

## CHANGES IN THE LEGAL AND SUPPORT BACKGROUND OF WOODY ENERGY PLANTATIONS

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### ABSTRACT

Current forestry laws and regulations are not applicable to woody energy plantations. The cultivation technology used in these plantations differs from ones used in conventional forest management; thereby, specific legislation to regulate cultivation in woody energy plantations is required. Hungary passed its first regulations for woody energy plantations in 2007. The legislation addressed permitting, range of plantable species, planting procedures, cultivation, and plantation harvesting. The legislation overregulated coppice technology and only targeted roundwood energy plantation. The legislation does not mandate forest site surveys and its related expert opinions despite their importance in plantation establishment, particularly regarding tree species selection. The latest legislation, which improves earlier deficiencies and prescribes planting-execution plans for all plantations, came into effect 2017. Another important change is the industrial purpose categorization of woody plantations, which appeared beside coppice and roundwood energy plantations. In addition to raw material production, this type of plantation also increases the carbon sequestration of agriculture. The availability of financial resources heavily influenced plantation area size and planting intensity over the years. Investigating plantation tendencies provides an opportunity to identify forms of support that play an important role in creating the conditions for rational land use. Our research presents the effects these changes in legislation and financial support have had on energy plantations.

Keywords: woody energy plantation, law, subsidy

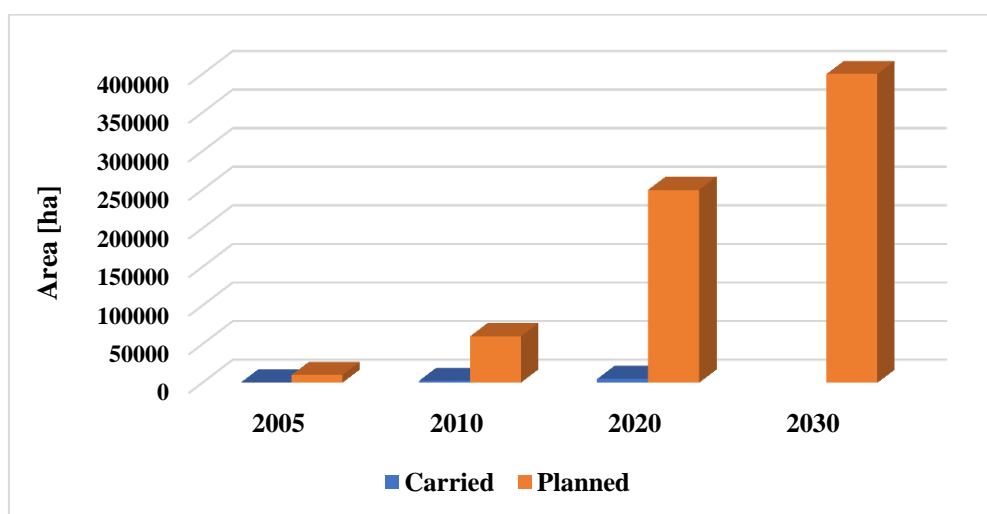
### 1. INTRODUCTION

In addition to conventional biomass, there is an increased need for plants grown specifically for energy purposes to meet the growing demand for energy and to reduce dependence on fossil energy sources.

The National Energy Strategy 2030 proposes a two-pole agriculture in Hungary with the establishment of an incentive and support system that allows for biomass cultivation for energy purposes. The energy sector can efficiently integrate raw material such as dendromass from woody energy plantations, which currently plays the most important role in the renewable raw material supply of power plants and heating plants. Nevertheless, dendromass cultivation must avoid conflict with food and feed crop cultivation and is only feasible if it meets sustainability criteria. In light of this, emphasis should be placed on woody energy plantations because they can be cultivated on arable fields according to Decree 135/2017 (VI.9.). The literature supports establishing woody energy plantations on low-quality agricultural areas with the provision of appropriate tree species selection and careful soil preparation [1]. Examples of low-quality agricultural areas include drought and flood-affected areas, abandoned grasslands with shallow crop layers, and areas prone to erosion and deflation [2][3][4].

Moreover, experiments have proven that mining areas awaiting re-cultivation and denominated areas affected by red sludge pollution are also appropriate for short-rotation woody energy plantation cultivation [5][6][7]. According to some researchers, poplar and black locust plantation yields can attain a maximum 3-4 t / ha / year in these areas; other research proves average yields or higher are possible with some tree species [8][9][10][11]. Energy plantation legislation, including the obligation to prepare forest site exploration and related expertise, becomes important in this regard. These measures ensure the choice of appropriate tree species / variety to be planted in the area. The cultivation of woody energy plantations plays a significant role in reducing greenhouse gas emissions in the energy sector [12][13].

The economics of woody energy plantations are questionable [14]; therefore, planned intensive plantation establishment has been lacking in the past. Prior to 2005, woody energy plantation experiments were conducted on 50-60 hectare plots. Planting 5-10 thousand ha of short rotation coppice as planned in 2005-2006 would have resulted in approximately 60,000 hectares of woody energy plantations by 2010 [15]. The Thesis of New Hungarian Energy Policy [15] recommends the forest area be expanded with energy plantations in the period of 2012-2030, which implies the necessity of the planting of 210-230 thousand ha of energy plantation. Marosvölgyi (2005) claims 150 thousand ha of woody energy plantation can be planted [16]. Gockler (2010) calculates 100-250 thousand, but states up to one million ha woody energy plantation can be established by 2020 [17]. Garay et al. (2012) puts this number at 200 thousand ha while Scultety and Seiffert (2009) estimate 300-400 thousand ha of woody energy plantations in Hungary in the long term [18][19]. Over the past few years, the trend toward the realization of the planned plantation areas has been decreasing (Figure 1.)



*Figure 1. Implementing woody energy plantation compared to planned projections [15][17][19][20]*

## 2. MATERIALS AND METHODS

Woody energy plantation data in Hungary have been available since 2009. We evaluated previous research by comparing it to the available literature. We then contacted the Forestry Directorate of the National Food Chain Safety Authority (hereinafter referred to as the NÉBIH) to acquire current data. With the data provided, we assessed the situation of woody energy plantations for the period 2009-2018.

The official statistical data provided indicates a smaller area of woody energy plantations than practitioners report. Nevertheless, the data processing from official sources was part of this research. Initial regulations concerning woody energy plantations came into effect in Hungary in 2007.

The present study comprises a survey, analysis, evaluation and the conclusions drawn regarding the legal background from 2007 to the present. The financial opportunities to support solid biomass utilization are many, but the currently available sources of support are extremely limited.

This study reviews the background of the direct and indirect support possibilities of woody energy plantations with the help of the available plans, action programs, legislation, and websites.

## 3. RESULTS AND DISCUSSION

### 3.1. Legal background for woody plantations

Legislation did not address woody energy plantations before 2007, which lead to the modification of the 1996 LIV. Act (Forest Act). Consequently, woody energy plantations are separated from “traditional” forests. Article 4 (2) (h) of the New Forest Act (Act XXXVII of 2009 on Forestry, Forest Protection and Forest silviculture) states: “The force of this Act shall not extend to woody crops grown for energy purposes plantations established under separate legislation.

The authorization of woody energy plantations, sometimes accompanied by a subsidy case, became an official act after 2007. Decree 71/2007 (IV. 14.) addresses woody energy plantations and supplies the authorization for the establishment of woody plantations.

The decree states, “Woody energy plantation is a plant for bio-energy cultivation, it can be plant with specific species or variety according to the specific law with an area of more than 1500 m<sup>2</sup>”.

The law distinguishes coppicing (cutting cycle: max. 5 years) and roundwood tree plantation (cutting cycle: up to 15 years). The Forestry Authority has already supplied the official tasks connected to the planting and ceasing. The planting of the woody energy plantation can only be carried out under license.

The 45/2007 (VI. 11.) Decree issued by the Ministry of Agriculture provides details for the authorization, planting, cultivation, and ceasing of woody energy plantations as well as the administrative service fees for these procedures. The legislation concerns the requirements for the quality of planting material in § 1 of the law: “Certified propagation material generated by a licensed producer can be used.” Annex 1 of this Decree contains a list of the basic species authorized in Hungary, which are presented in Table 1.

The above-mentioned legislation also states that coppiced woody energy plantation can only be applied to poplar, willow, and black locust. A plant species owner must supply a certificate to plant poplar and willow plantation. With black locust, farmers must apply to the Forest Research Institute for a certificate.

The certificate must contain the ideal site conditions to plant the species and variety. Planting black locust (*Robinia pseudoacacia*) in protected natural areas and in the Natura 2000 area is prohibited.

An analysis of the relevant legal background revealed the legislation overregulated the planting regulations for coppicing technology and neglected roundwood technology, which appeared in the legislation as a concept only. At the same time the legislation did not mandate site surveys and related evaluations; nevertheless, both are crucial for planting because they can be used to select the tree species and the variety to be planted in a given area.

Government Decree 135/2017 (VI.9.) was passed by merging and simplifying two older laws concerning woody plantations. In the following, we highlight the key elements of the legislation. According to the “new” regulation, woody plantations can be established from basic species specified in the annex to the Act (Table 1).

The woody energy plantation are classified according to the new Hungarian law:

- rolling energy plantation: there are kept up to 20 years, intended for energy recovery;
- coppicing energy plantation: there are at most 5 years of rotation, intended for energy recovery;
- woody industrial plantation: for the production of wood raw material. The “energy” aspect has disappeared from the name of the decree and an important point has been added to the base material production, up to now mostly for energy purposes, namely, industrial woody plantations for the production of wood raw material.

The number of the usable species has not changed over the last ten years, but the number of varieties has increased slightly (Table 1).

Table 1. List of permitted basic species that can be planted in Hungary

45/2007 (VI. 11.) Decree	135/2017 (VI. 9.) Decree
Black poplar / <i>Populus nigra</i> / Grey poplar / <i>Populus x canescens</i> / Trembling poplar / <i>Populus tremula</i> / White poplar / <i>Salix alba</i> /	Poplar species / <i>Populus</i> spp./
Water willow / <i>Salix viminalis</i> /	Water willow / <i>Salix viminalis</i> / White willow / <i>Salix alba</i> /
Black locust / <i>Robinia pseudoacacia</i> /	Black locust / <i>Robinia pseudoacacia</i> /
Common alder / <i>Alnus glutinosa</i> /	Common alder / <i>Alnus glutinosa</i> /
Common ash / <i>Fraxinus excelsior</i> /	Common ash / <i>Fraxinus excelsior</i> /
Narrow-leaved ash / <i>Fraxinus angustifolia</i> /	Hungarian ash / <i>Fraxinus angustifolia danubialis</i> /
Red oak / <i>Quercus rubra</i> /	Red oak / <i>Quercus rubra</i> /
Black walnut / <i>Juglans nigra</i> /	Walnut species / <i>Juglans</i> spp./
Norway maple / <i>Acer platanoides</i> /	Norway maple / <i>Acer platanoides</i> /

The list of basic species should be updated and expanded. Since 2007, there have been ongoing experiments with other species including empress, ailanthus, elm, false indigo bush, and Manitoba maple; however, the planting of any of these species is only permitted under the experimental plantation category. The Decree also provides that woody plantations can only be established in areas of at least 5,000 square meters. This is larger than the 1,500 m<sup>2</sup> area defined in the 2007 legislation. Planting woody energy plantations can be decisive in reducing energy poverty and increasing rural employment [21][22][23]. This is especially true for non-contiguous fallow fields.

Machine cultivation and harvesting is only worthwhile in short rotation energy tree plantations that exceed a few hectares; manual work proves more efficient than machines in smaller plantations [24].

In addition, the high energy demand of machine decreases the total energy balance. The energy demand of feller-chopper machines is nearly twice as high as the energy demand of the manual harvesting [25] thereby increasing the amount of harmful emissions during the maintaining of plantation [26].

Technology of most machinery needed for plantation harvesting can be found first of all in the forest management, which necessitates the development of the machines for farmers who often only rent the machines required. The cost of both is significant. Compared to the previous legislation, the maximum maintenance period of the plantations, increased from 15 to 20 years. This gives greater security for power plants in the raw material supply and offers the possibility of long-term contracts with farmers.

A new element has appeared in the Government Decree: "The presentation of the site conditions of the land to be planted and the appropriateness of the suitability of the wood species to be applied with the data content according to the description of the place of production according to the specific legislation on the exploration of the forest production site". If we apply this term, it will lead to planting species/variety appropriate to specific sites.

### 3.2. Support system of woody energy plantations

The following forms of financial support have been introduced for woody energy plantations:

*Additional support of energy crops was regulated by 33/2007 (IV.26.) Decree of Ministry of Agriculture. The following restriction has been introduced by this regulation: "The rate of area based additional support for energy crops production will be determined according to the procedure which was laid down in Article 89 of Regulation (EC) No 1782/2003, which may not exceed EUR 45/ha."*

The 72/2007 Ministry of Agriculture (VII.27.) Decree described the detailed conditions for the use of financial support from the European Agricultural Rural Development Fund for short rotation coppices planting. This non-refundable financial support could be used for planting until the first harvest. Farmers are only eligible for this aid if the farm size concerned exceeded 4 European Size Units (ESU). The size of the smallest eligible parcel is 1 ha. The maximum amount of financial support is 375,000 EUR per application. The maximum rate of aid is 40% of the total eligible expenditure for all investments, which is increased to 50% for young farmers or if the planting was completed in low-quality agricultural areas, and 60% if both of the two previously mentioned criteria are applicable.

The eligible expenditures were as follows: area preparation, nutrient supply, procurement, storage and installation of planting material, annual maintenance according to the planting stock until the first harvest, fencing, and pavement design. It is important that the producer should have a pre-contract for the purchase of wood chips for at least 5 years after installation. Financial support requests of 15 million HUF or more required a completed business plan. For one table, support cannot exceed

- HUF 160 thousand/ha for black locust planting;
- HUF 200 thousand/ha for non-robinia species planting with coppicing technology allowed by 45/2007 (VI. 11.) Ministry of Agriculture Decree.

The New Hungary Rural Development Program (2007-2013) (hereinafter: NHRDP) also supported the cultivation of woody and herbaceous plants. The NHRDP based on Article 15 § (1) of Council Regulation (EC) No 1698/2005 for support of rural development from the European Agricultural and Rural Development Fund. Within the NHRDP, there were four development areas (axes): the first axis pertained to improving the competitiveness of food processing and the agricultural and forestry sector. One of its sub-axes provided support for the installation of short rotation woody energy plantations.

The Environment and Energy Operational Program (2007-2015) (hereinafter: KEOP) gave priority to support biomass use: “The aim is to support biomass projects for energy production connecting to development of agriculture, primarily based on energy crops and agricultural waste” (KEOP, 2007). This support structure contributed indirectly to the planting of woody energy plantations.

The Green Investment Scheme (ZBR) was the most radical support system for reducing carbon emissions in Hungary. The program only supported activities that reduce greenhouse gas emissions to the greatest extent. The ZBR system also “indirectly” supported the planting of woody energy plantations, for example, to cover the energy needs of wood chip-fuelled boiler in a settlement from a plantation. Farmers are eligible for the current Single Area Payment (SAPS) if they have legal land use on 16 June of the current year and have an agricultural area that meets the following conditions:

- used for agricultural activities or
- mainly used for agricultural activities

SAPS support is available only for eligible area reaching 1 hectare. The eligible area of the planned parcel per claim area unit must be 0.25 hectare. Only a single area payment application is eligible on the same noted parcel.

The 51/2017 (X. 13.) Ministry of Agriculture Decree provides for the establishment of 2017 agricultural subsidy amounts. The amount of the single area payment based on the 5/2015 (II. 19.) Ministry of Agriculture Decree is HUF 227,830,155,170. The eligible area is up to 4,966,738 hectares. An advance payment of up to HUF 32,110 per hectare has been available since October 16, 2017.

From 2015 onward, farmers who receive a single area payment and submit a single application in the current year must comply with climate and environmentally-friendly agricultural practices (greening). The (EU) No 1307/2013 and the 10/2015 (III.13.) Ministry of Agriculture Decree regulate the requirements. The aims of the greening is to preserve existing environmental/natural values and climatic conditions. The amount of support for greening is ~ € 81 per hectare, which is an annual, non-refundable grant.

In the case of direct aids, the area-related reduction (digressive) system should be applied, as set out in 5/2015 (II.19.) Ministry of Agriculture regulation. If the annual amount of SAPS exceeds EUR 150,000, a 5% deduction will be applied. More than 176,000 SAPS support will be fully decommissioned, see Table 2.

*Table 2. Greening and SAPS support amounts [27]*

SAPS support [€]	Supported area [ha]	Sum of SAPS [€/ha]	SAPS withdrawal (degression) [%]	The rate of SAPS per hectare [%]	The rate of greening per hectare [%]
≤150,000	≤~1048	~143	0	100	100
150,000-176,000	~1048~1230	~136	5	95	100
>176,000	>~1230	0	100	0	100

The total amount of support is HUF 125 billion and the eligible area is up to 4.9 million hectares. Since October 16, 2017, advance payment amounts may not exceed HUF 17,643 per hectare. The regulations set out three practices that must be fulfilled to pay for greening. One of these is that farmers with over 15 hectares of arable land should have an ecological target area of 5% of their arable land. These areas are also referred to as ecological focus areas (EFA). A short rotation woody energy plantation can be eligible as an EFA area if they are free of fertilizers and pesticides. Additionally, only the ten tree species defined by law can be planted.

The “VP5- 8.1.1-16 Support for Afforestation” (2016-2019) application is a non-refundable grant of EUR 1.640-2.216 per hectare for the establishment of an industrial woody plantation. Furthermore, optional additional activities include the establishment of electric fences (4.8 EUR/m) and fences (5.8 EUR/m) if appropriate conditions are met. The smallest eligible area with the crown area is 0.5 hectares. With industrial woody plantations, the requirement to pay the subsidies exist. This requirement is the sale of more than 50% of the timber production for industrial purposes within, at the latest, 20 years. In the announcement, special attention is drawn to the range of ineligible activities, including the establishment of woody and short rotation plantations for energy purposes.

### 3.3. Impact of changes in legislation and support on plantations

According Forestry Directory of NÉBIH data, the size of plantations established in Hungary is 4,351 ha. The majority, about 80%, of these plantations are poplar because this species is the most suitable for utilizing the available areas [28]. Willow accounts for 7.4% of the total area of plantations and 7% of robinia plantations. With regard to cultivation technology, the majority of plantations have a coppicing technology, because the former legislation has advocated of planting of willow, poplar and robinia species in a coppicing mode.

Earlier practice shows a number of plantations that were unreported the Forestry Directory of NÉBIH. Consequently, these did not appear on the register. Conversely, many discontinued plantations still appear on the register [25]. In an effort to avoid this in the future, the forest authority must be informed about the harvesting and elimination of woody plantations using the NÉBIH standard form according to the 135/2017. (VI. 9.) Government Regulation.

The economical planting and maintenance of energy plantations can only be realized in areas with favourable habitat conditions [29]. However, in recent years willingness to establish plantations in these areas has dropped due to the lack of support schemes. Between 2007 and 2013, financial support (additional for energy crops) offered through the 72/2007 (VII. 27.) Ministry of Agriculture Decree (ÚMVP) encouraged farmers to plant. With the lack of support and the appearance of the draft for the support of industrial plantations in 2016, energy plantation planting was barely realized (Figure 2).



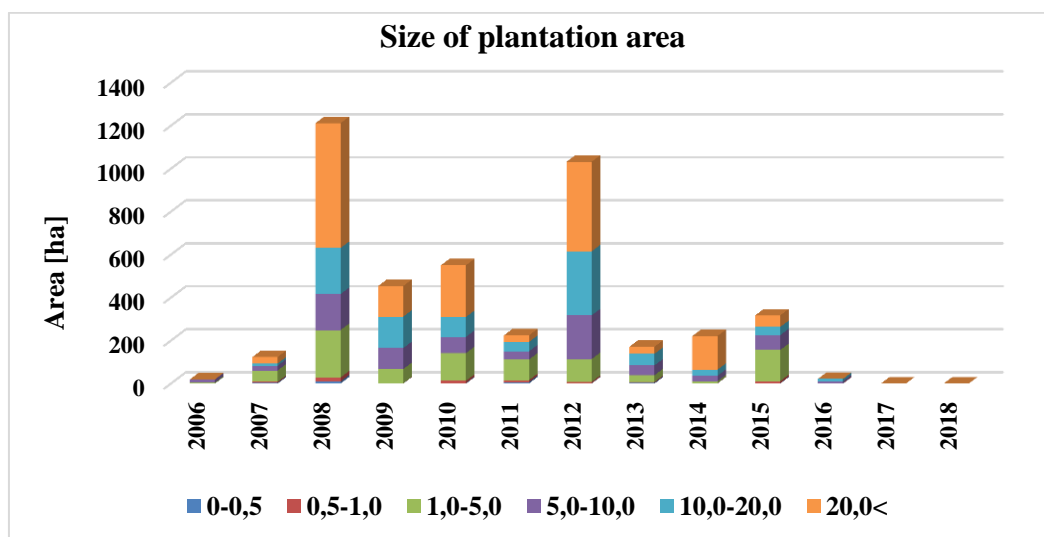


Figure 2. Area of established plantations [ha] depending on available support [based on the data of NÉBIH]

A look at the size sharing of the plantations reveals they also follow the requirements of the supports. The 72/2007 (VII. 27.) Ministry of Agriculture Decree only provided support for plantations over 1 ha. As a result, planting areas increased from between 1.0–5.0 ha. This shows farmers most often choose the smallest planting area, which is already possible according to the support form, in some cases the medium (5-10 ha) plantations, see Fig. 3. The small planting area choose is primarily due to the minimization of risk factors. Occasionally, after a successful planting, the farmers were more courageous in establishing further plantations.

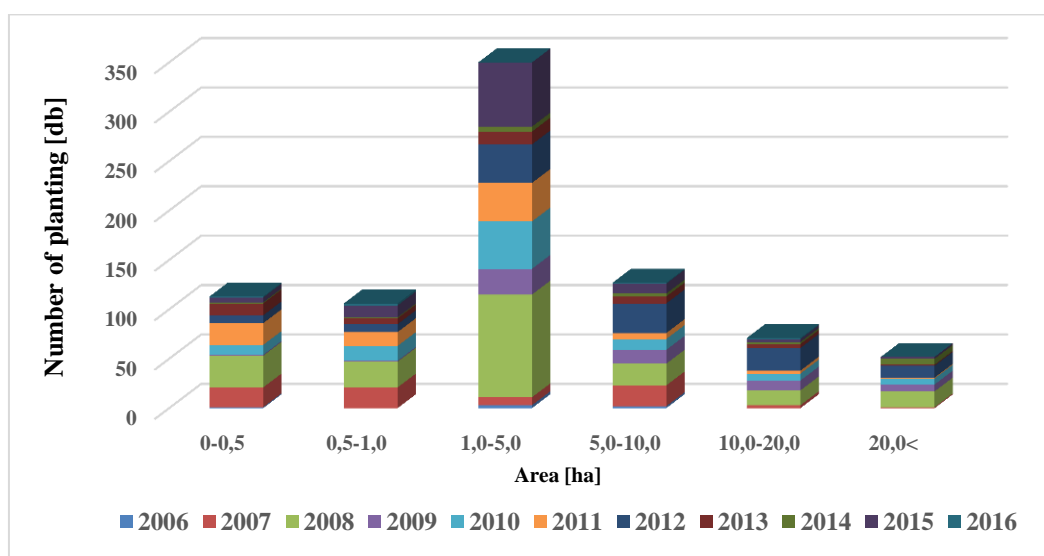


Figure 31. Number of plantation establishments depending of typical size [based on the data of NÉBIH]

From the perspective of economical machine utilization, the optimum plantation size can be a few dozen hectares, which do not have to be connected in all cases. Additionally, they do not have to belong to a same owner, but need to be fit into an integration system for economic reasons [30]. Therefore, we also examined the size of the total area of plantations belonging to each settlement.

The results give a far more favourable picture of a potential investment project. Plantations of under 10 ha exist near 77 settlements; plantations between 10-50 ha, near 47 settlements; and plantations over 50 ha, near 22 settlements. The settlements with outstanding plantations size are located mainly in Veszprém and Baranya counties, both of which have a purchaser (large power plants). Plantation near secure markets can be operated economically [25].

The average purchase price of the wood chips from plantations is 20,000 HUF/odt, which was the price Pannon Power Plant paid last year [29]. According to Posza (2018), in addition to the actual incurred costs, the cost of the raw material production is higher than the transfer price, apart from the various possible support and land rent [29].

Nonetheless, there is an interest in the district of large power plants without support. Only two power plants in the country have had plantations established near them since 2012, as shown in Figure 4.

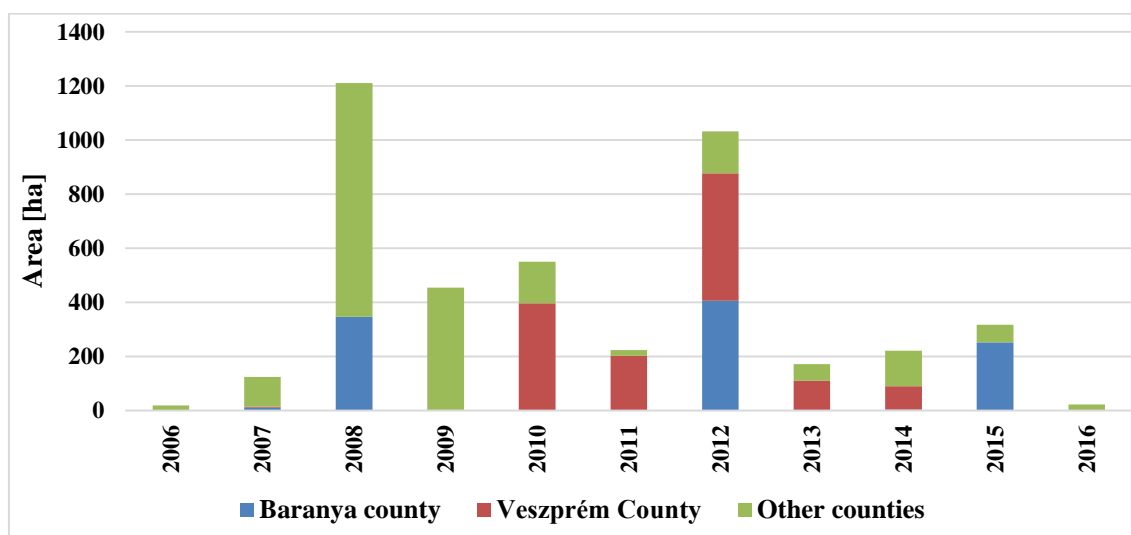


Figure 4. The size of plantations in counties with high buying capacity [based on the data of NÉBIH]

The first and most important aspect during plantation planning is to select a site with a high local feedstock.

## 4. CONCLUSIONS

New legislation addresses woody energy plantations in a more transparent manner and establishes a new plantation category. In some cases, the cutting cycle has been lengthened. Site exploration and the related expert consulting has been made obligatory before planting, and the list of usable wood species has been expanded. The recent changes, which have eliminated the direct and indirect support of short rotation coppices (SRC), leaving only area-based and greening-related support, has significantly reduced the willingness of farmers to establish SRC in Hungary. The support of roundwood plantations for industrial purposes, which have been available since 2016, did not increase farmer willingness to plant, as NÉBIH. At the same time, plantations were established close to the secure markets with buyers like Pannon Power



Plant and Bakonyi Power Plant because the wood chips from plantations play a significant role in the supply of raw materials to power plants.

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## Laws (in Hungarian)

1996. évi LIV. törvény az erdőről és az erdő védelméről (hatályon kívül helyezve)

2009. XVII. törvény az erdőről, az erdő védelméről és az erdőgazdálkodásról (hatályon kívül helyezve)

71/2007. (IV. 14.) Korm. rendelet a fás szárú energetikai ültetvényekről (hatályon kívül helyezve)

A 45/2007. (VI. 11.) a fás szárú energetikai ültetvények telepítésének engedélyezése, telepítése, művelése és megszüntetése részletes szabályairól, valamint ezen eljárások igazgatási szolgáltatási díjáról szóló FVM rendelet (hatályon kívül helyezve)

33/2007. (IV.26.) FVM rendelet az Európai Mezőgazdasági Garancia Alapból az energetikai célból termesztett növények termesztéséhez nyújtható kiegészítő támogatás igénybevételének feltételeiről (hatályon kívül helyezve)

72/2007. (VII. 27.) FVM rendelet az Európai Mezőgazdasági Vidékfejlesztési Alapból a rövid vágásfordulójú fás szárú energiaültetvények telepítéséhez nyújtott támogatás igénybevételének részletes feltételeiről

51/2017. (X. 13.) FM rendelet az egyes agrártámogatások 2017. évi összegeinek megállapításáról

5/2015. (II. 19.) FM rendelet az Európai Mezőgazdasági Garancia Alapból finanszírozott egységes területalapú támogatás, valamint az ahhoz kapcsolódó átmeneti nemzeti támogatás igénybevételével kapcsolatos egyes kérdésekről

10/2015. (III.13.) FM rendelet az éghajlat és környezet szempontjából előnyös mezőgazdasági gyakorlatokra nyújtandó támogatás igénybevételének szabályairól, valamint a szántóterület, az állandó gyepterület és az állandó kultúrával fedett földterület növénytermesztésre vagy legeltetésre alkalmas állapotban tartásának feltételeiről

135/2017. (VI.9.) Kormányrendelet a fás szárú ültetvényekről