy/atwsg4

TECHNOLOGY NEEDS ASSESSMENT REPORT ADAPTATION. UKRAINE 2019 https://rb.gy/wx7fzs