ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
ΓΕΩΠΟΝΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ
ΕΙΔΙΚΟΣ ΛΟΓΑΡΙΑΣΜΟΣ ΚΟΝΔΥΛΙΩΝ ΕΡΕΥΝΑΣ

LIFE ANDROS PARK

LIFE Andros Park –
Conservation of priority species and habitats of Andros Island protected area integrating socioeconomic considerations
(LIFE16 NAT/GR/000606)

ACTION A.1

Feasibility study and specifications for the conservation of the target terrestrial habitat: restoration and management of 91E0*

AGRICULTURAL UNIVERSITY OF ATHENS

April 2019

The working team consists of the following persons:

s/n	Name	Body	Property
1	Panayiotis Trigas	AUA	Assistant Professor
2	Themistoklis Adamopoulos	External contributor to AUA	Forester-Environmentalist
3	Panayiotis Georgiou	AUA	Teaching and research associate

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Executive Summary

This Feasibility Study and Specifications for the Conservation of the Target Terrestrial Priority Habitat Type Alder (*Alnus glutinosa*) Alluvial Forests (code 91E0*) in Andros Island is compiled in the context of the deliverable A.1 of the project "LIFE Andros Park" and is directly linked to Action C.2 (Restoration of the alluvial *Alnus glutinosa* forests priority habitat).

Area selection for the implementation of the interventions followed the basic research on the priority habitat which began at the onset of the project. Vori and Lefka streams have been identified as the most important sites for the priority habitat within the Natura 2000 site of Andros. The project's area is the southernmost distribution limit of this habitat type in the Balkan Peninsula. The alluvial *Alnus glutinosa* stands that occur in Andros are highly important, as they represent the only known localities of this priority habitat type in the Cyclades and the whole south Aegean area.

The *A. glutinosa* stands in Andros are widely impoverished, without (or with sparse) regeneration and they are partially replaced by *Nerium oleander* formations and especially by the invading synanthropic giant cane (*Arundo donax*). During a severe flood episode in 2012, the *Alnus glutinosa* stands of Vori and Lefka streams lost a significant part of their area, corresponding to hundreds of mature individuals. The alder stands of Lefka stream practically disappeared and only remnant trees are currently present at this area.

Permanently stagnant waters cover a large part of Vori estuaries, resulting to the loss of all alder trees at the NW part of the wetland. Grazing by sheep and goats is extensive, mainly in Vori. The predominant practice involves uncontrolled flock grazing without the attendance of a shepherd. A large number of over 500 feral goats enter the priority habitat and destroy any new vegetation.

Wild fires are quite common during summer and although they have a limited direct effect on *A. glutinosa* forest, the habitat suffers from denudation of the surrounding slopes. Soil erosion follows resulting in heavy floods, as is dramatically evident on the slopes above Vori and Lefka valleys where large areas were recently burnt.

Restoration interventions in the *Alnus glutinosa* stands in Andros come into a clear consequence of the habitat degradation. Implementation of the restoration objective shows that the main interventions should be:

1. Planting of alder seedlings
2. Fencing, and

3. Giant cane control
4. Debris removal

Planting alder seedlings will enhance the priority habitat conservation and will induce its climate change resilience. At these sites re-establishment of the population of A. *glutinosa* and its associated ectomycorrhizal fungi will be performed through targeted planting of alder seedlings. Fencing will exclude the access of grazing livestock to planted areas. The giant cane control will to some extent decrease competition pressure to alders and will create new sites for alder plantings. Debris removal, mainly dead wood from the streambeds, will reduce flood risk and will ensure alder seedlings survival in the mid-term.

The suitable planting locations along the streams were identified and mapped. Alder seedlings will be planted manually only, as most planting sites are not suitable for planting by mechanical means. As several planting sites are largely inaccessible, bare-root seedlings will be planted at these distant sites in order to facilitate their transfer by the workers. All seedlings will be watered after planting and additional watering could be implemented during next two years after planting.

During 2018, approx. 3,500 black alder seedlings were produced at the plant nursery of the Agadaki Estate. All seedlings were planted in Lefka and Vori streams during March 2019. Additional seedlings (about 8,000) will be produced during 2019 and they will be planted in the study areas during autumn-winter 2019-2020 according to the schedule of Action C.2.

Fences will be made of rectangular mesh secured by iron bars and their height will be 1.30 m. They will enclose the vast majority of the planted alder seedlings, securing them from herbivore animals, e.g. feral goats. In certain cases, like those of isolated areas far away from the existed roads, fences will not be established, at least during the first year of plantations.

Giant cane (*Arundo donax*) control will be mainly implemented by manual methods. Small giant cane clusters can be removed by digging. The canopy will be removed first by using chain saws or pruning shears. Then, the remaining of the cane stems, rhizomes and roots will entirely remove from the soil using shovel, mattocks or pick-ax. Uprooted material will be removed or burned onsite to prevent rerooting.

Εκτενής περίληψη

Το παρόν κείμενο αφορά τη μελέτη σκοπιμότητας και τις προδιαγραφές για τη διατήρηση του οικοτόπου προτεραιότητας των παραποτάμιων δασών σκλήθρου (*Alnus glutinosa*-κωδικός 91E0 *) στο νησί της Άνδρου. Η μελέτη σκοπιμότητας γίνεται στο πλαίσιο σχετικού παραδοτέου στα πλαίσια της Δράσης Α.1 του Προγράμματος LIFE Andros Park και συνδέεται άμεσα με τη Δράση C.2 (Αποκατάσταση του οικοτόπου προτεραιότητας του αλλουβιακού δάσους *Alnus glutinosa*).

Η επιλογή των περιοχών για την υλοποίηση των παρεμβάσεων ακολούθησε τη βασική έρευνα για τον οικότοπο προτεραιότητας που ξεκίνησε από την έναρξη του προγράμματος. Τα ρέματα Βόρη και Λεύκα έχουν χαρακτηριστεί ως οι σημαντικότερες τοποθεσίες για τον οικότοπο προτεραιότητας στο χώρο του Natura 2000 της Άνδρου. Η περιοχή του έργου είναι το νοτιότερο όριο κατανομής αυτού του τύπου οικοτόπου στη Βαλκανική Χερσόνησο. Η θέση των αλλουβιακών *Alnus glutinosa* που εμφανίζονται στην Άνδρο είναι πολύ σημαντική, καθώς αντιπροσωπεύουν τις μοναδικές γνωστές θέσεις του τύπου οικοτόπου προτεραιότητας στις Κυκλάδες και σε ολόκληρο το Νότιο Αιγαίο.

Οι σχηματισμοί *A. glutinosa* που βρίσκονται στην Άνδρο είναι υποβαθμισμένοι, χωρίς (ή με αραιή) αναγέννηση και αντικαθίστανται εν μέρει από σχηματισμούς πικροδάφνης *Nerium oleander* και ιδιαίτερα από το εισβλητικό ανθρωπόφιλο είδος καλαμιού (*Arundo donax*). Κατά τη διάρκεια ενός σοβαρού πλημμυρικού επεισοδίου το 2012, οι συστάδες *Alnus glutinosa* στη Βόρη και στη Λεύκα, απώλεσαν ένα σημαντικό μέρος της έκτασής τους, που αντιστοιχεί σε εκατοντάδες ώριμα άτομα. Τα σκλήθρα στη Λεύκα σχεδόν εξαφανίστηκαν και μόνο λίγα υπολειμματικά δενδρώδη άτομα απέμειναν σε αυτήν την περιοχή.

Τα μόνιμα στάσιμα ύδατα καλύπτουν ένα μεγάλο μέρος των εκβολών της Βόρης, με αποτέλεσμα την απώλεια όλων των σκλήθρων στο βορειοδυτικό τμήμα του υγροτόπου. Η βοσκή των αιγοπροβάτων είναι εκτεταμένη, κυρίως στη Βόρη. Η κυρίαρχη πρακτική είναι η ανεξέλεγκτη βόσκηση του κοπαδιού χωρίς την παρουσία βοσκού. Πάνω από 500 άγριες κατσίκες εισέρχονται στον οικότοπο προτεραιότητας και καταστρέφουν κάθε νέα βλάστηση.

Οι πυρκαγιές είναι πολύ συχνές κατά τη διάρκεια του καλοκαιριού και παρόλο που έχουν περιορισμένη άμεση επίδραση στο δάσος *A.glutinosa*, ο οικότοπος υποφέρει από την απογύμνωση της γύρω περιοχής. Η διάβρωση του εδάφους οδηγεί σε πλημμύρες, όπως έχει γίνει εμφανές στις πλαγιές πάνω από τις κοιλάδες Βόρη και Λεύκα, όπου σημαντική έκταση κάηκε πρόσφατα.

Οι παρεμβάσεις αποκατάστασης του *Alnus glutinosa* στην Άνδρο έρχονται ως συνέπεια της υποβάθμισης του οικοτόπου. Οι κύριες παρεμβάσεις για το στόχο της αποκατάστασης θα είναι:

1. Φύτευση σποροφύτων σκλήθρου

2. Περιφράξεις και

3. Περιορισμός του καλαμιού

4. Καθαρισμοί-απομάκρυνση νεκρού ξύλου

Η φύτευση σποροφύτων θα ενισχύσει τη δυνατότητα διατήρησης του οικοτόπου προτεραιότητας και θα προκαλέσει την ανθεκτικότητά του στην κλιματική αλλαγή. Στις μελετούμενες περιοχές, η αποκατάσταση του πληθυσμού του *A. glutinosa* με τις συμβιωτικές του μυκόρριζες θα πραγματοποιηθεί μέσω στοχευμένης φύτευσης σποροφύτων. Η περίφραξη θα αποκλείσει την πρόσβαση των βοσκόντων ζώων στις ζώνες φύτευσης. Ο έλεγχος του καλαμιού θα μειώσει σε κάποιο βαθμό την πίεση του ανταγωνισμού στα σκλήθρα και θα δημιουργήσει γι αυτά νέες εκτάσεις που θα προκύψουν από τις φυτεύσεις. Η απομάκρυνση υπολειμμάτων νεκρού ξύλου από τη ροή του νερού στα ρέματα, θα μειώσει τον κίνδυνο πλημμύρας και θα διασφαλίσει την επιβίωση των σποροφύτων μεσοπρόθεσμα.

Οι κατάλληλες θέσεις φύτευσης κατά μήκος των ρεμάτων καταγράφηκαν και χαρτογραφήθηκαν. Τα σπορόφυτα του σκλήθρου θα φυτευτούν μόνο χειρωνακτικά, καθώς οι περισσότερες θέσεις φύτευσης δεν είναι κατάλληλες για φύτευση με μηχανικά μέσα. Καθώς πολλές θέσεις φύτευσης είναι σε μεγάλο βαθμό απρόσιτες, γυμνόριζα φυτάρια θα φυτευτούν σε αυτές τις δύσκολες θέσεις, προκειμένου να διευκολυνθεί η μεταφορά τους από τους εργάτες. Όλα τα σπορόφυτα θα ποτιστούν μετά τη φύτευση και το πρόσθετο πότισμα θα εφαρμοστεί κατά τα επόμενα δύο χρόνια μετά τη φύτευση.

Κατά τη διάρκεια του 2018, περίπου 3.500 φυτάρια σκλήθρου παρήχθησαν στο φυτώριο του κτήματος Αγαδάκη. Όλα τα σπορόφυτα φυτεύτηκαν στα ρέματα Λεύκας και Βόρης στις αρχές Μαρτίου 2019. Επιπλέον φυτά (περίπου 8.000) θα παραχθούν κατά τη διάρκεια του 2019 και θα φυτευτούν στις περιοχές μελέτης κατά το φθινόπωρο και χειμώνα του 2019-2020 σύμφωνα με το πρόγραμμα της Δράσης C.2 .

Οι περιφράξεις θα είναι κατασκευασμένες από ορθογώνιο πλέγμα στερεωμένο από ράβδους σιδήρου και το ύψος τους θα είναι 1,30 μ. Θα περικλείουν τη συντριπτική πλειοψηφία των φυτευμένων σποροφύτων, προστατεύοντάς τα από τα φυτοφάγα ζώα. Σε ορισμένες περιπτώσεις, όπως σε απομονωμένες θέσεις μακριά από τους υπάρχοντες δρόμους, δεν θα γίνουν περιφράξεις, τουλάχιστον κατά το πρώτο έτος των φυτεύσεων.

Ο περιορισμός του καλαμιού (*Arundo donax*) θα εφαρμοστεί κυρίως με χειρωνακτικές μεθόδους. Οι μικρές συστάδες καλαμιού μπορούν να αφαιρεθούν με σκάψιμο. Η κόμη θα αφαιρεθεί πρώτη με αλυσοπρίονα και ψαλίδια κλαδέματος. Στη συνέχεια, τα υπόλοιπα στελέχη, ριζώματα και ρίζες θα απομακρυνθούν εξ ολοκλήρου από το έδαφος χρησιμοποιώντας φτυάρι,

αξίνα και τσάπα. Το ξεριζωμένο υλικό θα αφαιρεθεί ή θα καεί επί τόπου για να αποφευχθεί η επαναριζοβολία.

1. Introduction

Riparian forests are sensitive ecosystems threatened by several human activities but especially by land use changes and climate change. *Alnus glutinosa* alluvial forests are widely distributed across Europe, but they are increasingly rare in the south. This habitat type has experienced severe area reduction during the past decades, as a result of the use of the fertile alluvial deposits for agricultural production. In Greece, like in other European countries, the increased need for new arable land has severely decreased alder stands. Only remnants of alluvial alder stands exist today in the southern part of the Greek mainland. The conservation status of this sensitive habitat type is much worst in the Aegean Islands. Most islands in the Aegean archipelago are small and relatively dry, supporting only small streams that hardly form alluvial deposits at their estuaries. The habitat type 91E0* has been recorded in 20 Natura 2000 SAC sites in Greece, but only two of them are located in the Aegean Islands. The first is located in Samothraki Island in the North Aegean region, while the only *Alnus glutinosa* alluvial forest in central Aegean Archipelago is located in Andros. Hence the project's area is the southernmost distribution limit of this habitat type in the Balkan Peninsula.

Area selection for the implementation of the interventions followed the basic research on the priority habitat that has begun from the start of the program. Vori and Lefka streams have been identified as the most important sites for the priority habitat within the Natura 2000 site of Andros.

The present feasibility study is made in the context of the deliverable A1 of the LIFE Andros Park – Life16 NAT/GR/000606, under the title "Feasibility study and specifications for the conservation of the target terrestrial habitat: restoration and management of 91E0*" and is directly linked to Action C.2 (Restoration of the alluvial *Alnus glutinosa* forests priority habitat).

2. Objectives

After the preparation of the Interim Report, the floristic composition and structure of the *Alnus glutinosa* alluvial forests of Andros (priority habitat 91E0) have largely been revealed. To our knowledge, this is the first comprehensive study for *A. glutinosa* alluvial forests at the southernmost distribution limits of this habitat type. The *A. glutinosa* stands in Andros are

widely impoverished, without (or with sparse) regeneration and they are partially replaced by *Nerium oleander* formations and especially by the invading synanthropic giant cane (*Arundo donax*). The main objective of Action C.2 is the restoration of the priority habitat 91E0* in Andros, which is largely detriorated by human activities and their consequences in the hydrological cycle. The establishment of balanced alder alluvial stands at Vori and Lefka streams that will offer all their valuable ecosystem services at these isolated areas of Andros island are the main targets of Action C.2.

Management specifications (e.g. localization and mapping of clearing and fencing actions, plantations) for the Actions C.l and C.2 will be determined during the Action A.1 and specifically by the present feasibility study.

The aforementioned actions will have a positive effect in climate change mitigation. Improving the conservation status of the priority habitat and reducing various negative impacts (giant cane competition, overgrazing) will improve resilience of the habitat to climate change and will increase the whole ecosystem resilience to natural disasters.

3. The habitat 91E0 and aspects of its current condition

3.1 Distribution and importance

Alluvial forests with *Alnus glutinosa* are rare and threatened throughout Europe, where although widely distributed, only remnants of narrow stripes or lines of trees presently exist along rivers. Their presence is particularly decreased in the Mediterranean. For this reason, alder stands are designated as priority habitat type (91E0) in the Commission environmental legal system.

Alnus glutinosa is widely distributed along streams almost throughout Andros Island. It usually grows together with *Platanus orientalis* forming riparian galleries mainly at moderate altitudes. *Platanus orientalis* is the dominant species in almost all cases, while alders grow in small groups or as single trees within *Platanus* formations. In Vori and Lefka streams small alluvial deposits have been formed at the estuaries and along the lower part of the streams. The alluvial *Alnus glutinosa* stands that occur there are highly important, as they represent the only known localities of this priority habitat type in the Cyclades and the entire south Aegean area.

3.2. Degradation

Vori wetland is one of the most important wetlands of Andros Island. It faces, however, intensive disturbances. In the wetland as well as along the streambed there are multiple problems that are interrelated. Flooding events have destructed alder and platanus stands, have carried and deposited alluvial material in adjacent meadows, cultivated fields and terraces, as well as within the riverbed and delta, altering wetland's structure. The wetland has been largely enclosed by sedimentary materials (soil, tree branches, and dry canes) that hinder the smooth flow of water, forming a permanent water cover and anaerobic conditions locally throughout the year. A road construction that crosses the wetland along the seaside also prevents wetland drainage. Permanently stagnant waters cover a large part of Vori estuaries, mainly at the NW part of the wetland, resulting to the loss of all alder trees at this part of the wetland.

During a severe flood episode in 2012, the *Alnus glutinosa* stands of Vori and Lefka streams lost a significant part of their area, corresponding to hundreds of mature individuals. The alder stands of Lefka stream practically disappeared and only remnant trees are currently present at this area. The regeneration of the forest is limited and the former alder stands are gradually replaced by giant cane and *Nerium oleander* formations. Sparse alder seedlings still appear in the area, but they are quickly consumed by goats. Of the three Lefka sample plots with alder taken, only alder seedlings were found in two of them and a mature tree was recorded in the third plot.

In Vori stream a compact alder stand still exists at the delta area, close to Vori beach. However, of the seven Vori sample plots with alder taken, *Alnus glutinosa* stands were in good condition only in four. In none of them there is seedling regeneration, probably because of the grazing mainly by goats. The hydrological conditions of the delta area have probably altered after 2012 flood event. As a result, a part of the former *A. glutinosa* alluvial forest is permanently flooded, and all trees in this part have died. Despite the *A. glutinosa* cover increase after 1945 (when almost any tree has been fallen during World War II), disturbances often come up and fall the ecosystem in a backward direction.

Grazing by sheep and goats is extensive, mainly in Vori. The predominant practice involves uncontrolled flock grazing without the attendance of a shepherd. A large number of over 500 feral goats enter the priority habitat and destroy any new vegetation. This has a disastrous effect leading to complete eradication of emerging *Alnus glutinosa* seedlings, and results in stunted alluvial forest natural regeneration and a serious degradation of their floristic

composition. In Lefka stream grazing is less intensive, but remains a major threat for alder seedlings.

Wild fires are quite common during summer and although they have a limited direct effect on *A. glutinosa* forest, the habitat suffers from denudation of the surrounding slopes. Soil erosion follows resulting in heavy floods, as is dramatically evident on the slopes above Vori and Lefka valleys where large areas were recently burnt.

Intense flooding phenomena are responsible for serious degradation of *A. glutinosa* alluvial forests in 91E0* during the last few years. A large number of trees were uprooted, while rocks, trunks and other plant debris were moved downstream, the appearance of several sites has drastically changed and no forest vegetation could be further observed in some cases. The main reason for flooding are recent wild fires, particularly around Vori and Lefka valleys where 40% of the total *Alnus glutinosa* cover area has severely degraded as stated in the LIFE Program habitat description.

Last but not least, another aspect of degradation is related to the local farmers attitude towards the forest. They don't perceive the forest itself as an unfavorable natural condition but nor they think it has to expand. After 2012 flooding event several local inhabitants believe that alder trees will act as dams during the next flood that will intensify flood disasters.

4. Restoration interventions

Restoration in wetlands using tree planting has been used worldwide in recent years (Sweeney et al. 2002, Bigley & Deisenhofer 2006, Liu et al. 2017, Morimoto et al. 2017). Conservation implementation often uses tree planting combined with other interventions. Selection of intervention areas has been based on: (a) the status/threats of the priority habitat type 91E0, (b) habitat representativeness within the SCI site of Andros, and (c) the possibility of implementing effective measures to address the existing threats.

Restoration interventions in the *Alnus glutinosa* stands in Andros come into a clear consequence of the previously exposed situation. Implementation of the objectives of the Program Action C.1 show that the main interventions should be:

1. Planting of alder seedlings
2. Fencing, and
3. Giant cane control
4. Debris removal

Technical plans for anti-erosion and anti-flooding measures produced during Action A.3 specify additional protecting measures in Vori and Lefka stream basins, further ensuring alder plantations.

Planting alder seedlings will enhance the priority habitat conservation and will induce its climate change resilience. At these sites re-establishment of the population of A. *glutinosa* and its associated ectomycorrhizal fungi will be performed through targeted planting of alder seedlings, which will enhance soil stabilization and act as a major protection measure against flooding. Fencing will exclude the access of grazing livestock to planted areas. The giant cane control will to some extent decrease competition pressure to alders and will create new sites for alder plantings. Debris removal, mainly dead wood from the streambeds, will reduce flood risk and will ensure alder seedlings survival in the mid-term.

5. Specifications for restoration

5.1. Planting

Planting works will include planting of seedlings inoculated with symbiotic fungi. Seedlings come from the nursery created under Action C.2. Seeds are of local origin, collected from alder trees from the local stands, ensuring that the planted material will be completely adapted to the local environment.

During Action A.1 a detailed demarcation of the intervention areas in both Vori and Lefka streams was made. The suitable planting locations along the streams were identified and mapped during fieldwork within the study areas. The corresponding maps of Vori and Lefka with restoration actions are attached in the present feasibility study. Planting areas are mainly located in alluvial deposits in both stream estuaries and banks. Only the main planting areas are indicated as polygons on the maps. Small groups of seedlings will also planted in suitable microhabitats in other parts of the study areas as well, but it is not possible to be mapped at the scale used (1:1000 for Lefka stream and 1:2000 for Vori stream). Alder seedlings in small groups will also be planted in small openings within the existed alder stand in Vori, as natural regeneration is especially low.

Plantings will be implemented following the standards presented at the detailed technical description of the Action C.2. Alder seedlings will be planted manually only, as most planting sites are not suitable for planting by mechanical means. Alder seedlings will be transferred

from the nursery to the planting sites with trucks, and then to the planting locations manually by workers (Figures 1 and 2).

Figure 1. Placement of black alder seedlings at their planting locations at Lefka stream.

Figure 2. Manual planting of black alder seedlings.

As several planting sites in Lefka stream and some in Vori are largely inaccessible, bare-root seedlings will be planted at these distant sites in order to facilitate their transfer by the workers. All seedlings will be watered after planting and additional watering could be implemented during next two years after planting, depending on the local climatic conditions and the distance of each individual plant from the streambed.

During 2018, about 3,500 black alder seedlings were produced at the plant nursery of the Agadaki Estate. All seedlings were planted in Lefka and Vori streams during early March 2019, in areas that have been indicated in the present specifications of restoration actions (see corresponding maps). Additional seedlings (about 8,000) will be produced during 2019 and they will be planted in the study areas during autumn-winter 2019-2020 according to the schedule of Action C.2.

5.2. Fencing

Grazing has been identified as a major threat for the alder seedlings, as several consumed small trees have been observed in both Vori and Lefka streams. Thus, securing planted alder seedlings from grazing by establishing fences is an obligate action, crucial for the success of the restoration works. Fencing along streams, however, could create additional threats, as fences could be carried away during flood events increasing damages at the restoration sites. A detailed fencing design that will ensure the survival of the young alder trees, while not creating additional risks during flood events is necessary in such cases.

Fences will be made of rectangular mesh secured by iron bars and their height will be 1.30 m. (Figure 3). They will enclose the vast majority of the planted alder seedlings, securing them from herbivore animals. In certain cases, like isolated areas far away from the existed roads, fences will not be established, at least during the first year of plantations; transferring them to these sites by the workers is extremely difficult here is a high risk of injury.

Alder seedlings planted by the streambeds will be secured by fences established by two different methods, in order to avoid additional damages by flooding events. The first method includes the establishment of rectangular fences with the side facing the stream open (unfenced). This method will be tested during the first year of plantations only in places with reduced possibility of seedlings consuming by the goats. The second method includes periodic fencing. Black alder is a deciduous tree. The leaves appear during March and fall during

October. The wet period of the year (autumn-winter) with high flood risk the plants are not threatened by grazing. Thus, the fences could be removed during this period without increasing grazing risk and they will be re-established during the alder growing season. This procedure will be repeated until the trees are tall enough, not threatened by grazing.

Figure 3. Fence for the protection of black alder plantation along Lefka stream.

5.3. Giant Cane control

Giant cane (*Arundo donax*) is an invasive grass species common in riparian areas throughout Greece. It is an especially competitive, fast growing species, outpacing native plant growth. Management of giant cane is not an easy task. Its root system consists of tough lateral rhizomes that form a dense underground network.

Herbicide application is considered as the most effective method for controlling giant cane. Its use in Vori and Lefka streams, however, should be excluded, as they both are natural areas with high biodiversity. Mechanical control methods are also not easy to apply in the study sites, as most giant cane clusters are located in remote areas not accessible by roads. Thus, giant cane control will be mainly implemented by manual methods. Hand removal of giant cane rhizomes is especially difficult, but small reed clusters can be removed with digging.

The canopy will be removed first by using chain saws or pruning shears. Then, the remaining of the reed stems, rhizomes and roots will entirely remove from the soil using shovel, mattocks or pick-ax. Uprooted material will be removed or burned onsite to prevent rerooting.

Giant cane control areas are shown in the corresponding maps. The presented polygons show the locations of giant cane control, but the control areas are indicative only. Manual reed removal cannot be applied in large areas and priority will be given to small reed clusters close to the streambeds. Cleaned areas will be prepared for planting of alder seedlings.

6. Maps

Number	Map	Scale
1	Restoration interventions in Vori	1:2,000
2	Restoration interventions in Lefka	1:1,000

7. References

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The AUA Working Team