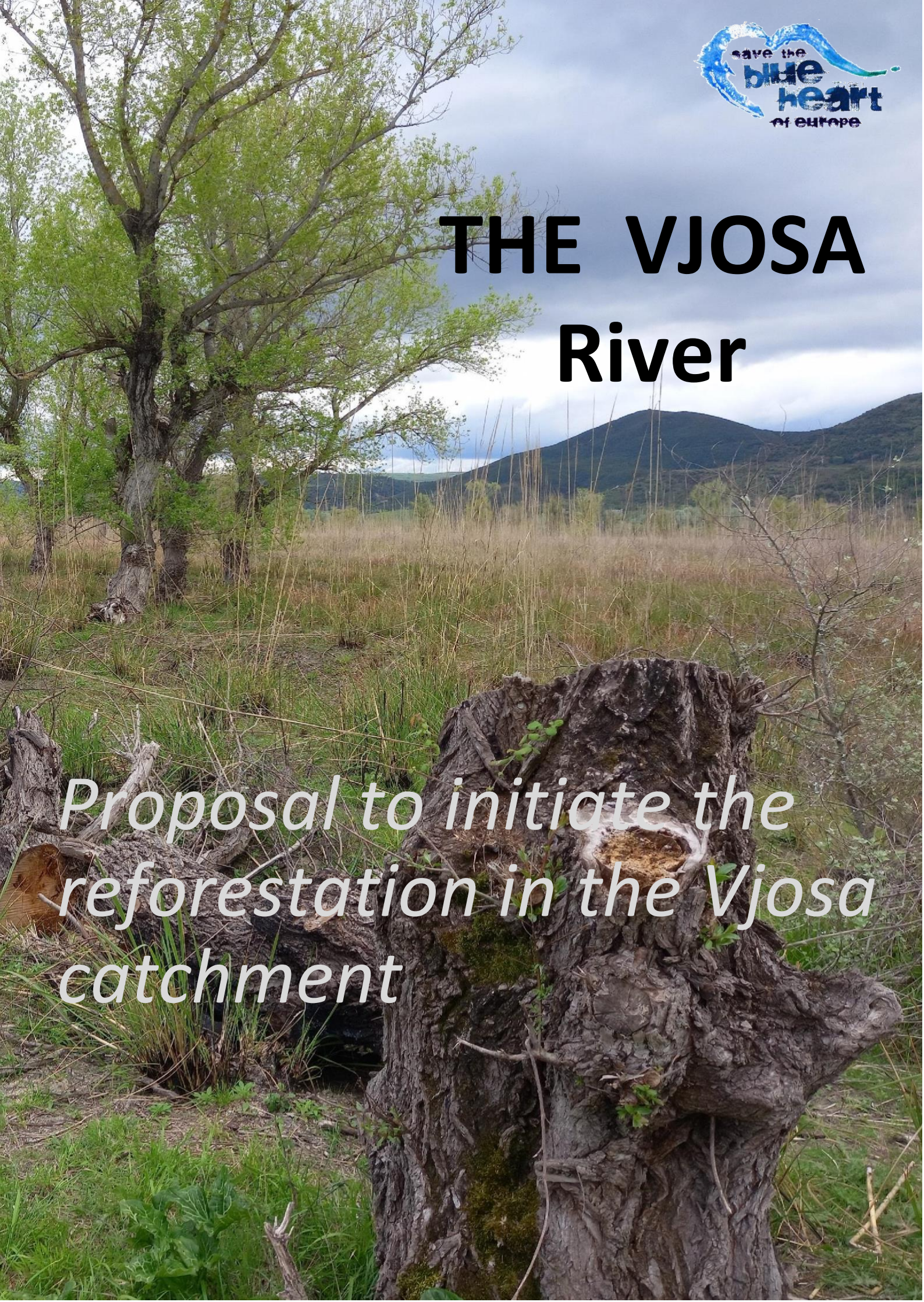

THE VJOSA River

Proposal to initiate the reforestation in the Vjosa catchment

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Proposed citation

Drescher A., Toromani E. 2023. The Vjosa River – Proposal to initiate the reforestation in the Vjosa catchment. 32 pp.

Photo credit

All photos are by the author except figure 1 [modified after Hasenauer et al. 2022, fig. 18] and the screenshots from Google Earth (figures 7, 9, 11, 15, 17, 20, 22, 25, 26, 28 and 31 (credit: Friedrich Schiemer).

This study was carried out in the framework of the initiative "Save the Blue Heart of Europe„ www.balkanrivers.net

Cover and inside: Forest patches in the Vjosa floodplain near the settlement Brataj.

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Executive Summary

We investigated the possibility of afforestation measures in the catchment area of the Vjosa. The floodplain and its slopes have been heavily deforested due to centuries of pastoralism and firewood extraction, which still continues. Already noticeable human-induced changes in the climate, such as extremely heavy precipitation or prolonged dry periods, increase the danger of erosion and landslides in particular. For the time being, we propose ten areas for afforestation in which, starting from small areas of a few hectares, contiguous, closed forest areas are to be created: to protect the floodplain but also to provide shelter for grazing animals and wildlife. As there is no autochthonous planting material available on the market, it has to be grown from diaspores/mother plants from the region in a forest garden to be established on site. The site for this was chosen for technical and practical reasons at the southern edge of the settlement area of Tepelenë near the banks of the Vjosa. Establishing a nursery in such a location is useful for growing seedlings/saplings and provides a good basis for their acclimatisation and increases the survival rate. Seeds and mother plants for the production of cuttings can be collected in the surrounding area. Propagation by cuttings is the fastest and most economical way to quickly obtain a larger number of plants for various willow and poplar species, wild vine. For other species we intend to collect seeds from other locations within the Vjosa catchment and plant them in the nursery to produce seedlings. This procedure is in accordance with legal requirements for protected areas (law 81/2017, article 65).

Monitoring is recommended as an important tool for controlling the measures, comparing the development of the afforestation areas protected by fencing or individual protection against browsing by grazing animals with traditionally managed areas.

The idea of national parks is to protect natural processes. The changes in river morphology and, in connection with this, the development of vegetation in the floodplain within the framework of succession and destruction are the formative factors. The higher levels of the floodplain are subject to natural regrowth of woody vegetation after the cessation of grazing or decrease of the livestock and the prevention of burning of the cogon grass areas. Simply because of the lack of forest remnants and thus fruiting old trees, this process would take many decades in the present case. The danger of the spread of invasive neophytic woody species such as black locust (*Robinia pseudacacia*), foxglove tree (*Paulownia tomentosa*) and trea of heaven (*Ailanthus altissima*) is also many times higher on fallow land than in closed forest stands. Subsequent "control" of neophytes is – if at all feasible – much more expensive than small-scale afforestation with local floodplain forest species. These act as starting points for larger contiguous forest areas and promote the natural reforestation process. Therefore this appears justified in the present case.

The most urgent steps are i) securing the area for the forest garden, ii) collecting plants for propagation iii) insuring support from the Tepelenë municipality and the Regional Administration of Protected Areas (RAPA) in Gjirokaster and opening the forest garden, iv) Information of landowners/users and discussion especially in case of planned fencing as well as clarification of the question of possible compensation.

Proposal to initiate the reforestation in the Vjosa catchment

Preface

The IUCN protected area management categories are used to classify protected areas following definitions of the IUCN. The Vjosa National Park was created to protect the biodiversity as well as large scale ecological and hydrological processes in the entire Vjosa catchment. The definition for category II means that education and tourism will also be promoted and implemented.

Investigations to date show a relatively large human footprint. Extensive land use for centuries and gravel extraction are the causes responsible for this. Gravel extraction, which is responsible for serious disturbances of the transport of coarse material, and the lack of forested areas as well as the largely missing late successional stages on higher floodplain levels are the greatest deficits. These areas currently have the greatest development potential.

Despite the naturalness of the Vjosa and its floodplain, an important element along the waterway and the slopes is largely missing: forests. This has a negative impact on soil erosion, leading to a higher risk of flooding in the lower reaches. Furthermore, the consequences for the biodiversity of the entire catchment are obvious: species that depend on the microclimate of forests are almost completely missing. The remaining forest patches along the Vjosa and its tributaries are mostly young, small, fragmented, and degraded by intensive grazing and forms of traditional (mis)management like regular burning.

For these reasons, afforestation measures in the National Park (and adjacent landscapes) should be one of the primary goals of National Park management – for the benefit of nature and the local population.

This report defines important criteria for afforestation measures and suggests areas where the processes can be initiated.

The following proposals are based on a total of six visits of several days to two weeks in the months of April to September in the years 2017 to 2023. Other participants in the research visits were (in alphabetical order) Isabell Becker, Elisabeth Brugger-Schiefermüller, Gregory Egger, Marjol Meco, Leonard Pfaff, Friedrich Schiemer.

1. The forest nursery

1.1. Why we need a forest nursery

The forest nursery plays a key role in afforestation projects. A principle issue in afforestation is the question of plant material to be used. According to the IUCN definition and national legal framework, biodiversity should be preserved or promoted in national parks. For this reason, only local or regional plant material should be used in afforestation projects. Since neither plant material of all species intended for afforestation nor of local or regional origin is available in tree nurseries, it is necessary to establish a forest nursery where plant material obtained from autochthonous plants can be grown

for the afforestation measures. This nursery is also considered important for RAPA in Gjirokaster to ensure various seedlings for reforestation of protected areas based on their management plans.

Fig. 1: Grazed poplar stand near Poçem (phot. 2017-09-21).

1.2. What are the functions of a forest nursery

The function of a forest garden is the seeding and rearing of autochthonous tree and shrub species, because native planting material from the catchment area is not available. For afforestation measures in the National Park, priority must be given to the local or regional origin and genetic diversity of the planting material. This can only be guaranteed if seeds and cuttings are collected in the catchment area. Which wood species are suitable for reforestation projects in the catchment area of the Vjosa and which methods can be used for their propagation?

Two practices that have been established over centuries are **cultivation from seeds** and **propagation via cuttings**.

Reproduction via seeds is the most common method of passing on genetic information in nature. This way of reproduction has been used by humans since the Neolithic Age for plant breeding for example through selection. Meteochore species usually produce a high number of seeds. When these fall onto a well-moistened sandy or silty substrate (after the flood waters have receded), they germinate rapidly. *Populus* and *Salix* species also have this dispersal mode, although they can be well propagated vegetatively. Reproduction by seed also plays the main role for meteochore floodplain species like *Platanus orientalis, Ulmus minor* (Fig. 2).

The dynamics of floodplain sites have favoured the second method mentioned here: branch pieces broken off during floods become embedded in moist, usually fine-grained sediment after the water recedes and takes root. Man took advantage of this and perfected this method, propagation via cuttings (Fig. 2 left part).

While in the case of reproduction via seeds, usually after pollination by insects or wind in the ovary, fertilisation occurs when the sperm cells of the pollen grain fuse with the egg cell. In the process, genes from the parent plants are recombined.

In the case of propagation via cuttings, on the other hand, genetically identical new individuals are produced from the parent plant. If only one mother plant is used to obtain the cuttings, this type of

propagation carries the risk of large-scale damage in the event of epidemic diseases. It is therefore important to use several mother plants from different locations for propagation via cuttings.

Fig. 2: Picture block (clockwise starting top left) Salix purpurea long shoots; cuttings approx. 20 cm long with 4 to 5 buds; horizontally cut upper end of a cutting (top) and diagonally cut lower end; opening capsules of a catkin of Populus alba (above), shoots from exposed roots of Populus nigra; cuttings are inserted so that only the uppermost bud is above the soil surface; Populus nigra seedlings of the same age from seed. Line drawings (right column from top to bottom). Seeds of 24: Populus alba; 26: Populus nigra; 30: Salix alba; 33: opened capsule and seeds of Salix purpurea; 41: seeds of Ulmus minor.

In late autumn or winter, pencil-thick woody long shoots of willows or poplars are cut into pieces about 20 cm long (Fig. 2), bundled and labelled and kept in moist sand until planting. The lower end is cut at an angle. In spring, the cuttings are planted 3 to 5 cm apart in rows 50 cm apart in loose soil. Only the top bud should emerge above the soil surface (Fig 2). The cuttings must be kept moist, after a few weeks they will form adventitious roots.

In the case of poplar species, direct planting of whole long shoots ("heister") in the afforestation area is also possible.

In the case of the oriental plane, which can also be propagated by cuttings, the annual or preferably biennial woody, long shoots about 0-30 cm long are obtained for propagation in autumn before the frost period. Remove the lower third of the leaves and plant the branches up to about halfway in moist, low-nutrient sand. Plant out in the following spring. To ensure high growth rates, the young plants should be kept moist, at least initially. The cuttings can already be dipped in rooting powder to ensure better rooting. To promote the formation of healthy new roots, rooting powder (growth hormone) can be applied to the already formed roots when planting out (detailed information see: https://www.gartentipps.com/platane-vermehren-anleitung-tipps.html). Parallel to this, planting material can also be grown from seeds (details see the video (https://www.bing.com/videos/search?q=Vermehrung+der+orientalischen+Platane&docid=603525875300196079&mid=D00568686BD1DA4FD054D00568686BD1DA4FD054&view=detail&FORM=VIRE).

Which of the two methods is more suitable for our purposes (maintenance effort, growth or germination rate) cannot be judged at the moment and should be tested on site.

The spread of shrub species (marked with NPh in the column 'LF, GF' in table 1) in the active channel occurs mainly in the course of succession on newly created sites or sites previously partially destroyed by floods. However, the shrubby *Salix* species can also be propagated with cuttings without any problems. The diaspores of the lianas, both the *Clematis* species and *Periploca graeca*, are spread by wind, only those of *Hedera helix* and *Vitis sylvestris* are spread by animals (endochor or dysochor). All the lianas are usually raised from seeds. The lianas are semi-shade plants with mostly a wide range of variation, so they can also invade forest stands whose canopy is not too dense.

1.3. Tree and shrub species for afforestation in the Vjosa National Park

A species list of the floodplain-specific woody species in alphabetical order is provided in Table 1. In addition to the growth or life form, the occurrence in the particular succession phases is listed in column three and the type of propagation/spreading in column four.

Table 1: Alphabetic list of main woody species occurring in the area of the National Park suitable for afforestation measures in the floodplain and in adjacent slopes. In the left column the species list is depicted, column 2 shows the life form/growth form of each species, column 3 lists the succession phases in which the species mainly occur, column 4 provides information on the method of propagation, column 5 finally lists the mode of dispersal.

GF = Growth form, LF = Life forms: L: lianas, MPh: shrubs, NPh: trees;
SP = Succession phases. BP: Biogeomorphic Phase, EBP: Early Biogeomorphic Ph., LBP: Late Biogeomorphic Ph.;
P = Method of propagation/spread. C: propagation by cuttings, S: propagation by seeds;
D = dispersal mode: Bo: Boleochorie (Spreading through wind gusts), Dy: Dyschorie (Dispersal as food reserve for animals), En: Endochorie (Spread through the intestine of animals), Ep: Epi(zoo)chorie (Spread by adhesion to animals), Me: Meteochorie (wind dispersal), My: Myrmekochorie (Dispersal by ants).

Species	***LF, GF***	***SP***	***P***	***D***
Alnus glutinosa	MPh	EBP, LBP	S	Me, Dy
Carpinus orientalis	MPh	LBP	S	Me, Dy
Clematis flammula	NPh, L	LBP	S	Me
Clematis recta	NPh, L	LBP	S	Me
Clematis vitalba	NPh, (MPh) L	EBP, LBP	S	Me
Clematis viticella	NPh, L	LBP	S	Me
Cornus mas	NPh	LBP	S	Dy, En,
Cornus sanguinea	NPh	EBP, LBP	S	En, Dy
Corylus avellana	NPh	LBP	S	Dy

Cotinus coggygria	NPh	(EBP), LBP	S	Me
Crataegus monogyna	NPh	(EBP), LBP	S	En, Dy
Ficus carica	MPh	LBP	C	En
Frangula alnus	Mph	EBP, LBP	S	En, Dy
Fraxinus angustifolia	MPh	LBP	S	Me
Fraxinus ornus	MPh	(EBP), LBP	S	Me
Hippocrepis (Coronilla) emerus	NPh	(EBP), LBP	S	Me
Ligustrum vulgare	NPh	(EBP), LBP	C, (S)	En, Dy
Paliurus spina-christi	NPh	LBP	S	En, Dy
Periploca graeca	NPh, (MPh), L	EBP, LBP	S	Me
Phlomis fruticosa	NPh	LBP	S	Ep, Dy
Platanus orientalis	MPh	(BP), EBP, LBP	S, C	Me
Populus alba	MPh	(BP), EBP, LBP	C	Me
Populus nigra	MPh	(BP), EBP, (LBP)	C	Me
Prunus spinosa	NPh	EBP, LBP	S	En, Dy
Pyracantha coccinea	NPh	LBP	S	En, Dy
Pyrus amygdaliformis	NPh	LBP	S	En, Dy
Quercus cerris	MPh	(LBP)	S	Dy
Quercus coccifera	MPh	(LBP)	S	Dy
Quercus frainetto	MPh	(LBP)	S	Dy
Quercus robur	MPh	LBP	S	Dy
Salix alba	MPh	(BP), EBP	C	Me
Salix amplexicaulis, S. purpurea	NPh	BP	C	Me
Salix eleagnos	NPh	BP, (EBP)	C	Me
Salix triandra	NPh	BP	C	Me
Smilax aspera	NPh, L	EBP, LBP	S	Ep
Solanum dulcamara	NPh, L	EBP, LBP	S	En, Dy

Spartium junceum	NPh	LBP	S	Bo, My?
Tamarix parviflora	NPh	BP	S	Me
Ulmus laevis	MPh	LBP	S	Me
Ulmus minor	MPh	LBP	S	Me
Viburnum tinus	NPh	(LBP)	S	En, Dy
Vitex agnus castus	NPh	BP	S	En, Dy
Vitis sylvestris	MPh, L	EBP, LBP	S, C	En

Both the seeds and the cuttings are preferably obtained in the wide valley sections of the Drinos and the Vjosa between Tepelenë and Novosele from wild plants found there.

1.4. Location of the first forest nursery

The forest nursery is the starting point of all afforestation project and is the central facility for sitespecific management in an IUCN-approved national park. A very appropriate area to establish a forest garden is located on the southern edge of Tepelenë (see Fig. 1). It is suitable for the following reasons:

- The selected area is ideally suited in terms of site characteristics, it is not flooded during floods (see Fig. 1), is situated around 3.7 m above mean water level. The soil profile ("Tep Weide oben" in Fig. 4) shows up to a depth of 100 cm a reddish brown colluvial material from the slope (gray cinnamom soil) without any signs of flooding. The soil is well supplied with water over long periods of the year.
- The central location for measures in the entire catchment area of the Vjosa.
- The location close to the settlement, where trained personnel is available for the care of the seedling during dry periods.
- The stream flowing close to the area proposed for the forest garden makes it possible to operate the drip irrigation without electric pumps. Therefore it is not necessary to build a well.
- The area of the proposed forest garden is privately owned. Discussions of forestry officials from Tepelenë with the owner revealed that he is inclined to lease the area designated for the forest garden.

Fig. 3: The southernmost part of Tepelenë with the Research Center (arrow) and the area of the proposed forest nursery (blue shaded area).

For growing oriental plane (*Platanus orientalis*), elm (*Ulmus minor* and *Ulmus laevis*) as well as field maple (*Acer campestre*) from seed, it is essential to set up drip irrigation (see Fig. 5), otherwise the seedlings will die back during dry summer months. Drip irrigation works with a low pressure of 0.2 bar, which is why an electric pump is unnecessary, the natural gradient is sufficient.

Fig. 4: Situation of the height measurement points in the surroundings of the projected forest nursery. Soil profile has been taken at the point 'Tep Weide oben' (*Screenshot from Google Earth*).

Fig. 5 left: Examples for drip irrigation from agriculture: irrigation of young plants of Cucurbita pepo; right:The pipe system is offered ready-made in the trade and is very inexpensive.

2. Reforestation areas

In a first step, 10 locations for afforestation measures have been selected on the lower Drinos and the Vjosa between Tepelenë and the mouth of the Shushica. They are the most appropriate areas to initiate the reforestation – and learn from them.

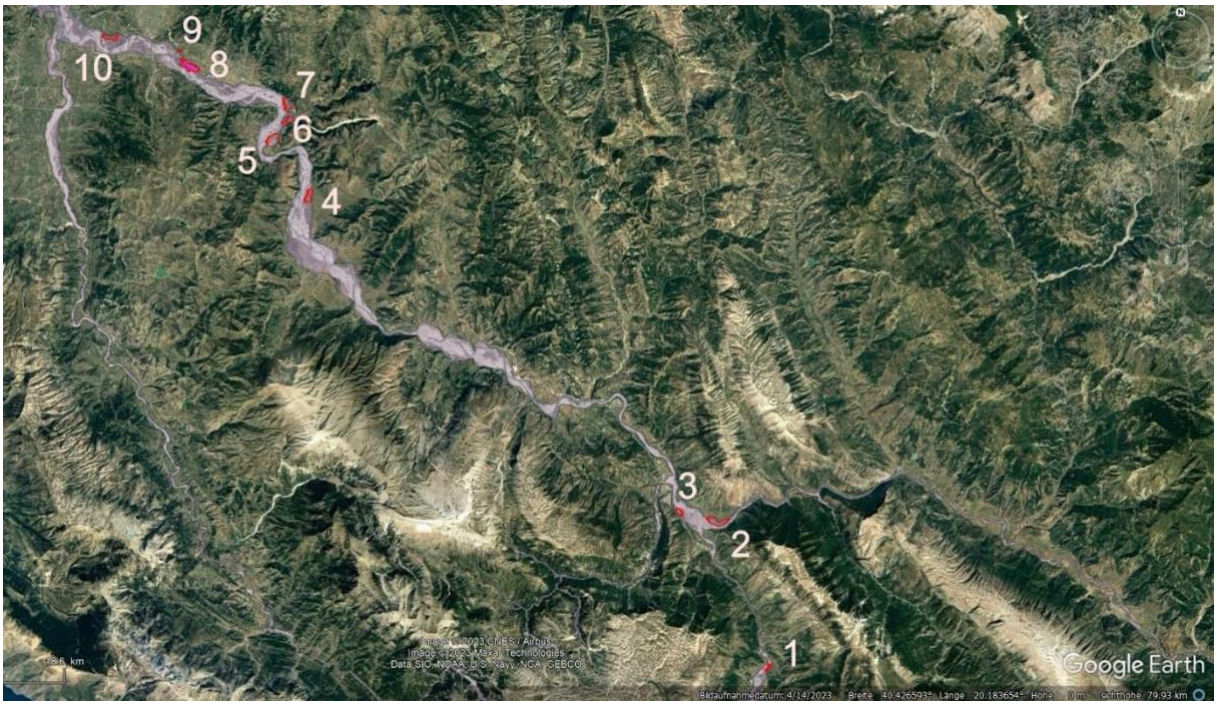


Fig. 6: Overview of the location of the afforestation areas: (1) Hundëkuq, (2) Dragot, (3) Tepelenë, (4) Kutë, (5) Poçem-South, (6) Poçem-Povla, (7) Poçem-Autogrill 24, (8) Cakran, (9) Rromës, (10) Banaj.

2.1. Description of the proposed afforestation areas

The description of the proposed afforestation areas begins with the area "Hundëkuq" (1) on the lower Drinos and concludes with the area "Banaj" (10) approx. 4 km upstream of the confluence with the Shushica.

The size of the proposed areas ranges from 10 to 45 hectares. All areas are located on higher floodplain levels about 2m above mean water. The root zone of the woody species has connection to the flowing groundwater at least during the periods of higher water level. Due to their location in the floodplain, the sites are suitable for planting pioneer species (poplars and willows) as well as species of more advanced succession stages (pedunculate oak, field elm, oriental plane tree, etc.). The proposed areas are currently grazed more or less intensively, often also burned locally at irregular intervals to prevent scrub development and overgrowth. As a result of the competitive advantage over woody species, the cogon grass (*Imperata cylindrica*) is spreading over wide areas (see fig. 33). After burning in winter, these areas are used as extensive pastures.

For this reason, the grazed and hitherto tree-free small areas of a few hundred square metres that are planted with saplings or young plants must be fenced to prevent browsing by grazing animals. On already stocked areas that are being compacted, single tree protection is the more favourable method.

2.1.1. *Hundëkuq*

Area: 10 hectares

Geographical situation: Quark Gjirokaster, south of Tepelenë. Coordinates and altitude see Tab. 2.

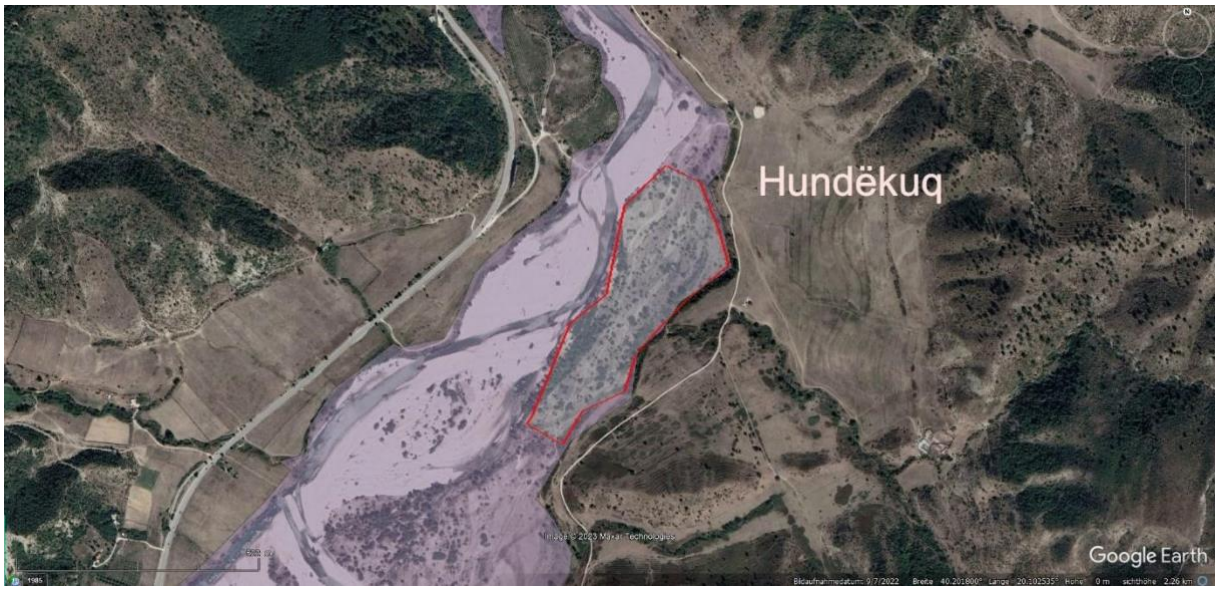


Fig. 7: Situation of the area "Hundëkuq" on the orographic right bank of the Drinos river about 1.3 km northwest of the village Hundëkuq (*ca 14 km northnorthwest of Girokaster*).

Stand characteristics: The heavily grazed area is loosely overgrown *with Salix eleagnos, S. alba, Populus nigra* and individual oriental plane trees (*Platanus orientalis*). The area situated about 1 to 2 meters above MW, the gravelly sediment is partly covered with a thin layer of fine grained sediment. Therefore in smaller patches, dry vegetation similar to dry grassland vegetation ("Heißländen") is developed (Fig. 6 right).

Fig. 8 left: Heavily grazed area with olive willow (*Salix eleagnos*) *and single exemplares of white willow* (*Salix alba*) *and oriental plane* (*Platanus orientalis*)*; right: dry grassland with a similar species composition as in Poçem-South.*

Proposed measures: Starting from remaining individual trees – mainly *Salix eleagnos* – an increase in crown cover is to be achieved by planting black poplar (*Populus nigra*), white poplar (*Populus alba*)

and oriental plane (*Platanus orientalis*). Without individual tree protection, an increase in the number of stems on the area cannot be achieved due to the high browsing pressure.

2.1.2. Dragot

Area: 39 hectares

Geographical situation: Quark Tepelenë, 3.6 airline km southeast of Tepelenë. Orographic right bank of the Vjosa river upstream the confluence with Drinos. Coordinates and altitude see Tab. 2.

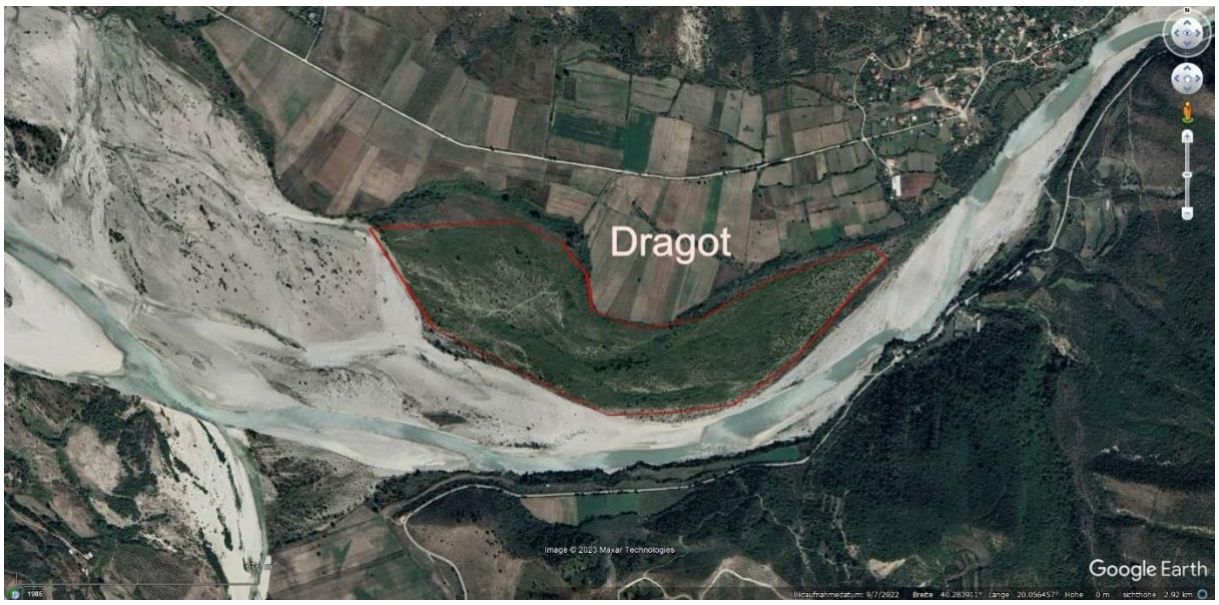


Fig. 9: Location of the area Dragot on the right river bank of the Vjosa southeast of Tepelenë (Screenshot from Google Earth, 2022-07-09).

Stand characteristics: The partly drained area with dry site conditions provide shallow topsoil. These areas are covered by a vegetation type dominated by mosses and lichens. Stands with a more mighty soil cover bare scrub vegetation. The area is anthropogenically altered. One of the consequences is the development of small patches covered with scrub dominated by *Robinia pseudacacia*.

Proposed measures: Before starting the afforestation, it is absolutely necessary to completely remove the individuals of black locust (*Robinia pseudacacia*) including their root system. Then the area should be quickly planted with shadowing species such as oriental plane (*Platanus orientalis*), field elm (*Ulmus minor*), field maple (*Acer campestre*), pedunculate oak (*Quercus robur*) and oriental hornbeam (*Carpinus orientalis*) leaving the existing native woody plants like lilac chastetree (*Vitex agnus-castus*), Spanish broom (*Spartium junceum*) and olive (*Olea europaea*).

Fig. 10 left: Dry site with the dominating moss species Tortella inclinata and Didymion luridus. Among others the lichen Psora decipiens characterizes the dry condition resembling to central European "Heißländen" (phot. 2022-06-30); right: Vitex dominated shrub with single individuals of olive tree (*Olea europaea*)*, Spanish broom* (*Spartium junceum*) *and scorpion senna* (*Coronilla emerus*) (*phot. 2022-06-30*)*.*

Neophyte control is particularly important in this area because their spread is responsible for the decline in biodiversity. Due to the lack of a specific regulation for the management of invasive species in Albania we suggest to apply the EU Regulation (EU) No 1143/2014, which contains a list (Union list) of invasive alien plant (neophytes) and animal species.

Under the current grazing pressure, no increase in stem numbers will be achievable without fencing or individual tree protection. The protection measure depends on the size of small afforested areas within the site.

2.1.3. Tepelenë

Fig. 11: Location of the area Tepelenë on the right river bank of the Vjosa southeast of Tepelenë (Screenshot from Google Earth, 2022-07-09).

Area: 13 hectares

Geographical situation: Quark Tepelenë, on the orographic left river bank. Coordinates and altitude see Tab. 2.

Stand characteristics: This area forested with old sorts of hybrid poplars (Fig. 8, upper right) was clear cut in 2021. From the previous cover, only few individual poplar specimens remained. The regularly flooded area was reforested with cuttings of hybrid poplars of different varieties and origin from commercial tree nursery (Fig. 9). The crown structure of old clones of hybrid poplar is looking similar than that of black poplar (*Populus nigra*). The high rate of hybridisation between black poplar and hybrid poplar (*Populus ×canadensis*) as well as the frequent backcrossings boosts the danger of displacing the genetically pure black poplar. In Central European riparian forests, such crossbreeds already predominate and pure black poplars have already become rare.

The higher levels of the floodplain, covered with fine-grained sediments, are regularly flooded. The area, which has been denuded for two years, without shrubs and only very loose herbaceous cover, offers no protection against erosion during floods. The area is grazed by cows, sheep and goats.

Fig. 12 upper left clockwise: View from the old road southwards with the forested floodplain on the orographic left river bank (phot. 2017-09-16); hybrid poplar stand S of Tepelenë before clearcut (phot. 2017-0916); bottom: same view like upper left after clearcut of the hybrid poplar stand (phot. 2022-07-03).

Proposed measures: To control the danger of erosion of the fine grained sediment cover a rapid planting of cuttings of several willow species, *Salix amplexicaulis, S. alba* and *S. eleagnos* is urgent.

Step by step replacement of the recently planted hybrid poplar trees by young plants of white willow (*Salix alba*), purple willow (*Salix amplexicaulis*), European white elm (*Ulmus laevis*), white poplar (*Populus nigra*), black poplar (*Populus alba*), and oriental plane (*Platanus orientalis*).

The area is used by the people of Tepelenë for recreational activities as well as grazed by sheep. Therefore, the entire area of 13 ha cannot be fenced. In order to be able to evaluate both costs and success of the two methods, two 20 x 20 m areas are to be fenced after planting and observed

comparatively with neighbouring equally large experimental plots with single tree protection. The results are to be applied in further afforestation projects. In addition, the proximity to the Research Centre allows observations to be made at regular intervals without the need for travel.

Fig. 13: Grazed Hybrid poplar stand south of Tepelenë before clearcut (phot. 2017-09-16).

Fig. 14: Former hybrid poplar stand south of Tepelenë after reforestation. Single trees from the former stand and planted young hybrids (phot. 2022-06-26).

2.1.4. Kutë

Area: 24 hectares

Geographical situation: Quark Fier, ca 1.5 airline km W Kutë. Coordinates and altitude see Tab. 2.

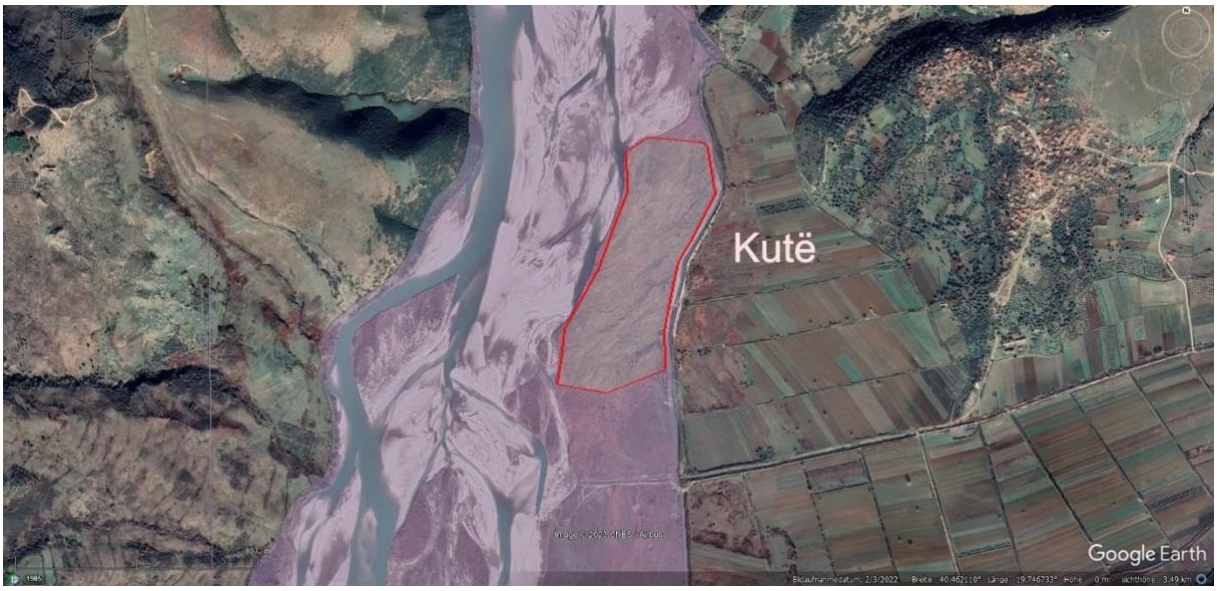


Fig. 15: The proposed area for reforestation west of Kutë (Screenshot from Google Earth, 2022-03-02).

Stand characteristics: The area west of Kutë is dominated by cogon grass (*Imperata cylindrica*) and lies more than 2 m above the mean water level. It is kept free of trees and shrubs by regular burning and is used for grazing by sheep and goats. Isolated small groups of oriental plane (*Platanus orientalis*) with admixed black alder (*Alnus glutinosa*) with a breast height diameter up to 20 cm, a height of up to 8(10) m and an age of > 20 years prove the tree capability of the sites provided with a fine sediment layer thicker than 40 cm. Amidst the species-poor cogon grass (*Imperata cylindrica*) grassland, the small forest remnants provide niches for species characteristic of floodplain forest such as bearded wheatgrass (*Elymus caninus*), false-brome *(Brachypodium sylvaticum*), eggleaf twayblade *(= Neottia o.) Listera ovata* and even woody regeneration species such as field elm (*Ulmus minor*). Usually, the tree species of the remnant forest stands (with an area of less than 1/2 ha) are felled before they reach the age at which they produce seeds or fruits.

Proposed measures: Creation of similar forest patches like in figure 16 by planting of oriental plane (*Platanus orientalis*), black alder (*Alnus glutinosa*), field elm (*Ulmus minor*) to provide the appropriate climatic and light conditions for forest understorey species. These small forest patches also provide shelter for grazing sheep and goats during hot summer periods.

After planting, the small areas of a few 100 square metres must be protected by fencing from browsing by grazing animals. Furthermore, care must be taken to ensure that set fires do not spread to the afforested areas. The currently dominant cogon grass (*Imperata cylindrica*) finally will be outcompeted by the shading of trees and shrubs.

The vegetation development of the fenced areas should be compared with areas of the same size without a fence in order to gain knowledge for further afforestation. The fence can be removed from an age of about 10 years.

Fig.16 top: Cogon grass (Imperata cylindrica, insert: flowering stem) (phot. 2017-04-25); bottom leftt: eggleaf twayblade (*Listera (Neottia) ovata, insert: flowering stem* (*phot. 2017-04-25*)*; bottom right: remnant of a floodplain forest near Kutë with oriental plane (Platanus orientalis), black alder (Alnus glutinosa) in the tree layer and the liana common ivy (Hedera helix). Age 18 years (counted tree rings, TurboVeg database no. 58)* (*phot. 2017-04-25*)*.*

2.1.5. Poçem-South

Fig. 17: The proposed reforestation area Poçem-South (Screenshot from Google Earth, 2021-07-22).

Area: 44 hectares

Geographical situation: Quark Fier, southwest of Poçem, west of the road leading to the bridge over the Vjosa. Coordinates and altitude see Tab. 2.

Stand characteristics: The area, which is about 2 m above the mean water table, is subject to high grazing pressure (Fig. 14). It is crisscrossed by many livestock trails.

Fig. 18: Burned and overgrazed area with sparse grass cover and burned lilac chastetree (Vitex agnus-castus). (TurboVeg database no. 134) (phot. 2022-07-01).

Fig. 19 left : Overgrazed area with elephant grass (Tripidium (= Saccharum) ravennae) in the foreground and burned lilac chastetree (Vitex agnus-castus) (TurboVeg database no. 134); right: impenetrable VitexPlatanus-Ulmus scrub with blackberry (Rubus sanctus) (TurboVeg database no. 136). (phot. 2022-0701).

The larger part of the area is dominated by a sparse grass cover. The characteristic species are cogon grass *(Imperata cylindrica*) and elephant grass (*Tripidium ravennae*), all other grass species as well as the herbs play a subordinate role for grazing activities. In late spring the grasses have already largely dried up. Only a few low *lilac chastetree* (*Vitex*) and oriental plane (*Platanus orientalis*) shrubs are to be mentioned as woody species (*TurboVeg database no.* 134). Embedded in this vegetation type are island-shaped shrubs of *Vitex* (dominant), *Platanus* and field elm (*Ulmus minor*) up to 4.5 metres high. They are almost impenetrable due to their density and the blackberry involved in their structure (*TurboVeg database no.* 136).

Proposed measures: Plantation of oriental plane (*Platanus orientalis*)*,* field elm (*Ulmus minor*) and olive willow (*Salix eleagnos*) in small groups. The young plants need individual protection due to the high grazing pressure.

2.1.6. Poçem-Pavla

Area: 17 hectares

Geographical situation: Quark Fier, around Poçem, south of the Pavla rivulet. Coordinates and altitude see Tab. 2.

Stand characteristics: The site is situated to the east of a stand of oriental plane (*Platanus orientalis*) and black alder (*Alnus glutinosa*). The site is criss-crossed by depressions and lies about 3 to 4 m above the mean water level. The loosely stocked silver willow stand with intermixed oriental plane tree shows burn marks on several trunks. A list of species (TurboVeg database no. 139) can be viewed at the author. The adjacent Parku Poçem to the east, directly next to the "Fontana" mineral water bottling plant, is planted with hybrid poplars. The southern part, which borders directly on the banks of the Vjosa, shows no tree cover and is partly characterised by stems of old, dead plane trees.

Proposed measures: Plantation of white poplar (*Populus alba*) and *black poplar* (*P. nigra*) in larger gaps in order to create a more close canopy, that can function as a shelter for livestock. Single tree protection is necessary. No fires should be lit in the newly planted areas to avoid damaging the young plants.

Fig. 20: The reforestation area near Poçem-Pavla S of the Pavla rivulet (Screenshot Google Earth 2021-07-22).

Fig. 21 Upper left: White willow stand with elephant grass (Tripidium ravennae) in the foreground (phot. 2022-07-01); Right: species rich white willow-plane stand (species list TurboVeg database no. 139 (phot. 2022-
07-01); Bottom: Parku Poçem, a loose stand of hybrid poplars (phot. 2022-07-01).

2.1.7. Poçem-Autogrill

Area: 26.7 hectares

Geographical situation: Quark Fier, north of Poçem, north and east of the Pavla rivulet, near Autogrill 24. Coordinates and altitude see Tab. 2.

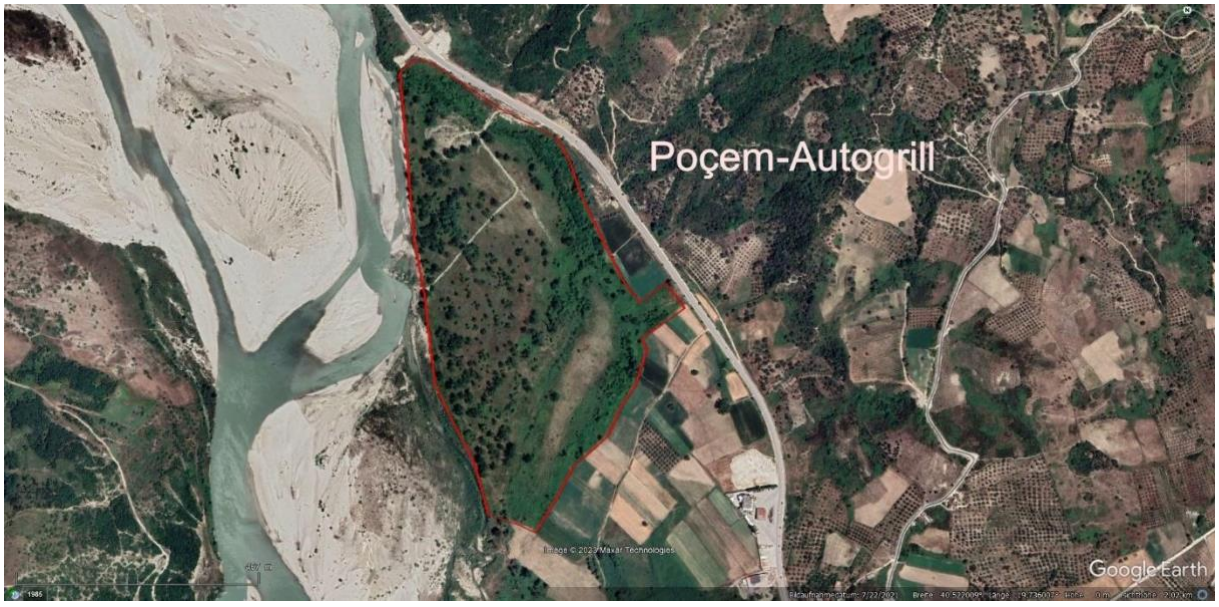


Fig. 22: Situation of the afforestation area Poçem-Autogrill north of Poçem (Screenshot from Google Earth 2021-07-22).

Stand characteristics: The northern part of the area on a level about 3 meters above the mean water level shows a sandy cover. It is preserved from lateral erosion by a groyne.

Fig. 23 Left: A mixed stand of white willow (Salix alba), black poplar (Populus nigra), black alder (Alnus glutinosa) within the reforestation area, in the foreground a burned stump (species lists: TurboVeg database no. 92 and 93 at the author); Right: Italian arum (Arum italicum) (phot. 2019-05-14).

The canopy of the loose stands (ca 0.2 crown cover) consists of white willow (*Salix alba*), black poplar (*Populus nigra*), black alder (*Alnus glutinosa*) and in a lower tree layer oriental plane (*Platanus orientalis*) (*TurboVeg database no.* 93, *TurboVeg database no.* 92). Thea area is burned and grazed. Despite grazing, these forest remnants are refuges for protected species such as the bug orchid (*Anacamptis coriophora subsp. fragrans)* or *Serapias* cf. *politisii.*

Fig. 24: Bug orchid (Anacamptis coriophora subsp. fragrans) (left); Serapias f. politisii (center); burned white willow (right) (phot. 2019, Mai 11).

Proposed measures: Compacting the tree population by planting of cuttings of tree species mentioned above. Because of grazing single tree protection is necessary. Anyway fire prevention is very important.

2.1.8. Cakran

Area: 44 hectares

Geographical situation: Quark Fier, south of Cakran, partly in the active channel. Coordinates and altitude see Tab. 2.

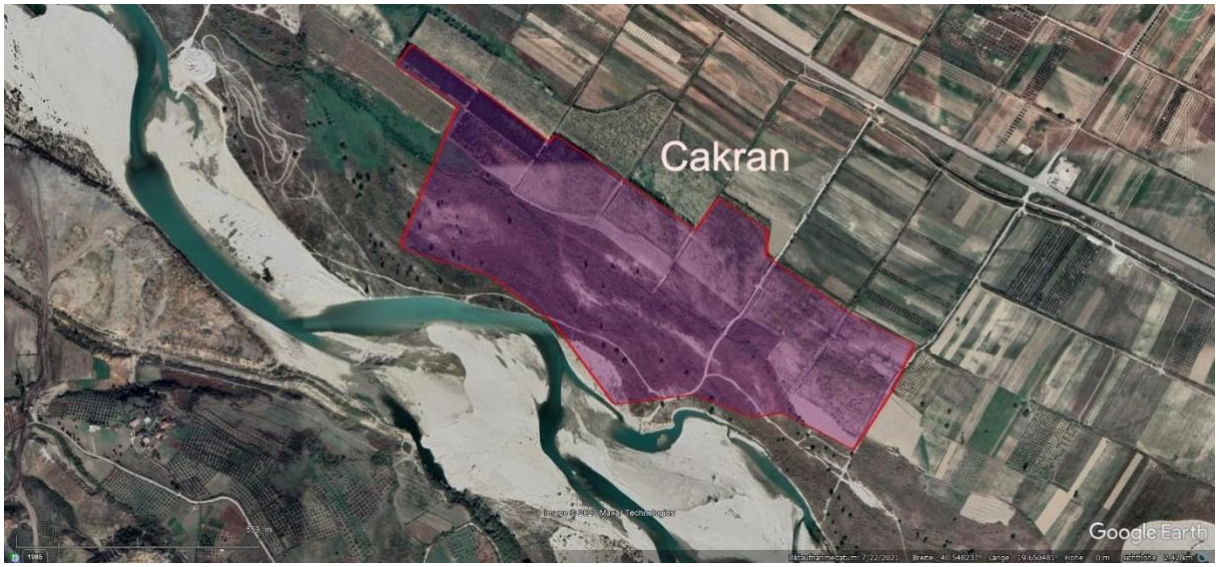


Fig. 25: Situation of the afforestation area Cakran (Screenshot from Google Earth 2021-07-22).

Stand characteristics: The afforestation area on the orographic right bank of the Vjosa is situated only about 1 m above the mean water level of the Vjosa river. The groundwater level, which rises during floods, obviously damages the root system of *Paulownia*. The damaged trees have died almost over the entire area. Description see Hasenauer et al. 2022.

Proposed measures: The entire area must be reforested with saplings of white willow (*Salix alba*), black poplar (*Populus nigra*) and white poplar (*Populus alba*) to prevent the invasion by neophytic woody plants. As the area situated within the national park boundaries is privately owned, the owner must be contacted before any measures are taken. The most effective solution would be the purchase of the area by an NGO.

2.1.9. Rromës

Fig. 26: Situation of the afforestation area Rromës (Screenshot from Google Earth 2021-07-22).

Area: 1 hectare

Geographical situation: Quark Fier, along the road SH4, south of Cakran. Coordinates and altitude see Tab. 2.

Stand characteristics: arable field. Planted with foxglove tree (princess tree, *Paulownia tomentosa*). It requires full sun and tolerates various soil types, but no flooding. *Paulownia tomentosa* is a very fast growing species, it becomes mature early. The winged seeds are dispersed by wind and water.

Proposed measures: Foxglove tree (*Paulownia tomentosa*) should be removed as soon as possible before it starts to spread. The species spread by wind is invasive and gets out of control easily. The area is privately owned, probably the only way to enforce measures is to purchase the area.

The area is situated outside the borders of the National Park far from the active channel. It is to be planted with Late Biogeomorphological Phase species. Initially, fast-growing pioneer species such as *Populus alba, Populus nigra* and willows (*Salix alba, S. amplexicaulis*) will be used to achieve a rapid canopy closure. In between, the species of the late succession phases such as pedunculate oak (*Quercus robur*), field elm (*Ulmus minor*), field maple (*Acer campestre*), oriental hornbeam (*Carpinus*

orientalis), common hawthorne (*Crataegus monogyna*), and the lianas purple clematis (*Clematis viticella*), bittersweet (*Solanum dulcamara*), silkvine (*Periploca graeca*), wildgrape (*Vitis sylvestris*) are planted simultaneously, which displace the light loving pioneer species in the course of crown development.

Fig. 27: The approx. 5 year old Paulownia plantation is already flowering (phot. 2023-04-19).

2.1.10. Banaj

Area: 19 hectares

Geographical situation: Quark Fier, west-southwest of the settlement Banaj, Vjosa floodplain ca 4 km upstream of the confluence with Shushica river. Coordinates and altitude see Tab. 2.

Stand characteristics: The open stands within the up to 1.2 km wide floodplain are characterized by a canopy cover below 0.3. The sites are situated around 2.7 to 3 m above MWT. Large areas of this level are covered with shrubs and trees of white poplar (*Populus alba*) and black poplar (*Populus nigra*). The stands are regularly grazed. For this purpose the understorey dominated by cogon grass (*Imperata cylindrica*) and plume grass (*Trypidium* = *Saccharum ravennae*) is regularly burned (see Fig 30). Obviously several white poplars with BHD > 40 cm have been cut probably to gain grazing area.

Fig. 28: Situation of the afforestation area Banaj (reach 2) (Screenshot from Google Earth 2021-08-28).

More dense stands are rare and in the greater part situated on the outer edge of the floodplain. They are dominated by *Populus nigra, P.alba* admixed in the tree and shrub layer. The fuel wood is rarely used!

Fig. 29: Open stands of black poplar (Populus nigra) with an understorey of cogon grass (Imperata cylindrica) (phot. 2023-04-19).

Fig. 30 Left: Rest of a burned stock of white poplar (Populus alba) (phot. 2023-04-19); Right: Huge area with dominating cogon grass (Imperata cylindrica) (phot. 2023-04-19).

Proposed measures: Planting of small groups of single trees of white poplar (*Populus alba*), black poplar (*Populus nigra*) and oriental plane (*Platanus orientalis*) to achieve areas of 0.2–0.5 ha with dense canopy of 0.6 to 0.8 canopy cover. This allows the development of a typical understorey plant cover and later provides shelter for livestock. Because of regularly grazing single tree protection is necessary.

The repeated fires to destroy the scrawny foliage of the cogon grass should be stopped at least until the crowns have outgrown the ground fires.

3. Management of the afforestation areas

Large afforestation areas dominated by cogon grass (*Imperata cylindrica*) and grazed can be most effectively stocked with fenced small areas of 0.2 to 0.5 ha within the total area. This can ensure both grazing of the remaining areas and rapid reforestation with shady woody plants such as oriental plane, white poplar or field elm. As soon as the young trees have reached a height that is out of reach of the grazing animals, the fence can be removed. Special attention must be paid to preventing fire, as young trees are particularly vulnerable (see fig. 31).

Fig. 31: Floodplain north of Poçem. Active channel in the foreground, grazed higher terrace behind with dominant cogon grass (Imperata cylindrica) and single trees of oriental plane (Platanus orientalis). Insert: The lower parts of the crowns are damaged by ground fires caused by the burning of cogon grass. (phot. 2017-09-18).

For loosely stocked areas such as Tepelenë or Barnaj, the newly planted individual trees are protected from browsing by individual tree protection until the crowns are out of reach of grazing animals. Compaction of the stand can be achieved more cheaply in this way without fencing the entire area.

Another important aspect is to stop illegal logging for fuel (fig. 32). Also setting fires to remove the dry foliage especially of cogon grass (*Imperata cylindrica*) must be prevented (fig. 23 left, fig. 30 left, fig. 33), because it destroys mainly the shrubs and the regeneration of tree species (fig. 31 insert). The ecological niche and the role of cogon grass in the ecosystem is the subject of ongoing research. For extensive pasture management, the species is of great importance, because due to its strong rhizome network (fig. 33 upper right), it tolerates both over-sanding during floods (fig. 33 upper left), and regular burning. The species then quickly sprouts fresh shoots in the spring that are used by grazing livestock.

Fig. 32: Probably illegal logging in the floodplain near Kutë; insert: Stump with a diameter of approx. 25 cm and 18 annual rings (phot. 2017-04-25, insert: 2017-09-17).

4. Restrictions on use and monitoring of the afforestation areas

In an agreement with the users of the areas to be afforested, restrictions on the use of the afforested areas must be established:

- Ban on the use of wood species of any age
- Exclusion of grazing in fenced areas
- Prohibition of setting fires

In the small fenced afforestation areas within the larger areas presented in chapter 2, checks should be made at regular intervals to determine the success of the growth. A protocol should also provide information on whether other woody species that were not planted have established due to the exclusion of grazing. Here, the shrub species scorpion senna (*Hippocrepis emerus*), common dogwood (*Cornus sanguinea*), Jerusalem sage (*Phlomis fruticosa*), bittersweet or climbing nightshade (*Solanum dulcamara*), common fig (*Ficus carica*), common hawthorne (*Crataegus monogyna*), evergreen rose (*Rosa sempervirens*), scarlet firethorn (*Pyracantha coccinea*), bay laurel (*Laurus nobilis*), and the oak species pedunculate oak (*Quercus robur*) and Turkey oak (*Quercus cerris*) are of special concern.

Fig. 33 Upper left: Burned cogon grassland; Upper right: Cogon grassland buried with sand during the last flood – resprouting from rhizomes. (phot. 2019-05-12); Bottom: Extensive cogon grassland on the orographic left bank of the Vjosa near Kutë (phot. 2019-05-12).

5. Conclusions

In order to meet the requirements of the IUCN for a National Park II – at least on small areas – succession processes like the natural forest development in the floodplain have to be protected. For this reason, at least small-scale afforestation measures are to be carried out to initiate these processes. At the beginning a management of these areas is necessary at least for some years. A parallel monitoring leads to a better understanding of these processes and to avoid mistakes in further afforestation measures.

6. Next steps

6.1. Forest nursery

Initial talks with the owner of the property designated for the establishment of the forest nursery took place on April 20th 2023.

Participants: the owner of the property, two members of the forest management of the municipality of Tepelenë, Univ.-Prof. Elvin Toromani and the author of this paper.

The next steps proposed:

- Conclusion of a long-term lease agreement with the owner of the designated land for the forest nursery
- Search and selection of a person to take care of the forest nursery
- Preparatory work for the cultivation of autochthonous plant material in autumn 2023
- Start collecting plant material for cultivation (young plants as source material for the production of cuttings; collection of diaspores of species propagated by seed) Opening of the forest nursery in spring 2024.

Table 2: List of the proposed afforestation areas with geographical coordinates and altitude above sea level. Priority areas in bold letters. The size of the afforestation areas is given in column 3, the geographical coordinates column 4 and 5 indicate the centre of the area. Column 6 and 7 indicate the height above sea level.

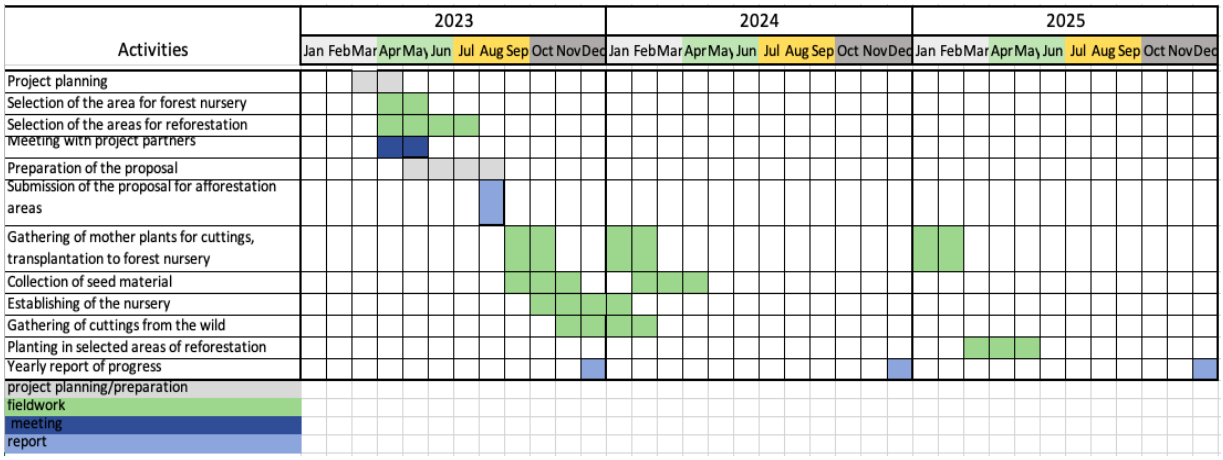
No	Name of the area	Area in hectares	Latitude in degrees	Longitude in degrees	Altitude above sea level (on total area)	Altitude (in the centre)
3	**Tepelenë**	13	40.288271	20.028799	126–130	126
8	**Cakran**	44	40.543813	19.622604	22–24	23
9	**Rromës**	1	40.553004	19.654721	22–23	23
2	**Dragot**	39	40.282053	20.057032	130–134	132
1	**Hundëkuq**	10	40.199628	20.094498	158–161	161
4	**Kutë**	24	40.469830	19.751879	49–53	49
5	Poçem-South	44	40.501996	19.725227	38–41	39
6	Poçem-Pavla	17	40.512921	19.736179	37–42	39
7	Poçem-Autogrill	26.7	40.522009	19.736007	36–40	38
10	Banaj	19	40.560489	19.603502	17–18	17

6.2. Reforestation areas

- A contract with the municipality of Tepelenë on the transformation of areas in the floodplain that are suitable for afforestation
- Identification of landowners of the proposed afforestation areas
- Presentation of the proposed afforestation areas in the municipalities and the planned afforestation measures there.
- Initiation of discussions with the municipalities and landowners.

Fig. 34: Edge of the active channel near Kutë with woody debris (2017-04-25).

Workflow



Literature

Beijerinck W. 1947. Zadenatlas der Nederlandsche Flora ten behoeve van de botanie, palaeontology bodemcultuur en Warenkennis. – H. Veenman & Zonen, Wageningen.

Drescher A. 2017–2023. Unpublished notes and vegetation records from several excursions in the Vjosa catchment.

Drescher A. 2017–2023. Unpublished vegetation data. Turboveg database.

Hasenauer H., Leiter M. and Toromani E. 2022. The forest in the Vjosa River basin: an assessment of the situation. – Unpublished report, 87 p.

Hennekens S.M., Schaminée J.H.J. 2001. TURBOVEG, a comprehensive data base management system for vegetation data. – Journal of Vegetation Science 12(4): 589–591.

Fig. 35: Stand of white willow (Salix alba) and poplars (Populus nigra, P. alba) on sandy sediment near Poçem (phot. 2017-09-21).

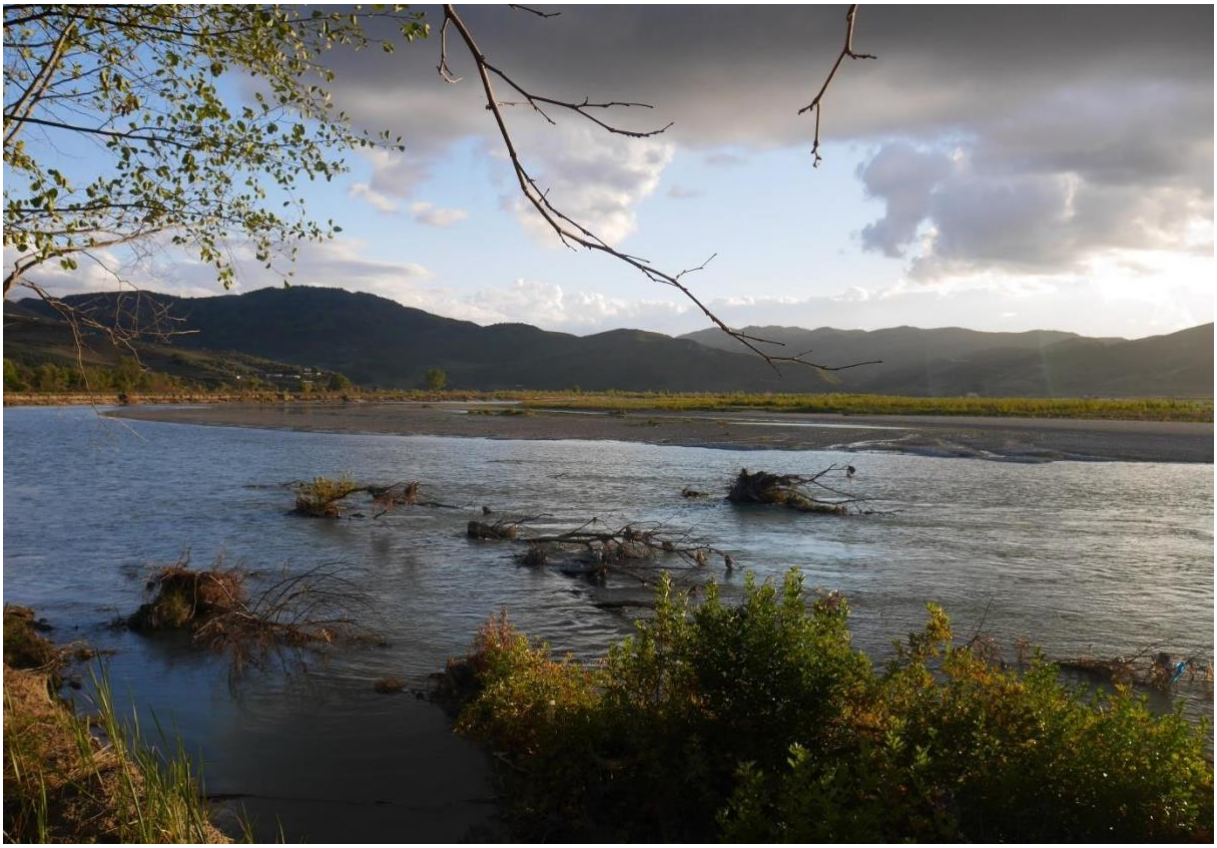


Fig. 36: Erosion bank near Poçem (phot. 2017-09-21).