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Fire Hazard: Undesirable Ecosystem Function of Orchard Vegetation

Jan Winkler [1], Markéta Ježová [1], Radek Punčochář [1], Erika Hurajová [1], Petra Martínez Barroso [2], Tomáš Kopta [3], Daniela Semerádová [4,5] and Magdalena Daria Vaverková [2,6,*]

[1] Department of Plant Biology, Faculty of AgriSciences, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic
[2] Department of Applied and Landscape Ecology, Faculty of AgriSciences, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic
[3] Department of Vegetable Growing and Floriculture, Faculty of Horticulture, Mendel University in Brno, 613 00 Brno, Czech Republic
[4] Global Change Research Institute, Czech Academy of Sciences, Bělidla 986/4a, 603 00 Brno, Czech Republic
[5] Department of Agrosystems and Bioclimatology, Faculty of AgriSciences, Mendel University in Brno, Zemědělská 1, 613 00 Brno, Czech Republic
[6] Institute of Civil Engineering, Warsaw University of Life Sciences—SGGW, Nowoursynowska 159, 02-776 Warsaw, Poland
* Correspondence: magdalena.vaverkova@mendelu.cz; Tel.: +420-545-132-484

Abstract: Fires will become an increasingly frequent perturbation even under the conditions of the mild climate zone and will interfere with the agricultural landscape. Fire is a natural phenomenon, and depending on ecosystems, vegetation may develop and contribute to the occurrence and spread of fire. Vegetation of the *sour* cherry orchard located in the climatically dry conditions of the South Moravian Region, Czech Republic (CR), was evaluated. Vegetation assessment was performed using phytocenological relevé. In each variant, 10 relevé were recorded. Coverage of the found species was estimated directly in percentages. Moreover, the maximum height in the stand was measured for each type of plant. Biomass of individual plant species was calculated, using the biomass index (*IB*) equation. The *IB* values of individual plant species in the treatments were processed by employing a multidimensional analysis of the ecological data. Different vegetation management practices in an orchard change the species diversity of the vegetation and thus the fire hazards in the orchard conditions. Grassy interrow has the most grass biomass during the entire vegetation season, and therefore represents the greatest hazard and spread of fire. The most important grasses include *Arrhenatherum elatius*, *Dactylis glomerata*, *Festuca pratensis*, *Lolium perenne*, and *Poa pratensis*. On the contrary, bare soil conditions in the interrow are most suitable for annual species, and this is the place with the highest changes in the number of species during the growing season. Biomass of the orchard vegetation combined with dry and warm weather increases the fire hazard. Annual and perennial grasses have very good potential for the production of biomass, which increases the hazard of fire. The nature of the vegetation in the orchards has the potential for the actual start of a fire and its subsequent spread, however, under other environmental conditions. During hot and dry weather, dead biomass may accumulate resulting in increasing the hazard of large wildfires. Varied orchard management practices lead to a higher diversity of vegetation and make orchards, islands of biodiversity in the agricultural landscape.

Keywords: fire; vegetation; orchard; ecosystem functions

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1. Introduction

Agricultural practices in orchards have a large impact on a number of agroecosystem functions [1–3]. Vegetation management can change biotic interactions in an orchard between fruit tree pests and their natural enemies and can also limit nitrogen leaching and change the water regime [3,4], which is essential for the functioning of the orchards. Water stress can reduce fruit size and quality [5–7]. Moreover, the timing of the water stress is important, if it occurs in late spring and early summer, it can impact fruit set and growth negatively [8–10].

Interrow soil management in fruit orchards is especially important for the water regime [11–13]. The widespread use of pre-emergent herbicides results in bare soil, which reduces infiltration and increases water runoff [3,14]. However, grassing the interrow soil of an orchard has been found to reduce yield and tree growth due to competition for nutrients and water between grasses and fruit trees [12,15,16]. For this reason, the technique called "sandwich" (developed in Switzerland) is recommended. It consists of alternating cultivated and grassy interrow strips, especially in areas with poor rainfall [17–19].

Competition of vegetation with fruit trees is a critical vegetation management issue [18–21]. Common and traditional methods of control include mowing. Though mowing the vegetation controls the growth of plant species, it is insufficient for their eradication in the case of perennial weed species. On the contrary, it can contribute to strengthening their root system, thus supporting their dominance, and increasing their competition. In addition, if plant biomass is used as mulch, in the case of young plantings, farmers risk large yield losses due to mulch competition for water [22]. Therefore, the combination of frequent mowing and the application of herbicides (chemical control) is very common for controlling vegetation in fruit orchards as an effective way of vegetation control [23–25].

High efficiency of chemical control raises concerns about the increasing occurrence of tolerant populations in perennial weeds, e.g., observed in *Taraxacum officinale* Weber ex F.H. Wigg. and *Trifolium* spp. [26–28]. In addition to this concern, there is increasing consumer demand for a reduction in agrochemicals. These trends force fruit growers to look for alternative ways of vegetation control. Besides weed control, mulch can maintain soil quality, support orchard biodiversity, and reduce nutrient leaching [18,19,25,29,30]. However, the use of mulch may not be sufficient in the case of the use of certain types of rootstocks of fruit trees due to the development of perennial weeds [31]. Orchard vegetation performs a number of ecosystem functions that are often studied in a number of scientific works [11,32–34]. However, one function has been neglected, namely the function of vegetation in case of occurrence and spread of fires. Accumulated dead biomass of different types of plants in the orchard combined with dry and warm weather increases the hazard of fires. Fires have recently become a major problem in many areas globally [35,36]. Many studies show that the frequency of fires has been exacerbated by climate change as well as by other factors such as fire suppression measures, management of urban and agricultural vegetation, afforestation, and the abandonment of rural areas [37–40]. Fire hazard assessment is based on the physical features of combustible materials, including vegetation biomass. The presence of biomass of grasses, which have a high calorific value (higher than 17,000 MJ·kg), increases the hazard of occurrence and subsequently rapid development of fire [41].

As extreme weather has become more frequent in the Czech Republic (CR) recently, natural catastrophes such as floods, droughts, and wildfires strike correspondingly. A case in point is the summer of 2022 when a fire broke out in the Bohemian Switzerland National Park in the CR, marking it as one of the worst forest fires in the history of Czech history. While the scientific literature and media generally focus on forest fires, agricultural field fires also have had a significant economic impact over the past few years in the CR. According to the official records (Fire Rescue Service of the CR, 2020), over 600 fires occurred in the CR agricultural areas in 2019. Furthermore, among the recorded fires, 140 cases were caused by the self-ignition of crops in 2019 [42].

This study deals with the evaluation of the species structure of the sour cherry orchard vegetation under the climatically dry conditions of the CR owned and managed by the School Farm Žabčice (Mendel University in Brno). The aim of the study was: (i) to evaluate the composition of the vegetation associated with different management of the vegetation in the orchard; (ii) to identify plant species and groups of species that are tolerant to individual management methods; and (iii) to indicate the fire hazard caused by the accumulation of vegetation biomass under different management conditions. It was hypothesized that: (1) The composition and amount of vegetation biomass in the orchard will vary under different management conditions, which will affect changes in the hazard of fire; (2) the vegetation management practices change the species diversity of vegetation and thus the hazard of fire hazards in orchard conditions.

2. Materials and Methods

2.1. Characteristics of the Territory

The area of interest (Figure 1), where the vegetation of the sour cherry orchard was evaluated, is located in the cadastral territory of the municipality of Žabčice (South Moravian Region, CR; coordinates GPS: 49.0132389° N, 16.5925986° E).

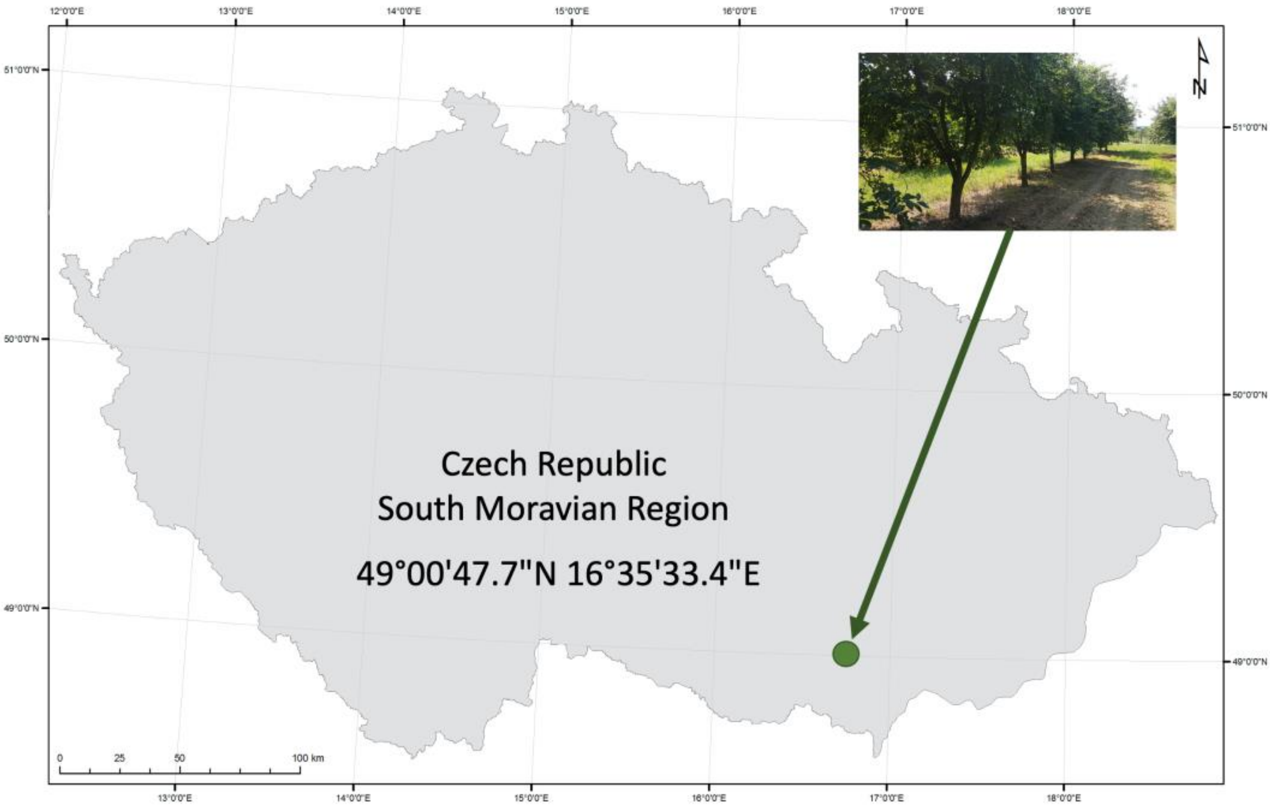

Figure 1. Location of the study area where vegetation of the sour cherry orchard was evaluated.

The *sour* cherry orchard is owned and managed by the School Farm Žabčice (Mendel University in Brno). The area of interest lies in the Graben Dyjsko-Svratecký basin, which rests mainly by Neogene sediments. The geological formation is composed of Quaternary gravels and partly of alluvial sediments. The soils here are neutral to moderately acidic with a lack of humus. The land contains black soil with a total skeleton content of up to 25%. The soil profile is deep to medium deep and consists mainly of sandy soils. The land is flat with an average altitude of 186.69 m above sea level. The long-term (years 1991 to 2020) average annual temperature is 9.2 °C and the long-term average annual rainfall is 481 mm. The data come from the Meteorological Station of the *Department of Agrosystems* and Bioclimatology—Žabčice, Mendel University in Brno. Drought in the area is caused by the uneven distribution of rainfall, drying winds, and rain shadow [43].

2.2. Characteristics of the Sour Cherry Orchard

The orchard is in the conventional farming mode. This regime allows the use of herbicides for vegetation control. The 'Fanal' and 'Morela late' varieties of sour cherries are cultivated here. The orchard was established in 2005 on an area of 6.86 hectares. The *sour* cherry orchard has no irrigation, spacing of the trees is 12 × 4 m.

Three methods of vegetation management are applied within the orchard: (a) interrow with bare soil (Bare soil)—in the interrow the soil is regularly mechanically processed during the vegetation, and biomass of the vegetation is incorporated into the soil; (b) grassy interrow (greening)—in the interrow, there is a green strip that was not sown but was created by spontaneous succession, vegetation is mowed twice a year and biomass is taken away; (c) strip under trees (under trees)—the area is directly under the *sour* cherry trees around the trunk, vegetation is maintained here by chemical control and by mulching. Rows of trees are separated from each other by interrow. Bare soil regularly alternates with the greening in the interrow (Figure 2).

Figure 2. Orchard and three methods of vegetation management: (**a**) bare soil; (**b**) greening; (**c**) under trees.

2.3. Methodology of Evaluation of the Vegetation

Vegetation assessment was performed using the method of phytocenological relevé. Observation took place in the period of 2014 and 2015, each year in three terms (April, June, October). In each variant, 10 relevé were recorded, and their area was 2 × 4 m. The relevé were always recorded at the same location. Coverage of the found species was estimated directly in percentages. Furthermore, the maximum height in the stand was measured for each type of plant. Biomass of individual plant species was calculated, using the equation for the Biomass Index (*IB*), (Equation (1)):

$$IB = c \times hm \quad (1)$$

where *IB* is the biomass index given in % m, *c* (%) is the percentage of coverage, and *hm* is the maximum height measured in meters [40].

Plant species were divided into groups according to biological features (annual dicots, annual monocots, perennial dicots, perennial monocots). Scientific names of the identified plant species were taken from the Pladias Database of the Czech Flora and Vegetation [44].

The *IB* values of individual plant species in the treatments were processed by employing a multidimensional analysis of the ecological data. The first method was the detrended correspondence analysis (DCA), which provided the gradient length. DCA is a technique to summarize environmental changes over time and organize environmental data. Response data are compositional and have a gradient of 3.0 of the standard deviation (SD), i.e., a linear method is not appropriate. Further statistical evaluation was then conducted using the canonical correspondence analysis (CCA), where the time factors (i.e., month and year) were incorporated into the analysis as a covariate to avoid pseudo-replication. This shows the association between the selected factors (vegetation management). Multivariate analyses explain the relationship between the explanatory variables, and the relationship between the plant species found. This analysis was aimed at determining associations between vegetation composition and different types of vegetation management practices. Statistical significance was further established using the Monte Carlo test, where 999 permutations were calculated. *IB* data were processed using the Canoco 5 [45].

Average water retention of the soil profile (AWR1) and normalized difference vegetation index (NDVI) were used to assess soil moisture and state of vegetation in the Žabčice location in 2014 and 2015. The SoilClim model provides information about current and reference evapotranspiration, and about the water content in the soil expressed as the average saturation of the soil profile with water. The soil moisture content values were recorded at 7-day intervals in the study location. The SoilClim model monitors the soil profile to a depth of 40 cm (topsoil). The core of the system is a dynamic model of soil water content [46,47]. This model is based on the work of Allen et al. [48]. An important role in assessing the impact of a potential drought episode on vegetation is played by satellite data databases (especially the NDVI of the state of vegetation) from the Aqua and Terra satellites. NDVI values provide information about the state of vegetation and can be used, among other things, to indicate places with physiological stress (e.g., as a result of a lack of moisture). NDVI values were used for our study location at a weekly interval.

3. Results

During the two-year monitoring, 79 plant taxa were found. The highest number of species for the different management of vegetation was found in the Greening interrow, and perennial plant species predominated here. Annual plant species predominated in the strips at trunks and in the interrow with Bare soil. During the period of monitoring, significant changes in the number of species for the different management of vegetation in the interrow with Bare soil were recorded. On the contrary, only minor changes in the number of species for the different management of vegetation were detected in the Greening interrow. Distribution of taxa into the groups according to the CCA analysis is presented in Table 1. Numbers of plant species and changes in the number of species for the different management of vegetation are presented in Figure 3.

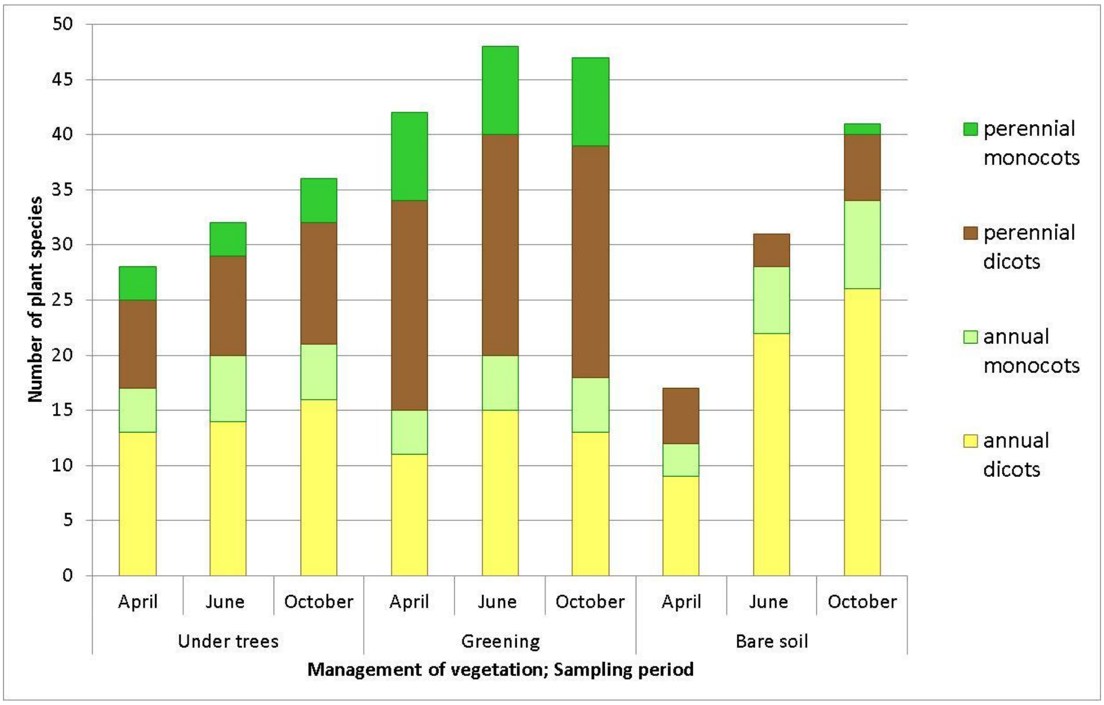

Figure 3. The number of plant species at different management and monitoring dates in the orchard.

Table 1. Groups of plant species according to CCA analysis.

Management Preference	Group of Species	*Taxa of Plants (Abbreviations)*
Greening	Annual dicots	*Geranium pusillum (GerPusi), Polygonum aviculare (PolAvic), Veronica arvensis (VerArve).*
	Perennial dicots	*Achillea millefolium (AchMill), Artemisia vulgaris (ArtVulg), Carduus acanthoides (CarAcan), Cichorium intybus (CicInty), Cirsium arvense (CirArve), Conyza canadensis (ConCana), Echium vulgare (EchVulg), Eryngium campestre (EryCamp), Falcaria vulgaris (FalVulg), Plantago major (PlaMajo), Potentilla argentea (PotArge), Reseda lutea (ResLute), Rumex acetosella (RumAcet), Silene latifolia (SilLati), Tragopogon pratensis (TraPrat), Trifolium repens (TriRepe).*
	Perennial monocots	*Arrhenatherum elatius (ArrElat), Dactylis glomerata (DacGlom), Elytrigia repens (ElyRepe), Festuca pratensis (FesPrat), Lolium perenne (LolPere), Poa pratensis (PoaPrat).*
Greening + Under trees	Annual dicots	*Capsella bursa-pastoris (CapBurs), Erigeron annuus (EriAnnu), Erodium cicutarium (EroCicu), Holosteum umbellatum (HolUmbe), Lycopsis arvensis (LycArve), Veronica polita (VerPoli).*
	Perennial dicots	*Glechoma hederacea (GleHede), Medicago lupulina (MedLupu), Taraxacum sect. Taraxacum (TarSect).*
	Annual monocots	*Bromus hordeaceus (BroHord), Bromus sterilis (BroSter), Bromus tectorum (BroTect).*
	Perennial monocots	*Festuca rubra (FesRubr).*
Under trees	Annual dicots	*Arenaria serpyllifolia (AreSerp), Epilobium adenocaulon (EpiAden), Filago arvensis (FilArve), Fumaria officinalis (FumOffi), Lactuca serriola (LacSerr).*
	Perennial dicots	*Bryonia alba (BryAlba), Plantago lanceolata (PlaLanc), Rosa canina (RosCani).*
	Annual monocots	*Digitaria sanguinalis (DigSang), Hordeum murinum (HorMuri).*
	Perennial monocots	*Festuca ovina (FesOvin).*
Under trees + bare soil	Annual dicots	*Chenopodium album (CheAlbu), Chenopodium pedunculare (ChePedu), Chenopodium strictum (CheStri), Lamium amplexicaule (LamAmpl), Lamium purpureum (LamPurp), Stellaria media (SteMedi), Veronica persica (VerPers).*
	Perennial dicots	*Convolvulus arvensis (ConArve), Malva neglecta (MalNegl).*
Bare soil	Annual dicots	*Amaranthus powelli (AmaPowe), Amaranthus retroflexus (AmaRetr), Amaranthus albus (AmaAlbu), Anagallis arvensis (AnaArve), Anagallis foemina (AnagFoem), Chenopodium hybridum (CheHybr), Chenopodium pumilio (ChePumi), Portulaca oleracea (PorOler), Senecio vulgaris (SenVulg), Sonchus oleraceus (SonOler), Thlaspi arvense (ThlArve), Trifolium arvense (TriArve), Tripleurospermum inodorum (TriInod), Veronica hederifolia (VerHede), Veronica triphyllos (VerTrip), Viola arvensis (VioArve).*
	Annual monocots	*Echinochloa crus-galli (EchCrus), Panicum miliaceum (PanMili), Poa annua (PoaAnnu), Setaria pumila (SetPumi), Setaria viridis (SetViri).*

The *IB* values are shown in Figure 4. The *IB* values change similarly at all monitored sites. The lowest values are in the first evaluation term (spring), the highest values are in the second evaluation term (summer), and the decrease is in the third term (autumn).

This trend corresponds to the vegetation period of the monitored area. In the Greening interrow, *IB* had the highest values and most of the biomass was comprised of perennial plant species. In the interrow with Bare soil, the *IB* values had the greatest difference between the observation dates. In the first term, the values were very low, in the second term they were 15 x higher. This growth is created mainly by the biomass of annual dicotyledonous species. In the under trees, the *IB* values are the lowest and the annual plant species predominate here.

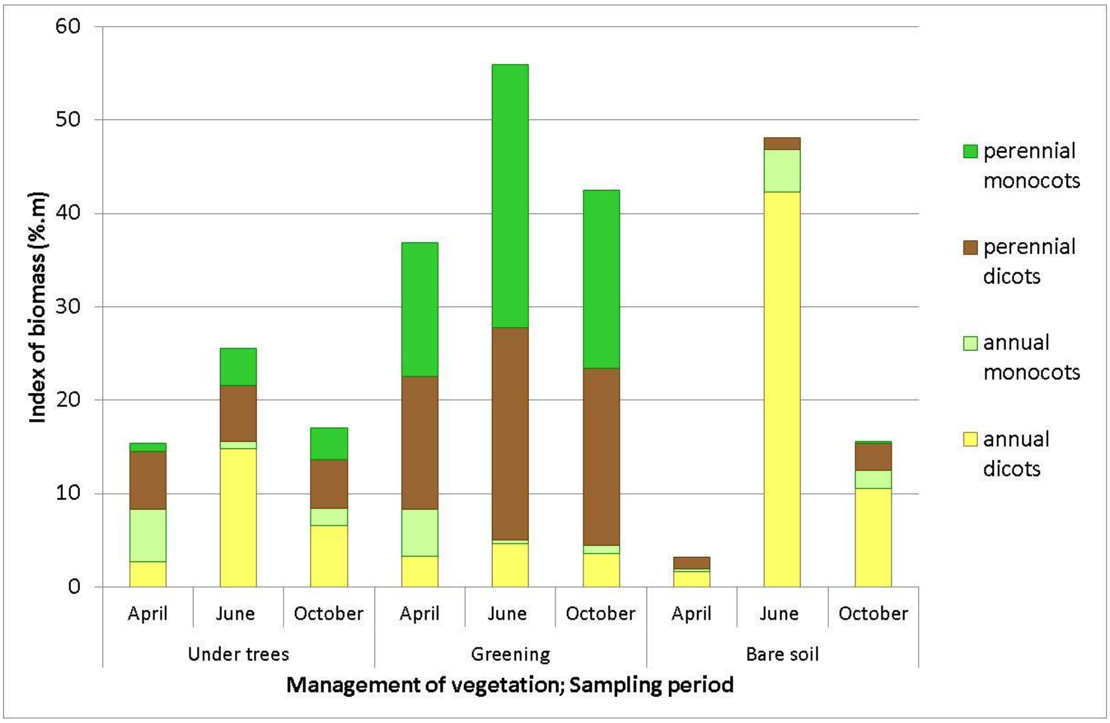

Figure 4. Values of biomass index at different sites in the orchard.

The results of the CCA analysis evaluate the coverage of plant taxa for the monitored sites. The results are significant, with a significance level $\alpha = 0.001$, for all canonical axes. A graphical representation of the results of the CCA analysis is presented in Figure 5. Based on the CCA analysis, the identified plant taxa can be divided into five groups (Table 1). Groups of the species correspond to the type of vegetation management where they have higher *IB* values.

The average water retention of the soil profile (AWR1) tends to decrease in the first half of the year. The trend changes from July to August when AWR1 despite certain fluctuations gradually grows. The amount of water in the soil profile is determined by the amount of water precipitation and by the intensity of water evaporation. AWR1 affects the NDVI values, which express the condition of the vegetation. The trend in the development of AWR1 is very similar to the trend of NDVI, as illustrated in Figure 6. Lower values of AWR1 and NDVI are considered to be suitable conditions for the occurrence of fires. This represents a state when the soil is dry, and the condition of the vegetation is poor. In the orchard, high biomass index values also contribute to the fire hazard. These conditions occurred in June 2014 and July and August 2015.

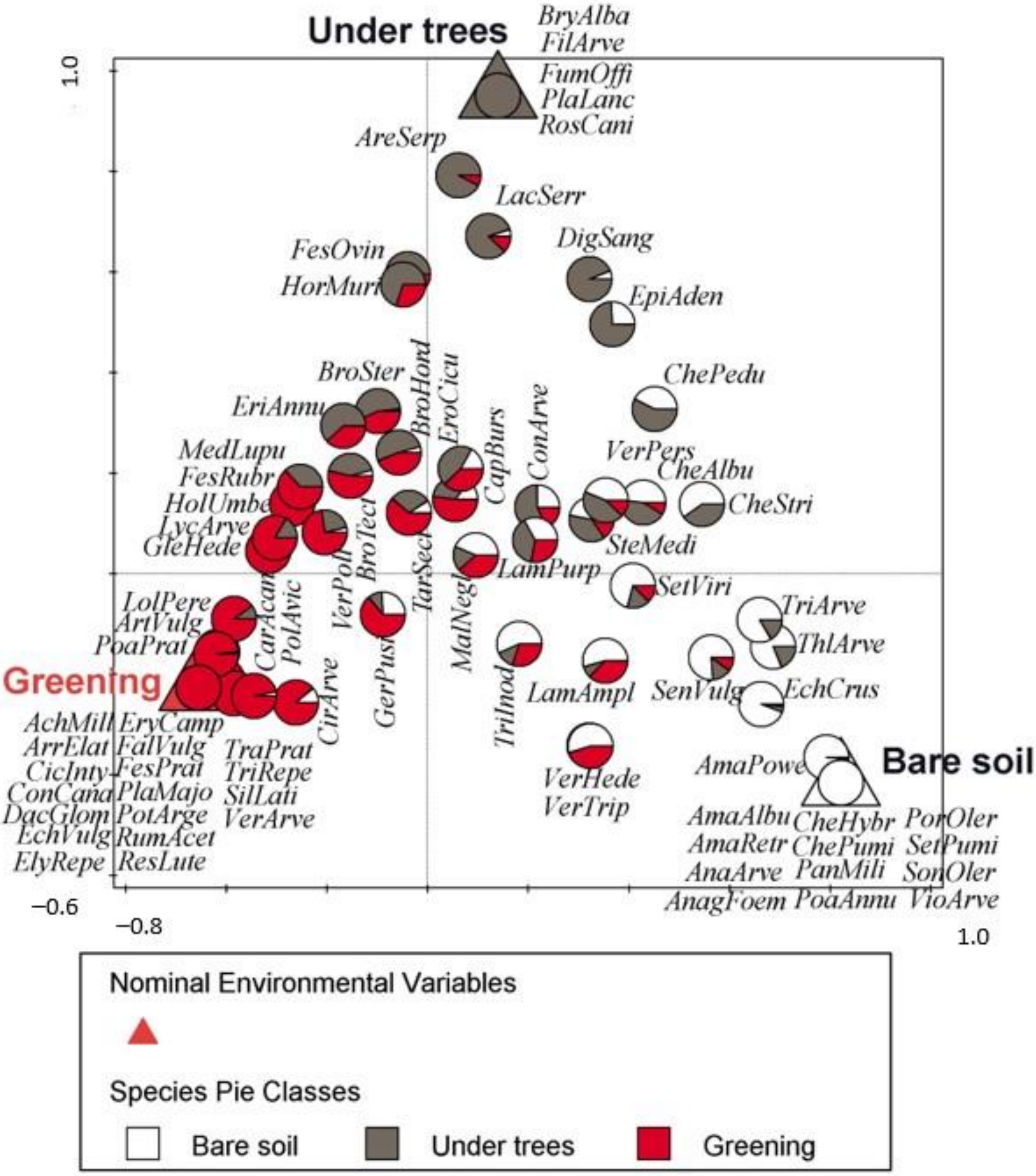

Figure 5. Occurrence of the plant taxa identified at the site with different management in the orchard. (Result of CCA analysis; total explained variability = 12.9%; F-ratio = 6.5; p-value = 0.001).

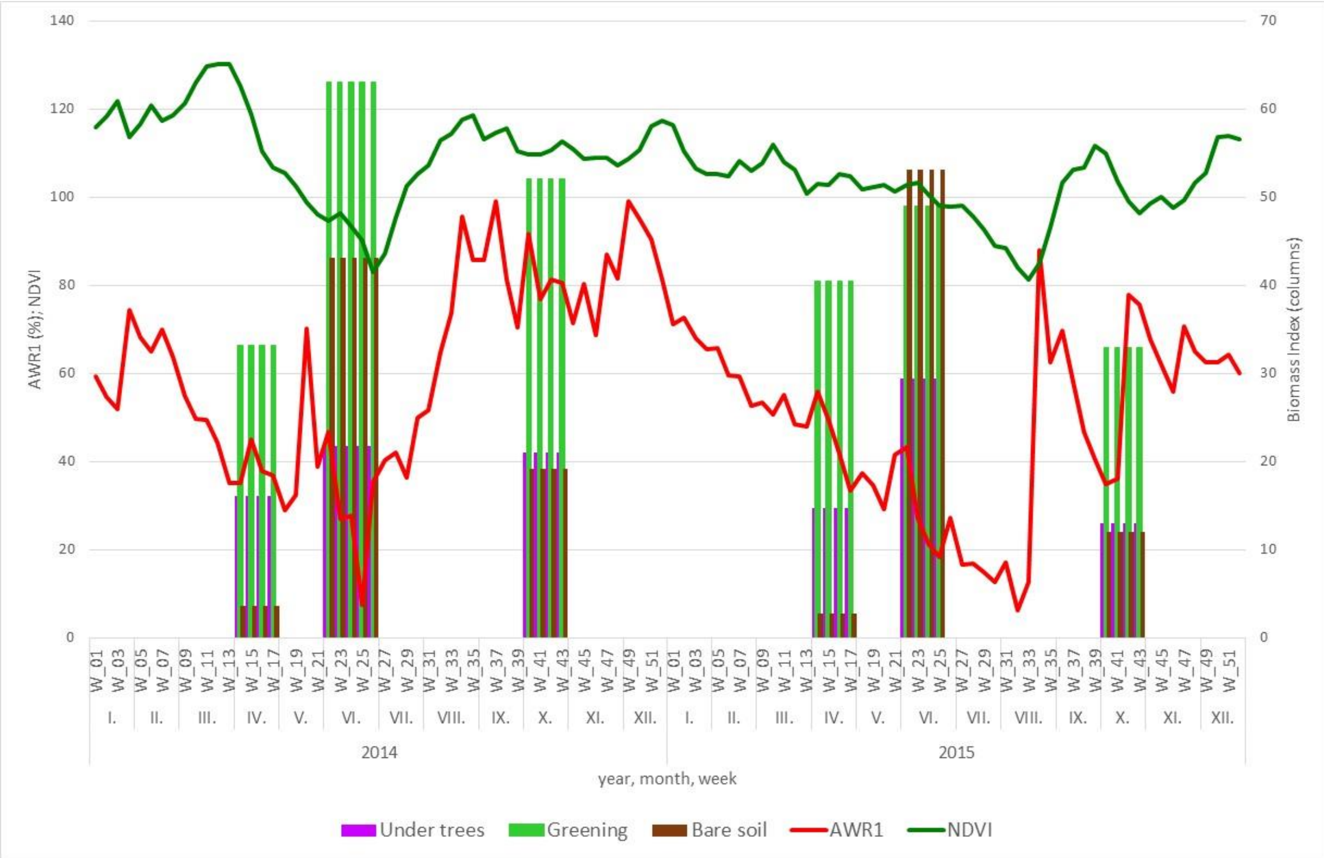

Figure 6. Development of AWR1, NDVI, and biomass index in the orchard.

4. Discussion

Fire is a natural phenomenon affecting biological processes and species composition of ecosystems, including the decomposition or accumulation of biomass [49]. On one hand, fires are an important and integral part of many ecosystems, affecting their distribution, biodiversity, and functioning worldwide. On the other hand, many current anthropogenic fire regimes are susceptible to catastrophic fires. This is especially relevant in ecosystems for which fire events were extremely rare throughout their evolutionary history, and for which fire regimes fall outside of the range of their historical variability [50].

Origin and outbreak of fire in the agricultural landscape are mainly determined by the course of the weather and especially by lack of water [51–53]. According to Lima et al. [54], fire can easily get out of control. According to Syswerd and Robertson [55], water availability in soil is most limited in July, which can vary by region. Under the conditions of the Czech Republic, drought is mainly expected from the end of July till the beginning of August [56]. During this period, it is necessary to monitor the biomass of vegetation as a possible cause of the fire. It is generally accepted that air temperature above 24 °C, relative air humidity below 40%, no precipitation, and no or low cloud cover are the parameters defining the so-called fire weather, in which more than 60% of plant biomass fires occur [39].

The amount of vegetation biomass is important for the origin and outburst of fires in the landscape [57,58]. Fire intensity generally rises with increasing vegetation cover due to fuel availability [59]. Moreover, fire behavior is largely driven by fuel flammability. Flammability can vary markedly between grass species and grass species composition. Excess biomass leads to an increased amount of fuel on both forest and non-forest land which is considered a key factor for fire hazard [58,60–63]. The intensity of the fire and, consequently, changes in soil features (such as soil structure, texture, porosity, wettability, infiltration rates, and water-holding capacity) [64] are determined not only by the quantity but also by the type of vegetation [59]. While high-intensity fires tend to decrease site productivity, low-intensity fires can increase site productivity [64].

In the agriculturally used landscape, the amount of biomass and species composition of the vegetation determines the type of human-performed management [65,66]. The applied management of vegetation in the landscape impairs the natural course of vegetation succession [67]. Impairment of vegetation succession results in changes in the accumulation of plant biomass, and subsequently alters conditions for the outburst and spread of fires. In combination with dry and warm weather, the hazard of fires rises even in areas where fires are an exceptional phenomenon.

Fire is a natural disturbance for vegetation, which consumes the existing plant community and initiates a new phase of vegetation succession. Biomass from different types of plants has different importance for the outburst and spread of fires. The flammability of vegetation varies throughout the year due to differences in its chemical composition, moisture content, leaf biomass, and the dead-to-living plant parts ratio [59,68]. The intensity and duration of fire depend on the features of the vegetation [68]. Badia et al. [69] demonstrated that higher soil temperatures are reached in the case of woody fires than in the case of grass and shrub fires. Biomass of annual plant species plays an important role in the origin of fires. Grass biomass is important for the start as well as for the full fire spread. Biomass of woody plants has been shown to be important for high fire intensity. All these categories of plant species can be found in orchards. Representation of these categories of species and the amount of biomass is determined by the vegetation management in the orchard.

The grassed interrow has the most grass biomass during the entire vegetation season and therefore represents the greatest hazard for the origin and spread of fire. The most important grasses include *Arrhenatherum elatius*, *Dactylis glomerata*, *Festuca pratensis*, *Lolium perenne*, and *Poa pratensis*. Winkler et al. [39] state that as far as biomass production associated with fire hazard is concerned, the species producing high to medium-high biomass are significant (*Acer negundo*, *Arrhenatherum elatius*, *Artemisia vulgaris*, *Bromus hordeaceus*, *Elytrigia repens*, *Hordeum murinum*, *Lolium perenne*, *Medicago sativa*, *Melilotus officinalis*, *Rosa canina*). According to Salemme et al. [70], it has been proven that the biomass of grasses increases the probability of origin and intensity of fire due to the quantity, structure, and flammability of their biomass. Agricultural land management influences the share of biomass, and thus the fire hazard of the area. The fire hazard increases during periods of grassland vegetation biomass drying out [39].

A very rapid increase in the biomass of annual dicotyledonous species in the interrow with bare soil is another possible source of the fire. From this point of view, the problematic taxa can be as follows: *Amaranthus* sp., *Chenopodium* sp., and *Tripleurospermum inodorum*. However, the amount of biomass is mainly determined by the course of the weather. Sufficient water and favorable temperatures ensure a very rapid increase in biomass. Subsequent drought in the summer months ensures that the biomass dries up and thus the fire hazard increases. Based on the results, the interrow with bare soil is the place with the highest changes in species composition. Considerable dynamics of vegetation structure also change the amount of biomass and change the level of fire hazard during one growing season. This raises the need for more frequent control and evaluation of the degree of fire hazard.

In the strip at the trunks under the trees, mulching is used, which is a frequent method of vegetation control and biomass management. Mulching consists in covering the soil surface with organic or mineral products such as gravel, bark, straw, hay, sawdust, and wood shavings, or with a variety of synthetic materials such as polyethylene plastics [71]. Mulching is not usually used widely in fruit growing due to high costs and/or availability of materials but is important for specific fruit species or in organic farming. Mulching provides a variety of tasks, including weed control, soil temperature reduction, and water saving [72]. Despite numerous benefits, mulches can pose a fire hazard [73]. On the other hand, mulching and chemical control suppress the formation of vegetation biomass, thus reducing the hazard of fire outbursts. However, chemical control is not applicable in organic farming and represents an unwanted burden for the environment. Among the found species that resisted mulching and chemical control well, was the species *Hordeum murinum*, which biomass can increase the fire hazard.

Cover cropping in the interrow of the orchard can be performed by mowing. The number of mowing should be adapted to the need and intensity of the vegetation control. A higher density of herbaceous vegetation provides better soil protection and greater carbon content in the soil. However, the risk of competition for water and nutrients rises in such conditions, which can negatively impact the yield of fruit trees [73]. In hot and dry climates with a high hazard of grass fires, control of the herbaceous vegetation should also be adjusted accordingly. Management of natural vegetation by mowing leads to a selection of stands for perennial species that tolerate mowing better and become difficult to control [73].

Biomass (fuel) growth dynamics and burning availability (drought) drive the fire trends [74–76]. This means that the course of the weather and the accumulation of biomass (grass species) are decisive for the origin of the fire. Alternating different types of vegetation management within an orchard affects the species spectrum and the amount of vegetation biomass, which contributes to a higher heterogeneity of vegetation and reduces the hazard of a widespread fire outbreak.

According to Trnka et al. [77], on average, 89.5% of all vegetation fires in the CR were recorded in the countryside and more than 65% of wildfires are recorded during the harvest periods. These authors emphasize that fires will become an increasingly frequent phenomenon even in the conditions of the mild climate zone and will intervene in the agricultural landscape. Although the CR, and Central Europe in general, has not been considered a wildfire hotspot compared to the Mediterranean area until recently (given the typical extent of fires, dedicated resources, or public perceptions), this situation has changed with the increase in dangerous fire weather. One of the ecosystem functions of vegetation is to ensure the occurrence and spread of fires, which is a natural phenomenon for vegetation. For human civilization, fire has primarily a destructive and negative character, which is why we strive to eliminate fire as a phenomenon in the landscape. Familiarization of farmers with this risk and modification of management of the vegetation of fruit orchards must become an integral part of the efforts to eliminate the fire hazard.

5. Conclusions

The results provide a different perspective on the relationship between orchard vegetation and potential fire hazard in human-managed ecosystems. It has been confirmed that different management practices applied in the orchard change the species composition of the vegetation. Grassed interrow creates the most favorable conditions for the occurrence of perennial species. On the contrary, bare soil conditions in the interrow are most suitable for annual species with the highest changes in the number of species during the growing season. The management applied in the strips under the trees, the combination of chemical control and mulching leads to the emergence of specific plant species (*Filago arvensis*, *Bryonia alba*, *Hordeum murinum*, *Festuca ovina*). It can be stated that varied vegetation management contributes to the high diversity and makes orchards islands of biodiversity in the agricultural landscape.

Biomass of the orchard vegetation combined with the dry and warm weather of the South Moravian Region increases the hazard of fire. Biomass of the annual and perennial grasses increases the hazard of fire. Green interrow has the most biomass of grasses during the entire growing season. Interrow with bare soil creates more suitable conditions for annual dicotyledonous species. These species have high biomass productivity. When the biomass dries up quickly due to specific climatic conditions and accumulates, the hazard of fires is increased. Therefore, it is necessary to perform regular monitoring in the interrow without vegetation and, if necessary, to incorporate the vegetation biomass into the soil on time. Mulching and chemical control suppress the formation of vegetation biomass, thus reducing the fire hazard. However, it is important to monitor the amount of biomass and its accumulation together with the course of the weather in the relevant year. Based on the monitoring of AWR1 and NDVI, it is evident that from June to August, the conditions for the fire occurrence are favorable. Orchards are still being omitted in the fire hazard assessment. From the results, it is noticeable that the selected AWR1 and NDVI values together with the vegetation biomass represent a hazard. The amount of orchard vegetation biomass is regulated by management, which can substantially reduce the hazard of occurrence and spread of fires. Alternating the types of vegetation management in the orchard changes the species spectrum and the amount of vegetation biomass, thus compensating for the negative features of individual types of orchard vegetation management.

Changes in the nature of the climate and the variability of orchard vegetation can create new interactions that can also result in changes in fire hazards. Fires on agricultural land are still a neglected hazard, so scientific discussion and the search for new risk sites are of great importance.

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