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PANTEION UNIVERSITY OF SOCIAL AND POLITICAL SCIENCES

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The socioeconomic cost of invasive insect species in Greece; The case of the Asian Tiger Mosquito

Εκτίμηση του Κοινωνικο-Οικονομικού Κόστους των Χωροκατακτητικών Ειδών Εντόμων στον Ελλαδικό Χώρο

ΔΙΔΑΚΤΟΡΙΚΗ ΔΙΑΤΡΙΒΗ

Αντώνιος Κολημενάκης

Αθήνα, 2019

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Αθήνα, 2019

Τριμελής Επιτροπή

Κλάιβ Ρίτσαρντσον, Καθηγητής Παντείου Πανεπιστημίου (Επιβλέπων)

Κωνσταντίνος Μπίθας, Καθηγητής Παντείου Πανεπιστημίου

Διονύσιος Λατινόπουλος, Επίκουρος Καθηγητής Αριστοτελείου Πανεπιστημίου Θεσσαλονίκης

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"παιδὸς ἡ βασιληίη" (Ηράκλειτος)

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Abstract

Globalization of trade and travel has facilitated the spread of non-native species across the earth. A proportion of these species become established and cause serious environmental, economic and human health impacts. These species are referred to as invasive. The establishment of invasive species is associated with increased economic losses worldwide. According to the European Commissions' Impact Assessment on IAS (Invasive Alien Species) (EC, 2013), IAS are estimated to have cost the EU at least €12 billion/year over the past 20 years and the damage costs continue to increase. The Asian tiger mosquito (*Aedes albopictus*) is an invasive mosquito species widely spread in Greece and Southern Europe during the last years and is associated with increased nuisance levels and the transmission of certain diseases such as Chikungunya and Dengue. The target of the present thesis is to evaluate the socio-economic cost imposed by the problem in selected areas of Greece and to identify the crucial parameters of the economic burden associated with the problem of Invasive Mosquito species using a synthesis of methods. Specifically, prevention cost categories, are analyzed based on market prices and on a small scale survey conducted in Greece and Italy. A separate cost of illness approach was conducted for the estimation of medical costs and productivity losses of mosquito borne diseases in Greece from 2010 to 2017. Cost-benefit and cost-effectiveness analysis is employed in order to evaluate the economic efficiency of prevention strategies from 2010 to 2017. The willingness of citizens to pay for improved prevention programs averting health and nuisance costs is based on a contingent valuation study using the discrete choice method. An online survey as well as an experts' survey was conducted in order to evaluate qualitative dimensions related to the implementation of specialized control programs. Results indicate that the implementation of specialised control and prevention programs can create a net socioeconomic benefit, however, the spread of epidemics and the overall socioeconomic consequences, had the various prevention costs not been employed, remain unpredictable and extremely difficult to calculate. In addition, citizens are highly concerned with the health risks associated with the new mosquito species and consider public prevention strategies highly important for the confrontation of the problem, while experts tend to place a higher value on mosquito control when associated with the prevention of serious health risks. The synthesis of

methods and results produced by the current thesis could act as a preliminary policy guide for the estimation of societal welfare from the confrontation of similar problems in a complex ecosystemic context.

Keywords: Socioeconomic impacts of Invasive mosquito species; Cost of Illness; Cost Benefit Analysis; Choice experiment; Urban ecosystems; Vector Borne Diseases and Climate Change; Citizens' wellbeing

Εκτενής Περίληψη στα Ελληνικά

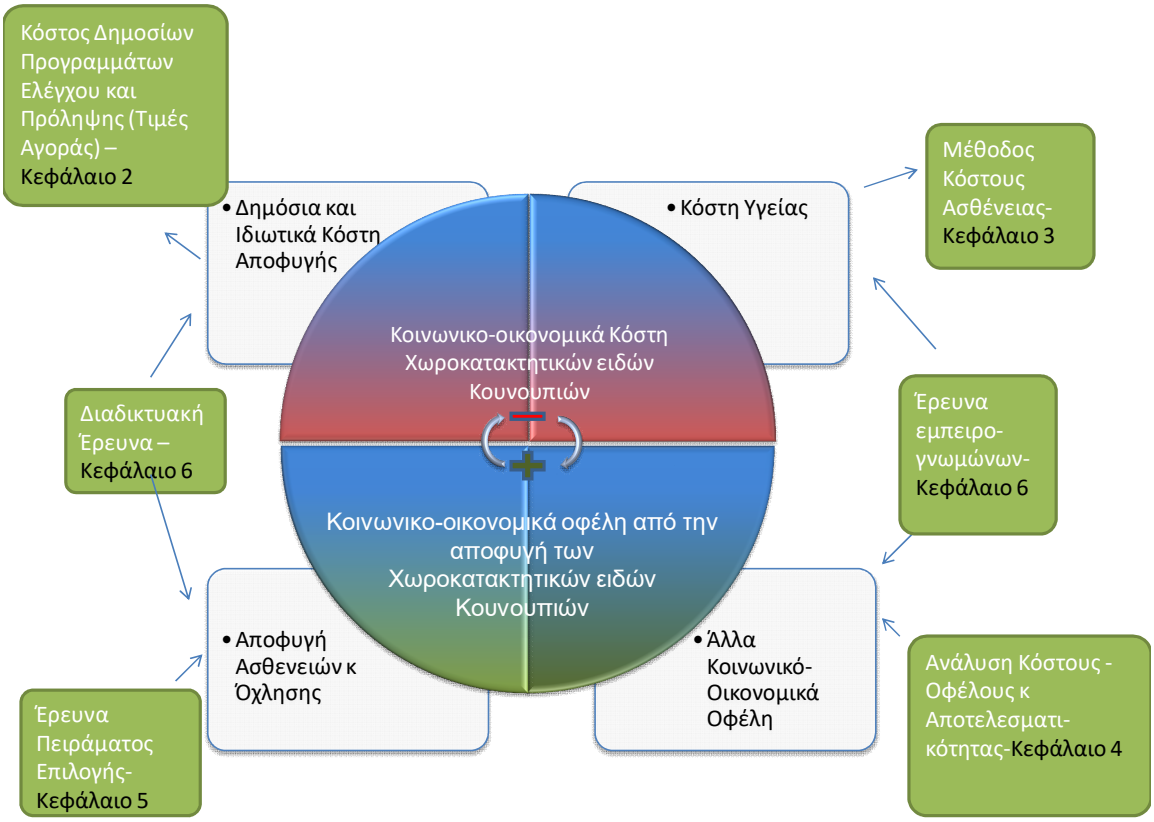
Η παγκοσμιοποίηση του εμπορίου και των μετακινήσεων έχει διευκολύνει τη διάδοση των μη ενδημικών-χωροκατακτητικών ειδών σε όλη τη γη. Ένα ποσοστό αυτών των ειδών καθιερώνεται και προκαλεί σοβαρές περιβαλλοντικές, οικονομικές και κοινωνικές επιπτώσεις. Αυτά τα είδη αναφέρονται ως χωροκατακτητικά. Η καθιέρωση διηθητικών ειδών συνδέεται με αυξημένες οικονομικές απώλειες παγκοσμίως. Η επέκταση των χωροκατακτητικών ειδών συνδέεται με αυξημένες οικονομικές απώλειες σε όλο τον κόσμο. Σύμφωνα με την εκτίμηση της Ευρωπαϊκής Επιτροπής «Επιπτώσεις των Ξενικών και Χωροκατακτητικών Ειδών» εκτιμάται ότι τα είδη αυτά έχουν κοστίσει στην ΕΕ τουλάχιστον € 12 δισεκατομμύρια κατά έτος κατά τα τελευταία 20 χρόνια ενώ το κόστος των ζημιών συνεχίζει να αυξάνεται. Ένα τέτοιο είδος είναι και το ασιατικό κουνούπι τίγρης (*Aedes albopictus*) το οποίο εμφανίζεται στην Ελλάδα και τη Νότια Ευρώπη τα τελευταία χρόνια και θεωρείται υπεύθυνο τόσο για τα αυξημένα επίπεδα όχλησης στον ανθρώπινο πληθυσμό, καθώς και για τη μετάδοση συγκεκριμένων επιδημικών ασθενειών όπως το chikungunya και ο δάγκειος πυρετός. Φιλοδοξία της παρούσας διατριβής είναι η διερεύνηση των διαφόρων κατηγοριών κοινωνικοοικονομικού κόστους, η εξέταση των επιπέδων ευημερίας που επιφέρουν τα δημόσια προγράμματα και στρατηγικές καταπολέμησης, όσο και ο έλεγχος των διαφόρων μεθόδων-προσεγγίσεων να αποτιμήσουν σε όρους οφέλους την επίτευξη ικανοποιητικών επιπέδων ευημερίας μέσα από την εφαρμογή μίας σύνθεσης μεθόδων. Συγκεκριμένα, οι κατηγορίες κόστους πρόληψης αναλύονται βάση διαθέσιμων τιμών αγοράς και μίας έρευνας ερωτηματολογίου μικρής κλίμακας που διεξήχθη στην Ελλάδα και την Ιταλία. Για την εκτίμηση του ιατρικού κόστους και της απώλειας παραγωγικότητας ασθενειών μεταδιδόμενων από κουνούπια στην Ελλάδα από το 2010 έως το 2017 διεξήχθη ξεχωριστή έρευνα με τη μέθοδο του "Κόστους Ασθένειας". Επίσης διεξήχθη ανάλυση κόστους-οφέλους και κόστους-αποτελεσματικότητας για την αξιολόγηση της οικονομικής αποτελεσματικότητας των στρατηγικών πρόληψης από το 2010 έως το 2017. Η προθυμία των πολιτών να πληρώσουν για βελτιωμένα προγράμματα πρόληψης που αποτρέπουν το κόστος υγείας και όχλησης βασίζεται στη μέθοδο της Υποθετικής Αξιολόγησης και συγκεκριμένα την εφαρμογή του "Πειράματος Επιλογής". Τέλος, διεξήχθησαν μια διαδικτυακή έρευνα καθώς και μια έρευνα εμπειρογνωμόνων προκειμένου να αξιολογηθούν οι ποιοτικές διαστάσεις που σχετίζονται με την εφαρμογή ειδικών

προγραμμάτων ελέγχου. Τα αποτελέσματα δείχνουν ότι η εφαρμογή εξειδικευμένων προγραμμάτων ελέγχου και πρόληψης μπορεί να οδηγήσει σε καθαρό κοινωνικοοικονομικό όφελος, ωστόσο, η εξάπλωση των επιδημιών και οι συνολικές κοινωνικοοικονομικές συνέπειες, παραμένουν απρόβλεπτες και εξαιρετικά δύσκολες να υπολογιστούν. Επιπλέον, οι πολίτες αποδίδουν ιδιαίτερη σημασία στους κινδύνους υγείας που συνδέονται με τα νέα είδη κουνουπιών και θεωρούν ότι οι στρατηγικές δημόσιας πρόληψης είναι πολύ σημαντικές για την αντιμετώπιση του προβλήματος, ενώ οι εμπειρογνώμονες τείνουν να αποδίδουν μεγαλύτερη αξία στον έλεγχο των κουνουπιών όταν συνδέονται με την πρόληψη σοβαρών ασθενειών. Η σύνθεση των μεθόδων και των αποτελεσμάτων της παρούσας εργασίας θα μπορούσε να αποτελέσει έναν προκαταρκτικό οδηγό πολιτικής για την εκτίμηση της κοινωνικής ευημερίας από την αντιμετώπιση παρόμοιων προβλημάτων σε ένα πολύπλοκο οικοσυστημικό πλαίσιο.

Λέξεις κλειδιά: Κοινωνικό-οικονομικές επιπτώσεις των Χωροκατακτητικών ειδών κουνουπιών, Κόστος Ασθένειας, Ανάλυση Κόστους-Οφέλους, Πείραμα Επιλογής, Αστικά Οικοσυστήματα, Κλιματική αλλαγή και μεταδιδόμενες ασθένειες, Ευημερία των πολιτών

Κεφάλαιο 1. Εισαγωγή

Στο 1ο Κεφάλαιο επιχειρείται μία πλήρης εισαγωγή στο θέμα με έμφαση τα χωροκατακτητικά είδη κουνουπιών (ΧΕΚ), με έμφαση στο ασιατικό κουνούπι τίγρης "*Aedes albopictus",* και τους δημόσιους κινδύνους και τα επίπεδα όχλησης με τα οποία συνοδεύονται. Συγκεκριμένα, εξετάζεται τόσο η παρούσα κατάσταση σε σχέση με την έκταση του προβλήματος στην Ελλάδα και τη Νότια Ευρώπη καθώς και οι κοινωνικο-οικονομικές πτυχές που σχετίζονται με το θέμα. Στο παρακάτω διάγραμμα αποκεινόζεται η επιλογή των διάφορων μεθόδων με τις οποίες επιχειρείται η διερεύνηση του προβλήματος.



Εικόνα 1. Οι διαφορετικές μεθοδολογίες αξιολόγησης των κοινωνικο-οικονομικών επιπτώσεων σχετιζόμενων με την παρουσία των χωροκατακτητικών ειδών κουνουπιών στην Ελλάδα

Κεφάλαιο 2. Ανάλυση του δημόσιου και του ιδιωτικού κοινωνικο-οικονομικού κόστους

Μία από τις μεγαλύτερες προκλήσεις του υπό εξέταση προβλήματος είναι να καθοριστεί η μέθοδος για την εκτίμηση του κόστους ανάλογα με τη φύση του προβλήματος των ΧΕΚ. Το μεθοδολογικό πλαίσιο για την κατηγοριοποίηση του κόστους διαμορφώθηκε με βάση την τρέχουσα κατάσταση των σύγχρονων μεθοδολογιών που σχετίζονται με το στοχευόμενο πρόβλημα, καθώς και μέσω συναντήσεων και συνεντεύξεων με εμπειρογνώμονες, λειτουργούς της δημόσιας υγείας.

Ο κύριος στόχος αυτού του κεφαλαίου είναι ο προσδιορισμός του κόστους που σχετίζεται με τα προγράμματα και τα έξοδα δημόσιας και ιδιωτικής πρόληψης και ελέγχου. Το πρώτο μέρος επικεντρώνεται στην εξέταση των δημόσιων δαπανών

πρόληψης και ελέγχου και βασίζεται σε στοιχεία δημοσίων δαπανών που εκπονούνται από τις Περιφέρειες και τους Δήμους της χώρας, αλλά και κατά περίσταση από το ΚΕΕΛΠΝΟ και από δημόσιες επιχορηγήσεις όπως το ΕΣΠΑ και εκφράζεται σε "τιμές αγοράς". Το δεύτερο μέρος αποσκοπεί να εξετάσει τα ιδιωτικά κόστη ελέγχου και αποφυγής του προβλήματος, μέσα από την εφαρμογή μίας μικρής κλίμακας έρευνας ερωτηματολογίου που διεξήχθη στην Ελλάδα και την Ιταλία.

Πρέπει να τονιστεί ότι ο υπολογισμός των κοινωνικοοικονομικών δαπανών δεν είναι ο τελικός στόχος της συμβολής αυτής της διατριβής. Η περαιτέρω οικονομική ανάλυση που εφαρμόζεται στα επόμενα κεφάλαια συμβάλλει στην αξιολόγηση της αποτελεσματικότητας της εφαρμογής διαφόρων προγραμμάτων ελέγχου και διαχείρισης και στον καθορισμό του βαθμού στον οποίο τα οφέλη από αυτά τα προγράμματα υπερβαίνουν το συνολικό κόστος που παρουσιάζει το πρόβλημα των ΧΕΚ. Η σωστή εκτίμηση αυτών των δαπανών είναι απαραίτητη προκειμένου να παρασχεθεί η σωστή πληροφόρηση που θα οδηγήσει σε αξιόπιστα συμπεράσματα της οικονομικής ανάλυσης και θα συμβάλει στον σχεδιασμό ενημερωμένων παρεμβάσεων πολιτικής.

Κεφάλαιο 3. Το "Κόστους Ασθένειας" - (Cost of Illness) των μεταδιδόμενων από κουνούπια ασθενειών στην Ελλάδα

Ο στόχος του Κεφαλαίου 3 είναι να αναλύσει ένα σημαντικό μέρος των κοινωνικοοικονομικών δαπανών που σχετίζονται με τις μεταδιδόμενες από κουνούπια ασθένειες. Όπως ήδη αναφέρθηκε, διάφορα είδη κουνουπιών είναι υπεύθυνα για τη μετάδοση διαφόρων νόσων και ασθενειών όπως ο ιός του Δυτικού Νείλου, η Ελονοσία, η νόσος του Chikungunya και του Δάγκειου πυρετού. Το κουνούπι *Ae. albopictus* ήταν υπεύθυνο για τα πάνω από 200 εργαστηριακά επιβεβαιωμένα κρούσματα Chikungunya στην Ιταλία το 2007 και για τοπική μετάδοση κρουσμάτων Δαγκείου πυρετού στην Κροατία και τη Γαλλία το 2010. Στην παρούσα διατριβή εκτιμήθηκε το κόστος ασθένειας για τα κρούσματα του Ιού του Δυτικού Νείλου κατά την επιδημία του 2010 στην Κεντρική Μακεδονία, τα κρούσματα της ελονοσίας από την επιδημία του 2011 στη Λακωνία, το κόστος ασθενείας των νοσηλευθέντων κρουσμάτων της επιδημίας Chikungunya 2007 στην Emilia Romagna (Ιταλία), καθώς

και το κόστος των εισαγόμενων κρουσμάτων Chikungunya, Δάγκειου πυρετού και ιού του Ζίκα στην Ελλάδα από το 2013 έως το 2017.

Η μεθοδολογία που χρησιμοποιήθηκε για την εκτίμηση του κόστους που επιβλήθηκε από την εκδήλωση νόσων των κουνουπιών βασίστηκε στη μέθοδο του κόστους της ασθένειας- "Cost of Illness" κατά την οποία το βάρος μιας ασθένειας στην κοινωνία εκτιμάται από οικονομική άποψη. Το κόστος χωρίζεται σε δύο κύριες κατηγορίες: το άμεσο κόστος και το έμμεσο κόστος. Οι άμεσες δαπάνες, οι οποίες περιλαμβάνουν κυρίως την ιατρική περίθαλψη, είτε νοικοκυριού είτε εξωτερικού νοσηλευτή, υπολογίζονται με βάση τις τιμές της αγοράς. Οι έμμεσες δαπάνες αφορούν την απώλεια παραγωγικότητας κατά τις ημέρες νοσηλείας και ανάρρωσης και υπολογίζονται με βάση την προσέγγιση του ανθρώπινου κεφαλαίου- "Human Capital Approach".

Ο υπολογισμός των ιατρικών δαπανών που παρουσιάζονται σε αυτό το κεφάλαιο, σε συνδυασμό με την εκτίμηση του κόστους πρόληψης που παρουσιάζεται επίσης στο Κεφάλαιο 2, προσφέρουν τη δυνατότητα διεξαγωγής ανάλυσης κόστους-αποτελεσματικότητας σε συγκεκριμένες περιπτώσεις, που ενδέχεται να επιφέρουν ορισμένα προγράμματα ελέγχου και διαχείρισης η οποία εκπονείται στο Κεφάλαιο 4. Οι δείκτες αυτών των αναλύσεων μπορούν να αποτελέσουν έναν πρώτο οδηγό για την εκτίμηση των κοινωνικοοικονομικών επιπτώσεων των στρατηγικών πρόληψης και ελέγχου και μια προκαταρκτική αξιολόγηση του βαθμού στον οποίο τα οφέλη από την εφαρμογή ορισμένων σχεδίων διαχείρισης υπερτερούν των δαπανών τους.

Κεφάλαιο 4. Εφαρμογή Ανάλυσης Κόστους-Οφέλους και Κόστους-Αποδοτικότητας και διαστάσεις πολιτικής

Σύμφωνα με τον Παγκόσμιο Οργανισμό Υγείας, οι πιο κοινές προσεγγίσεις για την αξιολόγηση των προγραμμάτων πρόληψης που σχετίζονται με την υγεία είναι η ανάλυση κόστους-αποδοτικότητας (ΑΚΑ) και η ανάλυση κόστους-οφέλους (ΑΚΟ). Η ανάλυση κόστους-ωφέλους (ΑΚΟ) είναι μια δημοφιλής μέθοδος για την αξιολόγηση της «αποτελεσματικότητας» των δημόσιων αγαθών και πολιτικών και χρησιμοποιείται στην πραγματικότητα για την αξιολόγηση του καθαρού οικονομικού τους αποτελέσματος. Το κύριο πεδίο εφαρμογής της ΑΚΟ είναι η μέτρηση των

επιπέδων ευημερίας που προκύπτουν από την εφαρμογή ενός προγράμματος / στρατηγικής, εξετάζοντας τα σχετικά κόστη και οφέλη που προκύπτουν από την εφαρμογή του. Ένας συγκεκριμένος τύπος ΑΚΟ είναι η ανάλυση αντιστάθμισης κόστους, η οποία συγκρίνει το κόστος πρόληψης με τις μειώσεις κόστους που επιτυγχάνονται από την ιατρική και νοσοκομειακή περίθαλψη. Η ιδέα είναι ότι το κόστος της πρόληψης αντισταθμίζεται από την εξοικονόμηση μελλοντικών δαπανών για την ασθένεια. Στην περίπτωση αυτή διεξήχθη μια «περιορισμένη» ανάλυση κόστους-οφέλους, συγκρίνοντας τα Κόστος των Προγραμμάτων Δημόσιας Πρόληψης με τα σχετικά οφέλη που προκύπτουν από: α) αποφυγή επιπτώσεων στην υγεία και β) επίπεδα αποφυγής ενοχλήσεων στα νοικοκυριά λόγω της εφαρμογής αυτών προγράμματα.

Τα αποτελέσματα της εφαρμογής τόσο της ΑΚΟ όσο και της ΑΚΑ δείχνουν ότι μπορεί να προκύψουν σημαντικά κοινωνικά οφέλη στην περιοχή μελέτης από την εφαρμογή βελτιωμένων προγραμμάτων ελέγχου, υπονοώντας μια υψηλότερη χρηματική αξία χρησιμότητας έναντι της υγείας. Εντούτοις, η διεξαγωγή μιας καλά σχεδιασμένης έρευνας (Κεφάλαιο 5) που χρησιμοποιεί πιο εξειδικευμένα μεθοδολογικά εργαλεία είναι απαραίτητη για έναν πιο ακριβή ορισμό της χρηματικής αξίας της χρησιμότητας. Μερικοί από τους περιορισμούς του παρόντος κεφαλαίου συνδέονται με την αβεβαιότητα όσον αφορά τον αριθμό των περιπτώσεων κρουσμάτων που εμποδίζονται λόγω της εφαρμογής των προγραμμάτων ελέγχου και την πραγματική μείωση της όχλησης που μπορούν να αποδοθούν σε αυτά τα προγράμματα. Ως εκ τούτου, μέσω της εφαρμογής τόσο της ΑΚΟ όσο και της ΑΚΑ στην παρούσα μελέτη, είναι δύσκολο να παρασχεθούν ακριβείς δείκτες επιπέδων οφέλους και αποτελεσματικότητας.

Κεφάλαιο 5. Η εφαρμογή ενός "Πειράματος Επιλογής" για την αξιολόγηση βελτιωμένων προγραμμάτων καταπολέμησης

Ο βασικός σκοπός του κεφαλαίου 5 είναι η ενίσχυση της οικονομικής ανάλυσης που γίνεται στο Κεφάλαιο 4 σχετικά με την αποτελεσματικότητα των προγραμμάτων ελέγχου και πρόληψης της δημόσιας υγείας. Μια ενημερωμένη ανάλυση συμβάλλει στα αποτελέσματα που συνάχθηκαν σε προηγούμενα κεφάλαια, και συγκεκριμένα σε αυτά του Κεφαλαίου 4, παρέχοντας ακριβέστερες εκτιμήσεις των επιπέδων οφέλους

από βελτιωμένα προγράμματα ελέγχου κουνουπιών, όπως γίνονται αντιληπτά από τους πολίτες. Όπως επισημάνθηκε σε προηγούμενα κεφάλαια, η εγκαθίδρυση των ΧΕΚ αναμένεται να συνοδεύεται από αυξημένο κίνδυνο μετάδοσης ασθενειών, υψηλότερα επίπεδα όχλησης και αυξημένα έξοδα ελέγχου. Από την άποψη αυτή, είναι ήδη εμφανής η ανάγκη για σχεδιασμό νέων βελτιωμένων προγραμμάτων ελέγχου κουνουπιών, καθιστώντας απαραίτητη την συνεκτίμηση πιο περίπλοκων παραμέτρων όπως η προστασία από νέες μολυσματικές ασθένειες και η αποφυγή των οχλήσεων της ημέρας που συνδέονται με την παρουσία των ΧΕΚ στην Ελλάδα.

Το κεφάλαιο αυτό επιχειρεί να παρουσιάσει μια πιο ακριβή εκτίμηση των πιθανών οφελών από την ενίσχυση των προγραμμάτων ελέγχου κουνουπιών στην Ελλάδα. Γενικά, τα προγράμματα ελέγχου των κουνουπιών και οι στρατηγικές πρόληψης έχουν σκοπό να συμβάλουν στην προστασία από την εμφάνιση επιδημικών ασθενειών, τη βελτίωση της ποιότητας ζωής και τη μείωση των απωλειών στις οικονομικές δραστηριότητες. Όπως αναφέρεται επίσης στο κεφάλαιο 4, λόγω της πολύπλοκης φύσης του προβλήματος είναι δύσκολο να δοθούν ακριβείς εκτιμήσεις του οφέλους που προκύπτει από την εφαρμογή βελτιωμένων προγραμμάτων ελέγχου. Η οικονομική αποτίμηση που παρουσιάζεται στο παρόν κεφάλαιο βασίστηκε στην εφαρμογή της μεθόδου του "πειράματος επιλογής" που προσφέρει στον ερωτώμενο εύκολα κατανοητές και λειτουργικά καθορισμένες επιλογές μελλοντικών προγραμμάτων ελέγχου, που ποικίλουν σε χαρακτηριστικά που σχετίζονται με τις επιπτώσεις στην υγεία, τα επίπεδα ενόχλησης και το ιδιωτικό κόστος. Τα αποτελέσματα δείχνουν ότι μπορούν να προκύψουν σοβαρά οφέλη από την εφαρμογή δημόσιων εξειδικευμένων προγραμμάτων, ειδικότερα όταν αυτά σχετίζονται με την αποφυγή των κινδύνων υγείας.

Κεφάλαιο 6. Μια ολιστική προσέγγιση αξιολόγησης στρατηγικών αποφυγής από τους πολίτες και τους εμπειρογνώμωνες

Στο κεφάλαιο αυτό παρουσιάζονται δύο επιπρόσθετες έρευνες οι οποίες πραγματοποιήθηκαν προκειμένου να αξιολογηθεί ο συνολικός κοινωνικοοικονομικός αντίκτυπος της εφαρμογής βελτιωμένων στρατηγικών πρόληψης. Η πρώτη αφορά ένα πανελλαδικό διαδικτυακό ερωτηματολόγιο προς νοικοκυριά και το δεύτερο ήταν μια έρευνα μικρής κλίμακας εμπειρογνωμόνων που ασχολούνταν με δραστηριότητες

ελέγχου και πρόληψης των κουνουπιών στην Ελλάδα. Οι στόχοι αυτού του κεφαλαίου είναι: (i) η εκτίμηση του κόστους που συνδέεται με αυτά τα προβλήματα σε διάφορες κατηγορίες, (ii) η αξιολόγηση του επιπέδου ευημερίας των πολιτών από την αποφυγή του προβλήματος και (iii) η καταγραφή των προτιμήσεών τους όσον αφορά τα μέτρα ελέγχου. Από τα στοιχεία προκύπτει ότι οι εμπειρογνώμονες τείνουν να αποδίδουν μεγάλη αξία στον έλεγχο των κουνουπιών όταν συνδέονται με σοβαρούς κινδύνους για την υγεία, ενώ οι πολίτες είναι πιο ευαίσθητοι και ανησυχούν για τις περιβαλλοντικές επιπτώσεις των μεθόδων ελέγχου. Η σύνθεση των αποτελεσμάτων που παράγονται από το παρόν κεφάλαιο λειτουργεί ως ένας προκαταρκτικός οδηγός για την εκτίμηση της κοινωνικής ευημερίας από την αντιμετώπιση παρόμοιων προβλημάτων σε ένα ολιστικό-οικοσυστημικό πλαίσιο.

Ένα από τα σημαντικότερα ευρήματα της παρούσας μελέτης είναι ότι οι πολίτες αντιλαμβάνονται την προστασία από τις ασθένειες που μεταδίδονται από τα κουνούπια ως σημαντικό δημόσιο αγαθό το οποίο πρέπει να χρηματοδοτείται από τα δημόσια έξοδα. Τα αποτελέσματα της μελέτης μας δείχνουν ότι, αφενός, οι πολίτες είναι πιο πρόθυμοι να υποστούν προσωπικά έξοδα από την καθημερινή όχληση από είδη κουνουπιών και, αφετέρου, είναι διατεθειμένοι να πληρώσουν για ένα βελτιωμένο πρόγραμμα καταπολέμησης των απειλών κατά των ασθενειών όταν εφαρμόζεται από δημόσιες αρχές. Επομένως, σε κάποιο βαθμό, οι πολίτες φαίνεται να μεταφέρουν την ευθύνη των προστατευτικών μέτρων που σχετίζονται με την υγεία σε εμπειρογνώμονες και επαγγελματίες του τομέα της δημόσιας υγείας. Αυτό μπορεί να σημαίνει ότι αισθάνονται μάλλον ανασφαλείς όσον αφορά την αποτελεσματικότητα των προσωπικών τους μέτρων κατά των διαφόρων ασθενειών. Ωστόσο, η εφαρμογή αντίστοιχων εξειδικευμένων προγραμμάτων στην περιοχή της Emiglia Romana στην Ιταλία, δείχνει ότι η συμμετοχή των πολιτών είναι επίσης πολύ σημαντική, ιδιαίτερα στην παρακολούθηση και τον έλεγχο των ΧΕΚ. Όσον αφορά την περίπτωση της Ελλάδας, μια ορισμένη έλλειψη πληροφοριών από τις δημόσιες αρχές μπορεί να αυξήσει τόσο την ανασφάλεια όσο και την έλλειψη ενημέρωσης των πολιτών σχετικά με το συγκεκριμένο πρόβλημα. Ωστόσο, υπάρχουν πρόσφατες τρέχουσες πρωτοβουλίες που χρηματοδοτούνται από την ΕΕ (όπως το πρόγραμμα LIFE CONOPS), οι οποίες ενισχύουν την ενημέρωση του κοινού και οδηγούν στη συνεργασία μεταξύ της επιστημονικής κοινότητας, των δημόσιων αρχών και των πολιτών. Πρέπει να σημειωθεί ότι η συμμετοχή των πολιτών σε πολλές περιπτώσεις

ενθαρρύνεται από την εμφάνιση επιδημιών ασθενειών όπως στην περίπτωση της επιδημίας Chikungunya του 2007 στην περιοχή Italia της Emilia Romagna. Σε κάθε περίπτωση, το επίπεδο συμμετοχής των πολιτών στις αποφάσεις δημόσιας πολιτικής μπορεί επίσης να συνδέεται με κοινωνικο-πολιτιστικά χαρακτηριστικά και μπορεί να διαφέρει εάν εξεταστεί σε διαφορετικά πλαίσια και χώρες.

Κεφάλαιο 7. Συμπεράσματα

Η παρούσα διατριβή προσφέρει ουσιαστικούς δείκτες κυρίως αναφορικά με το λόγο του αντιληπτού οφέλους των πολιτών από την εφαρμογή βελτιωμένων προγραμμάτων ελέγχου κουνουπιών. Τα ευρήματα δείχνουν μεγαλύτερη προτίμηση για βελτιωμένα προγράμματα που αποσκοπούν στην αποφυγή των επιπτώσεων στην υγεία και οι πολίτες παρουσιάζονται πιο πρόθυμοι να πληρώσουν έναντι πιθανών επιπτώσεων στην υγεία και συγκεκριμένα κατά της εξάπλωσης ασθενειών που τους είναι άγνωστες, όπως αυτές που σχετίζονται με τα ΧΕΚ. Οι πολίτες φαίνεται να είναι πιο πρόθυμοι να δεχθούν υψηλότερο κόστος (για ένα βελτιωμένο πρόγραμμα ελέγχου), που στοχεύει στην εξάλειψη πιθανών επιπτώσεων στο μέλλον και αυτοί που ήδη γνωρίζουν το πρόβλημα είναι ακόμη πιο πρόθυμοι να πληρώσουν έναντι πιθανών συνεπειών. Το γεγονός ότι οι τάσεις της κλιματικής αλλαγής φαίνονται να ευνοούν την επιδείνωση του προβλήματος και τον αυξανόμενο κίνδυνο μετάδοσης νέων ασθενειών, είναι πιθανόν να οδηγήσουν σε υψηλότερο δυνητικό όφελος από την εφαρμογή πιο αποτελεσματικών σχεδίων διαχείρισης κουνουπιών κατά τα προσεχή έτη.

Η παρούσα διατριβή επιχειρεί να συμβάλει στην συζήτηση ενός πολυπαραμετρικού και διεπιστημονικού ζητήματος, όπως είναι το θέμα των χωροκατακτητικών ειδών, παρέχοντας σημαντικούς δείκτες της κοινωνικό-οικονομικής έκτασης του προβλήματος και των επιπέδων ευημερίας που επιτυγχάνονται από την εφαρμογή δημόσιων πολιτικών υγείας υπό ένα καθεστώς περιβαλλοντικής και κλιματικής αβεβαιότητας. Ωστόσο, εξακολουθούν να υπάρχουν ακόμη προκλήσεις τόσο για τη δημόσια πολιτική όσο και για τον κλάδο των οικονομικών της οικολογίας, όπως η ενσωμάτωση των οικοσυστημικών παραγόντων στην πρόβλεψη κινδύνου, η μοντελοποίηση μελλοντικών σεναρίων και η αναβάθμιση του επιπέδου ενημέρωσης των εθνικών και διεθνών αρχών. Ο γενικός στόχος της παρούσας διατριβής είναι να

δημιουργηθεί η βάση ενός στρατηγικού οδικού χάρτη για την αξιολόγηση των συνολικών κοινωνικό-οικονομικών επιπτώσεων που σχετίζονται με την εμφάνιση και την επανεμφάνιση λοιμωδών νοσημάτων από τα κουνούπια στη Νότια Ευρώπη λαμβάνοντας υπόψη τους πολύπλοκους κοινωνικό-οικολογικούς παράγοντες. Περαιτέρω μελέτες θα μπορούσαν να αξιοποιήσουν τα υπάρχοντα ευρήματα για να υποστηρίξουν νέα εμπειρικά στοιχεία από επιλεγμένα τμήματα της Ελλάδας και της Νότιας Ευρώπης που παρουσιάζουν υψηλά ποσοστά συνδεόμενων κοινωνικό-οικολογικών δεικτών (εισροές μεταναστεύσεως, αστικοποίηση, παρουσία διηθητικών φορέων κλπ.). Σύμφωνα με τα πορίσματα της παρούσας μελέτης, η πιθανή συνεισφορά παρόμοιων πρωτοβουλιών θα ήταν να προωθηθεί η υγεία και η ευημερία των μελλοντικών κοινωνιών, με σεβασμό τόσο στους στόχους της οικοσυστημικής ισορροπίας όσο και της βιωσιμότητας όπως αυτή τίθεται από τους πολίτες και τις κοινωνίες.

at my poor hovel
there's one thing I can offer —
small mosquitoes

Matsuo Basho (1644-1694)

Miltiadis Petalas, 2013, "A dreamer", etching

Chapter 1: Introduction; The socioeconomic aspect of the problem of Invasive Mosquito Species

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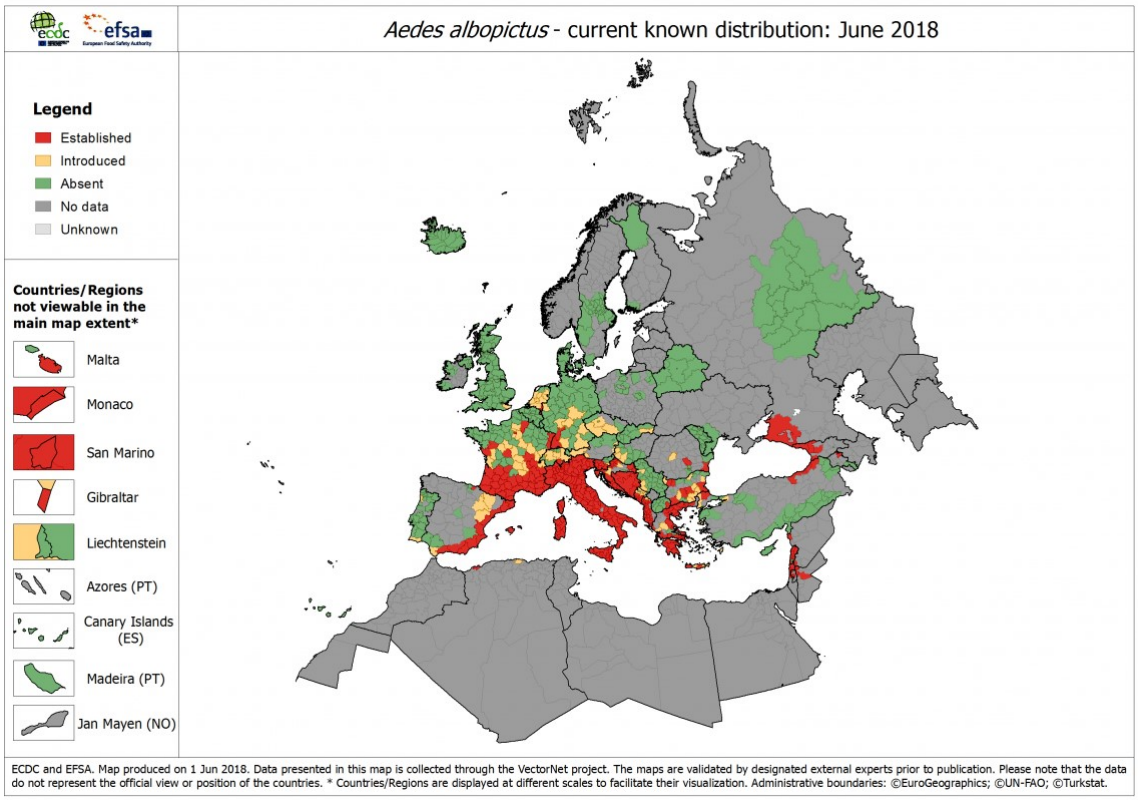
1 Introduction

According to IPCC (2014) anthropogenic GHG emissions are mainly driven by population size, economic activity, lifestyle, energy use, land use patterns, technology and climate policy. Recent reports indicate strong evidence for the forecat that the world's average temperature will increase by a further 1.4 to 5.8°C by 2100 (IPCC 2014). These projected changes bear implications for human health around the globe due to changes in vector survival and pathogen development and are directly related to various socioeconomic impacts. Consequently, new sanitary and environmental risks are emerging, including the reappearance of Mosquito Borne Diseases such as Chikungunya, Dengue, West Nile Virus which are currently emerging in different EU Member States, requiring the adoption of specific measures. In recent years, concern has arisen over the potential for an increase in mosquito-borne diseases as a consequence of environmental modifications in ecosystems and global climatic change (Tanser et al. 2003, McMichael et al. 2006).

Globalization of trade and travel has facilitated the spread of non-native species across the Earth. A proportion of these species becomes established and causes serious environmental, economic and human health impacts. These species are referred to as invasive. Insects are the dominant group among non-native terrestrial invertebrates in Europe: of 1,522 established species, 1,306 (86%) are insects. The establishment of invasive species is associated with increased economic losses worldwide. In the US it is estimated that invading alien species cause major environmental damages and losses adding up to almost $120 billion per year (Pimentel et al., 2005). According to the European Commissions' Impact Assessment on IAS (Invasive Alien Species) (EC, 2013), IAS are estimated to have cost the EU at least €12 billion/year over the past 20 years and the damage costs continue to increase. Regarding mosquitoes, several invasive mosquito species (IMS) have been inadvertently introduced into Europe, where they find favourable environmental and climatic conditions enhanced by Climate Change, to establish permanent populations.

In fact, it is estimated that due to the predicted Climate Change trends, the IMS problem will be more intense in the immediate future. In addition, studies indicate that the intensification of urbanization favours the spread of vector borne diseases which may flourish due to a greater density of people as well as domestic and peridomestic animals (Vora 2008, Soulsbury & White, 2016).



Map 1.1. Aedes albopictus, current known distribution, June 2018, (ECDC, 2018)

Nowadays *Ae. albopictus,* commonly known as the Asian Tiger Mosquito, is present mainly in the northwest Mediterranean basin (Map 1.1). The introduction of this species in Europe has been driven by global trade and travel between climatically similar regions, and it has been speculated that future European expansion of *Ae. albopictus* could be further facilitated by climate change, as altered warming and precipitation patterns might increase the number of suitable niches for the vector. *Ae. albopictus* has been responsible for transmitting both dengue and Chikungunya fever in continental Europe, including over 200 laboratory-confirmed cases of Chikungunya in Italy (Region of Emilia Romagna) in 2007 and local dengue transmission in Croatia

and France (Becker et al., 2010). Its presence in Greece and Italy is already intense and it is expected to expand even further in the coming years (Giatropoulos et al., 2012) (Map 1.2).

The main public health concerns related to mosquito borne diseases in Greece are associated with those transmitted by the *Culex* and *Anopheles* species such as the West Nile Virus and Malaria and those transmitted by the *Aedes* species such as Chkungunya, Dengue and Zika virus. West Nile Virus (WNV) is one of the most widely distributed arboviruses in the world, with endemic foci in Africa, the Middle East, West Asia, North and Central America, and some parts of Europe and Australia. WNV is transmitted in a bird-mosquito cycle, and humans and horses are dead-end hosts only. Most people infected with WNV show no symptoms and the infection therefore remains undetected. However, about 20% develop a mild disease, usually referred to as West Nile fever (WNF). In less than 1%, the virus causes a neuroinvasive disease (WNND) with serious neurological manifestations, i.e. encephalitis, meningitis, meningoencephalitis or acute flaccid paralysis.2 The first recorded outbreak of WNV infection in Greece was in 2010, when 262 cases were identified (Pervanidou et al., 2014).

Malaria was officially eliminated from Greece in 1974, following an intense national malaria eradication programme that was implemented between 1946 and 1960. According to Danis et al. (2011), between 1975 and 2005 approximately 50 cases of malaria were reported annually, mostly imported cases from malaria endemic countries. Between 2005 and 2009, 171 cases of malaria were reported in Greece, of which, 98% were in people that likely acquired the infection in endemic countries and 78% of all cases were in migrants from those countries. It should be noted that the Malaria cases recorded in the latest years in Greece are those of the genus *Plasmodium vivax*, associated with less morbidity rates in comparison with the *Plasmodium falciparum* which is culpable for high rates of disease burden globally (Murray et al.,2012). However, concerns have arisen over the potentiality of the disease suitability and re-establishment due to climate change patterns (Caminade et al., 2014).

In regards to the *Aedes* related diseases, Dengue virus is usually detected in tropical and subtropical regions, infecting about 390 million per year (Bhatt et al., 2013). Its common symptoms include among others: fever, lethargy, rash and joint paint, while the more severe forms of dengue virus include dengue hemorrhagic fever and dengue shock syndrome. On the other hand, Chikungunya virus, causes an acute febrile illness characterized by severe arthralgia (Vega-Rúa et al., 2015). Although these transmissions have not yet been reported in Greece, the country is potentially at risk of future outbreaks, as other European Mediterranean countries, such as Italy (2007, 2017) and France (2014), have already experienced outbreaks of autochthonous chikungunya cases, while local dengue transmission has been recorded in Croatia and France (Gjenero-Margan *et al*., 2011; La Ruche *et al.,* 2010).

According to WHO (2017) many countries are still unprepared to address the looming challenges of vector borne diseases which are further intensified by the strong influence of social and environmental factors on vector-borne pathogen transmission. Therefore, a critical necessity arises for an informed restructuring of of national control and surveillance programmes in order to address the risks posed by multiple vectors and diseases as well as a high preparedness level of national health systems. All these challenges require an increased level of information in regards to the effectiveness of control interventions, well-trained specialised staff who can build sustainable systems for their delivery and a high level of citizens' awareness necessary for the control of *Aedes* species (WHO, 2017).

As can be seen in Figure 1.1, the IMS problem, is a mutlidisciplinary problem affected by various socio-ecological factors that can affect the economy and society in various ways, through their impact on human, animal health and various services. These impacts can generate certain economic costs related to control strategies, public health measures, health treatments, productivity losses, information and awareness campaigns, losses in tourism and other sectors. Economic impacts can be direct or indirect. Direct economic impacts occur when invasive species cause damage that result in increasing costs of various types and can be described as the net increase in spending as a result of the appearance of IMS. These types of economic impacts are those most often clearly defined as they can be explicitly expressed in monetary

values. Control and Surveillance Programs, private expenditures, direct medical costs, are among the most common categories of direct economic impacts of alien species. Indirect socio-economic effects mainly associated with the introduction of alien pests include, among others, effects on the quality of life of residents, effects on public health, costs associated with new research and management services (for both public and private sectors of the economy), effects on tourism, etc. Indirect effects are often difficult to evaluate as many of them cannot be easily expressed in monetary terms and special methodologies are used for their valuation (e.g. contingent valuation methods).

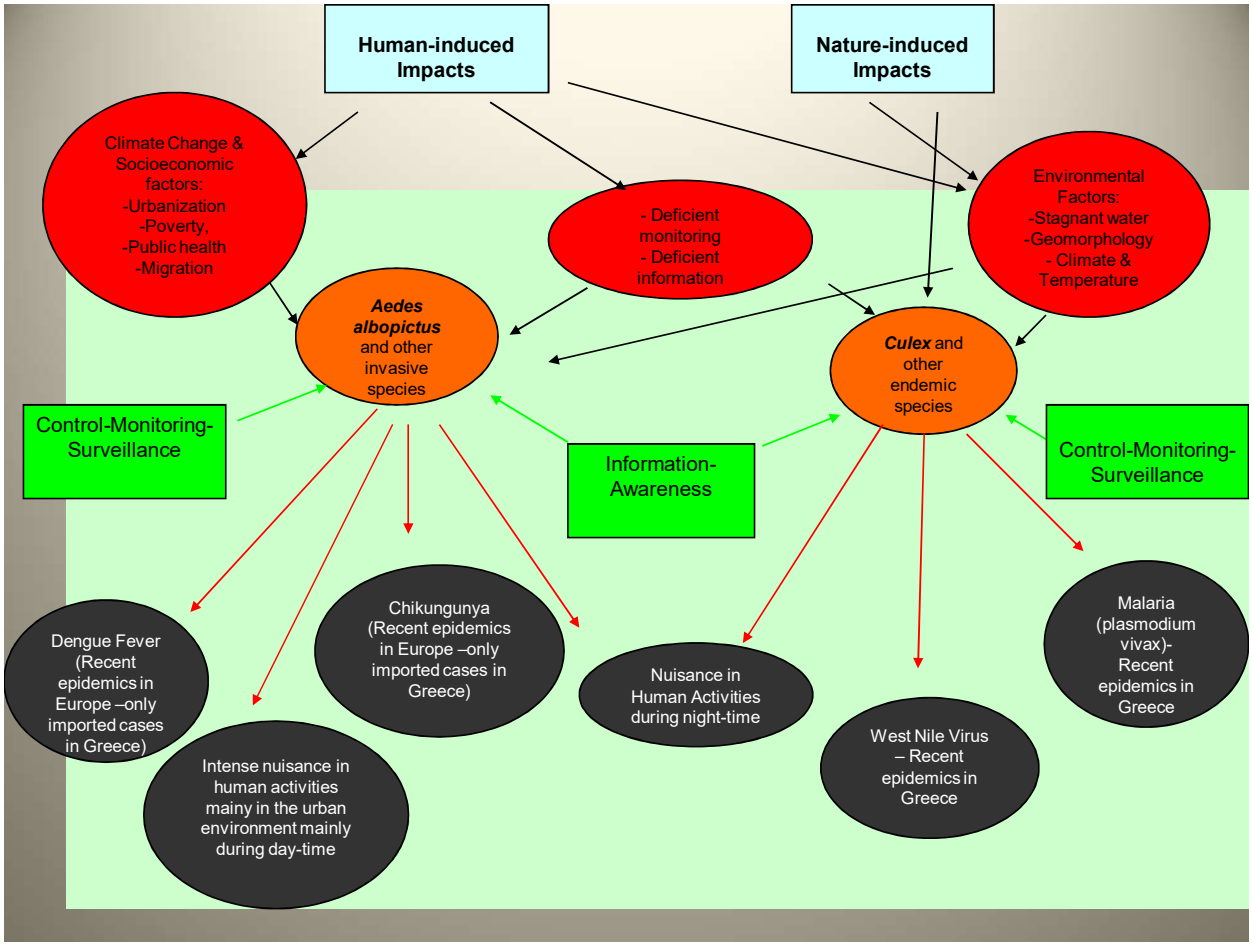


Figure 1-1. The IMS and Endemic Mosquitoes Impact Model

In general, two main categories of costs may be assigned to the overall mosquito problem (see Figure 1.2): a) public and private prevention costs, and b) socio-economic costs related to various health and nuisance impacts due to mosquitoes. An important economic issue related to the economic evaluation of the prevention strategy is thus to determine the effectiveness of the control measures (that is, the effect of public prevention costs) in reducing the health and nuisance impacts arising from relevant mosquito borne disease outbreaks and the overall problem of mosquitoes accordingly. This can be investigated through the implementation of specific economic analysis and tools, aiming to estimate the averted costs achieved as a result of the implementation of the mosquito control programmes, that is, the costs that would have occurred in the absence of those programmes. As shown in Figure 1.2, these reduced or avoided private prevention costs and socio-economic impacts can be actually considered as the potential social benefits of the preventive/control measures.

The costs associated with the overall mosquito problem can be distinguished as direct and indirect costs. Direct costs are the most clearly defined, as they can be explicitly expressed in monetary values. Control and surveillance programmes, private expenditures and direct medical costs are the main types of direct costs. On the other hand, indirect costs are associated with various socio-economic impacts including the nuisance cost (that is, the impact of mosquitoes on the quality of life and working conditions) and morbidity costs (productivity losses).

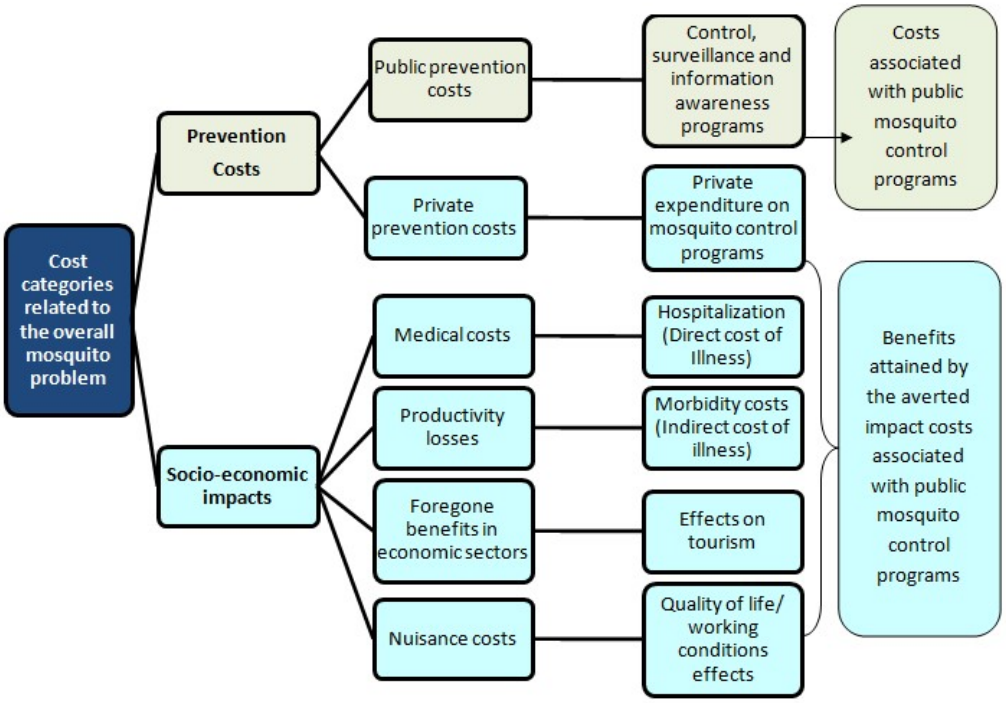
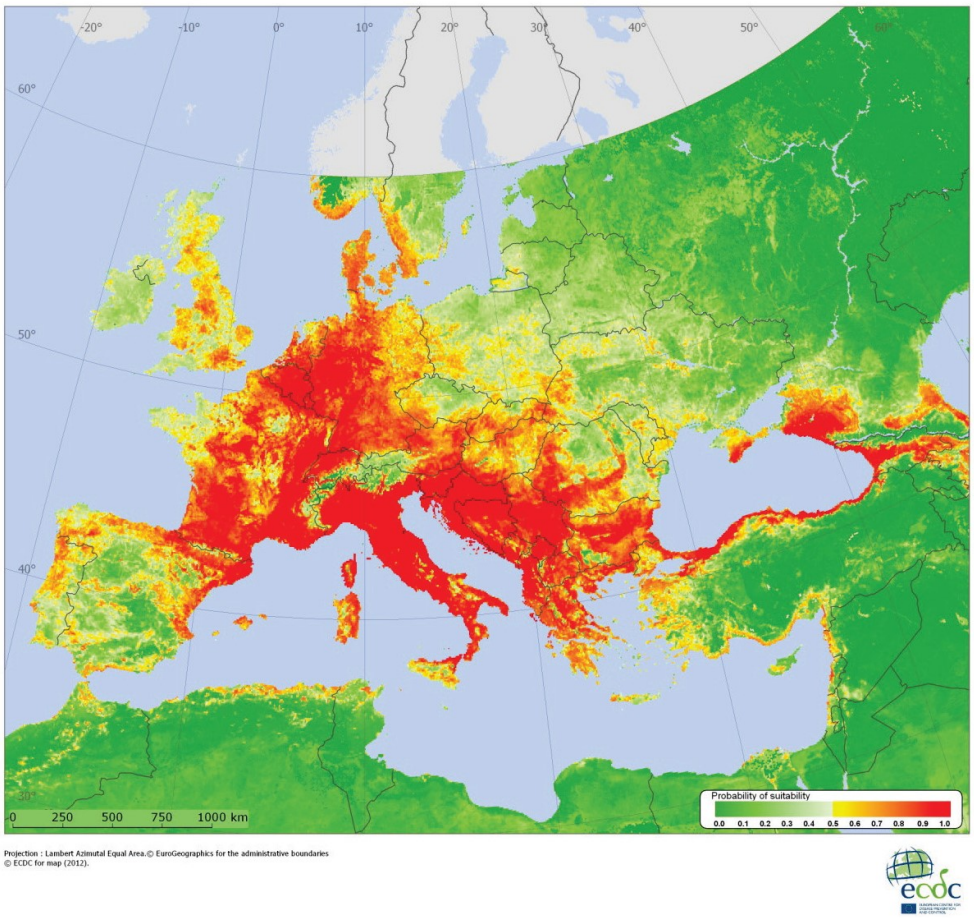


Figure 1-2. Cost categories related to the overall mosquito problem, including the WNV threat (Kolimenakis et al., 2016)

The socioeconomic implications brought by IMS in certain parts of Greece and Southern Europe are expected to be intensified by the risk of establishment of higher IMS populations accompanied by higher risks of mosquito-borne diseases, increased expenses for the confrontation of the IMS through various prevention measures, higher nuisance levels and side effects on other economic sectors such as tourism.



Map 1.2. Climatic suitability for Aedes albopictus in Europe (ECDC, 2012)

Thus, the objective of the current thesis is to evaluate the current socio-economic cost imposed by the problem of IMS in selected parts of Greece by considering public available data and implementing case specific methodologies with brief references to selected parts of Italy, in order to identify the policy dimensions of the issue at hand from a socioeconomic point of view. The results of the current study are expected to act as a guide for the estimation of the effectiveness of various control and management strategies and the examination of their societal welfare in indicative parts of the EU.

In line with the scope of the present thesis, Chapter 2 aims to provide a more detailed analysis of the public and private costs for mosquito control and prevention through the presentation of annual program costs in selected Greek Regions, municipalities

and case specific interventions, as well as the identification of private costs through the conduct of a small scale survey. The methodology and results of the small scale survey in Greek and Italian households related to private abatement costs are presented in the same chapter.

Chapter 3 is focused on the examination of medical costs and productivity losses related to various mosquito borne disease outbreaks and cases mainly in Greece, through the use of the "Cost of Illness" methodology. These costs have been elaborated with the provision medical data by the Hellenic Centre of Disease Control and Prevention. The data are considered confidential and for this reason only the aggregate tables of the detailed economic analysis appear in the current report.

Chapter 4 is based on the outcomes of the two previous chapters. This chapter presents the employment of cost-benefit and cost-effectiveness tests regarding the efficiency of current prevention and control programs. In addition, specific theoretical and policy dimensions from the implementation of similar approaches in health related interventions are analysed.

In Chapter 5 the implementation and results of a Choice Experiment survey conducted in the Metropolitan Area of Athens is presented. The “Choice Experiment Method” was selected for the elicitation of household preferences to control IMS. The results of this chapter contribute to the estimation of preliminary welfare levels of Chapter 4, offering more precise indicators of the citizens' perceived benefits from the implementation of improved mosquito management plans.

In Chapter 6 the findings of a web based survey targeted to Greek citizens are presented. A web-based questionnaire was conducted through a popular meteorological data website (www.meteo.gr). The scope of this questionnaire was the validation of specific parameters regarding the private prevention costs for IMS and the preferences for the application of improved mosquito control programs at a national level. The economic evaluation of the proposed management plans was also evaluated through “a stakeholders’ opinion” survey. This qualitative survey has been designed for the evaluation of the socioeconomic impacts of the management plans by

key stakeholders such as public policy makers, medical practitioners, public health experts and regional administrators in Greece and Italy.

Figure 1.2 presents the various methods implemented througout all chapters and how do they contribute to the overall estimation of the identified costs and benefits associated with the problem of invasive mosquito species. It should be pointed that the elimination of those socioeconomic costs bears a positive consequence on the benefit side resulting from the control of invasive mosquito species.

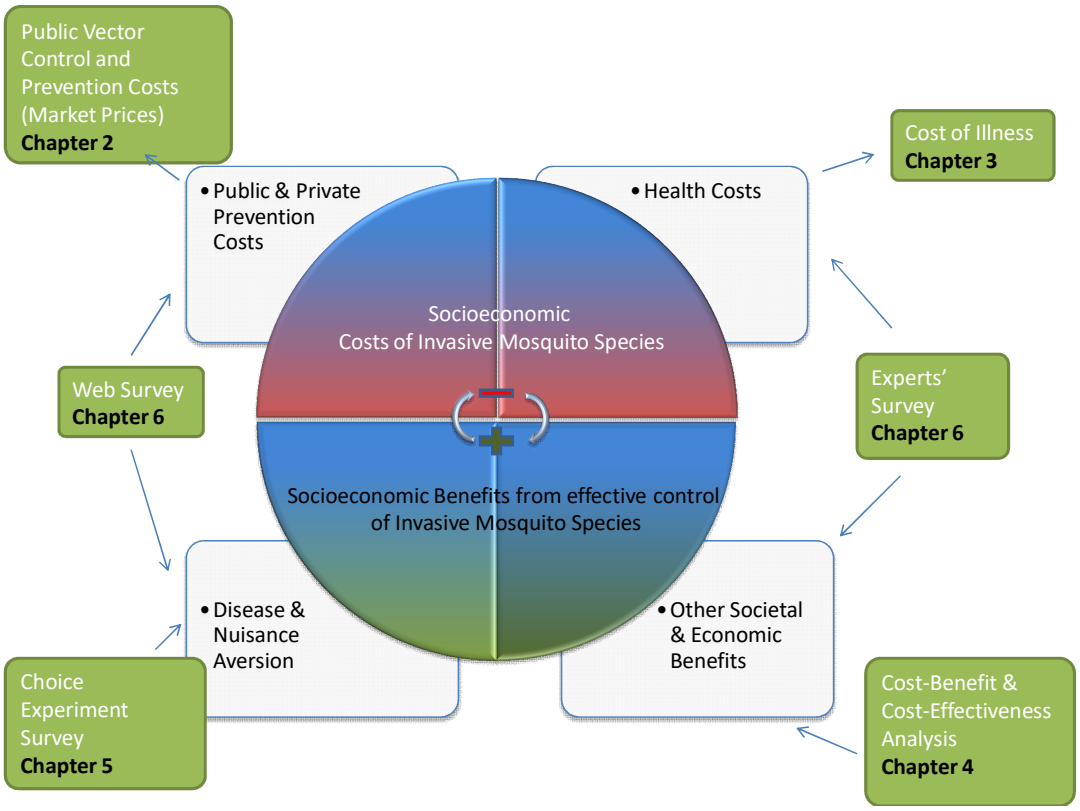


Figure 1-3. The employment of different methods for the estimation of socioeconomic costs and benefits associated with the problem of Invasive Mosquito Species

The findings of all the previous chapters contribute to:

- *the evaluation of the socioeconomic consequences associated with the problem of IMS through the use of empirical studies and case specific methodologies,*

- *the assessment of the economic effectiveness of ongoing and proposed management plans to control the IMS problem through the application of cost-benefit and cost-effectiveness tests*

- *the appraisal of the IMS problem from an integrated- holistic point of view taking into consideration citizens' and experts' view of the problem.*

The synthesis of results produced by the current thesis are expected to act as preliminary policy guide for the estimation of the effectiveness of present control and prevention strategies and the examination of possible societal welfare in the design of future control strategies. ***The results and evidence presented in this thesis constitute of the first attempt to estimate the efficiency of mosquito control and prevention measures in Greece, contributing towards a more thorough understanding of the net economic benefits of improving health and well-being as an important factor in public decision making.***

The current thesis attempts to contribute to the discourse of a multi parametrical and multidisciplinary issue, such as that of the IMS, by providing important indicators of the socioeconomic extent of the problem and of the welfare levels achieved from the implementation of informed public health policies under the social and environmental threats posed by climate change and the risks of new vector borne diseases and the apparent social challenges of Southern Europe. This is the multidisciplinary question that the structure of the current thesis aims to address by creating a preliminary basis for the evaluation of the overall socioeconomic impacts related to the emergence and

re-emergence of mosquito-borne infectious diseases in South Europe taking into account the complex socio-ecological factors affecting them.

Chapter 2: Public and Private Costs of Mosquito Control and Prevention

Chapter 2: Public and Private Costs of Mosquito Control and Prevention

2 The overall structure of Public and Private Socioeconomic Costs

One of the greatest challenges of the problem at hand is to define a method for the assessment of costs according to the nature of the problem of IMS. Based on the state of the art of current methodologies relevant to the problem targeted (Barber et al., 2010; Carney et al., 2008; Dowling, 2011; Gold et al. , 1996; Halasa, 2012; Staples, 2014; Unlu et al., 2012), as well as through meetings and interviews with experts, the methodological framework for the categorization of costs has been formulated and presented in Table 2.1.

Table 2-1. Main Cost Categories related to the IMS problem

COST CATEGORIES

- Public Prevention Costs
- Private Prevention Costs
- Quality of Life- Nuisance
- Impacts
  - Health Impacts
  - Non Health Impacts

The socioeconomic costs associated with the problem of IMS can be divided into various categories. First of all, costs are classified as *Market* or *Non-Market costs*. "Market Costs" are those costs which have a direct (market) monetary value, while "Non-Market Costs" are costs for which there is no direct monetary value (e.g. nuisance from mosquitoes, quality of life, etc.). Another categorization is into prevention and impact costs. "Prevention costs" are mainly associated with expenses induced in the public (regional authorities, national health services, etc) and private sector (households), for control, management and monitoring programmes, as well as other preventive activities (Tables 2.2, 2.3). The private prevention costs vary according to the severity of the mosquito presence, the perception of this phenomenon by residents and the available household budget.

Table 2-2. Basic Categories of Public Prevention Activities

Public Prevention Activities
• Monitoring/Surveillance of mosquito larvae population • Implementation of larvicidal, adulticidal and surface residual ground treatments • Aerial sprayings for mosquito control applying larvicidal and small scale adulticidal treatments • Information- Awareness Campaigns in schools and wider public • IRS (Internal Residual Sprayings) • Epidemiological Surveillance • Surveillance on humans and other species

Table 2-3. Basic Categories of private prevention expenses

PRIVATE PREVENTION EXPENSES
• Private expenses for indoor and outdoor spraying • Expenses for mosquito and insect repellents • Expenses for mosquito nets for beds and windows • Mosquito traps

The category of "Impact costs" refers to medical and non-medical costs associated with the presence of IMS. Medical costs, furthermore, are also separated into direct (e.g. hospitalization costs) and indirect costs (e.g. productivity losses) and they are generally evaluated with the use of specialised approaches such as the Cost of Illness (Segel, 2006) approach, Quality of Adjusted Life Years (Weinstein et al., 2009) and Value of a Statistical Life (Viscusi et al., 2003) approaches, implemented according to

the physiology of each studied case. More details on the analysis of this cost category of costs are provided in Chapter 3 and Annexes 8.4, 8.5.

On the other hand, non-health impacts are mainly related to all these foregone benefits associated with the presence of mosquitoes and may refer to disutilities caused in citizens' leisure, in certain economic sectors such as tourism, and in working conditions. These costs with specific emphasis on citizens' nuisance, are more thoroughly studied in Chapters 2.2 and Chapter 5 where the households' nusance levels are examined in combination with health risks imposed by IMS problem.

The aim of this chapter is principally, to identify the costs associated with market costs related to public and private prevention programs and expenses. The first part focuses on the examination of Public Prevention Costs and the second part on the identification of private prevention costs based on a small scale survey conducted to Greek and Italian households.

2.1.1 Public Prevention Costs Implemented by Regions and Municipalities

The main category of Public Prevention Costs in Greece is associated with control and management costs incurred by Regional Authorities and Municipalities for the elimination of the mosquito problem. Most of the control programmes in Greece are executed on an annual or a two-year basis and are financed by Regional and Municipal Funds, through the NSRF (National Strategic Reference Framework in Greece), or from the Authorities' own resources. All these activities are implemented according to the specific management plans and available resources of every country, region and municipality, and could vary significantly from place to place.

The main cost categories described in the various control programmes applied in Greece include:

- Monitoring/surveillance of mosquito larvae population

- Implementation of larvicidal, adulticidal and surface residual ground treatments
- Aerial sprayings for mosquito control applying larvicidal and small scale adulticidal treatments

Information about these costs has been provided directly by Regional and Municipal representatives, while many of these costs are directly published on the internet, via the national "Clarity" programme. In addition, cost categories were also provided by private companies that participate in the implementation of these control programmes; their provision from a second source enhanced the reliability of these data.

Some important limitations related to these data are that, first of all, there is no clear categorization of the activities included in the control programmes. Apart from a nominal categorization of the costs in the description of each control programme, there is no further analysis of the division of costs between different categories. More thorough contact with private companies' and regional representatives is necessary in order to clarify the categorization of costs for selected cases. Secondly, except in a very few cases, there is no clear distinction among costs incurred for invasive mosquitoes and for other mosquito species. For this reason an initial assumption has been made that these control programmes are designed to control all mosquito species, even though there are certain limitations to this approach. What is more, the re-organization of the municipalities according to the "Kallikratis" plan, which took place in Greece in 2011, caused certain difficulties in the estimation of prevention costs incurred by municipalities and in many cases the data have not been available.

Finally, the data related to the costs of control and surveillance programmes were available only for the years following 2011. The two tables in Annex 8.1 provide a precise estimate of the cost of mosquito control programmes for a number of Greek Regions and Municipalities for the years 2012 and 2013.

As can be observed, in the two tables of Annex 8.1 there was an increase in expenses for control programmes of about 1 million € from 6.05 million € in 2011 to 7.2

million € in 2012. From 2012 to 2013 there was a small decrease from about 7.2 million € to approximately 7 million €.

2.1.2 Prevention Costs implemented by the Hellenic Centre for Disease Prevention and Control (HCDCP)

It should be noted that supplementary prevention expenses are incurred also by the Hellenic Centre for Disease Control and Prevention (HCDCP). Its actions are implemented on an annual basis and they are mainly targeted towards malaria (plasmodium vivax) and West Nile Virus (WNV). HCDCP's prevention activities are divided principally into Information Activities, Enhancement of Epidemiological Surveillance, and Other Activities such as Indoor Residual Spraying. Even though these actions are not intended to control invasive mosquito species, they comprise an important indicator of regular expenditure against severe mosquito-borne diseases such as the West Nile Virus and malaria. The evaluation of these costs can provide important indicators regarding the effectiveness and benefit of control programmes on health and can contribute significantly to the further economic analysis of the problem.

Table 2-4. HCDCP actions against Malaria

	HCDCP ACTIONS AGAINST MALARIA 2012	COST
Information Activities for Health Professionals and the wider Public		**169.484,69**
1	Information Workshops for Health Professionals of Regional Authorities	15.784,30
2	Information Workshops of wider public and students	17.815,20
3	Information Material Prints (Leaflets, Posters) - (the material consisted of general directions for mosquitoes and was also used for info workshops for the prevention of West Nile virus)	117.000,00
4	Information Workshops for Health Professionals and the wider public (ESPA)	18.885,19
Enhancement of epidemiological surveillance against malaria		**379.802,06**
1	Active search and treatment of malaria cases in the Municipality of Evrotas Lakonia (outbreak investigation of outbreak points, active search for cases in the general population, screening of immigrants for malaria, serological tests)	182.486,58
2	Active search and treatment of malaria cases in other places apart from the Municipality of Evrotas Lakonia (outbreak investigation of outbreak points, active search for cases in the general population, screening of immigrants for malaria, serological tests)	43.352,47
3	Supply of Rapid Diagnostic Tests (RDTs)	13.186
4	Epidemiological surveillance of Malaria (ESPA)- includes cost for laboratory personnel (74.845 €) and equipment (18.380,22 €), common for malaria and West Nile virus	140.777,01
Other Activities		**43.908,16**
1	Supply of Anti-Malarial Medicines	858,16
2	(IRS) Spraying in the Municipality of Evrotas in Lakonia	43.050
Total Actions HCDCP - ESPA (Information, Enhancement of Surveillance, other activities)		**593.194,91**

2.1.3 Prevention Costs implemented by other organizations

Another significant control programme which has been implemented is the "Integrated surveillance and control program for West Nile Virus and Malaria in

Greece (MALWEST)". This is a project funded by the Greek Ministry of Health through the Operational Programme "Human Resources Development" of the National Strategic Reference Framework (NSRF) 2007-2013. The aim of the project has been the development of an integrated programme related to West Nile virus (surveillance for human cases, mosquito surveillance, avian surveillance, and equine surveillance) and malaria (surveillance for human cases, mosquito surveillance).The main objectives of the programme have been: 1) the detection of the West Nile virus and malaria activity and their impact on public health; 2) the identification of the geographic regions with the greatest risk and the development of risk assessment tools by using Geographical Information Systems (GIS); 3) the prediction of spreading of the disease; and 4) the assessment of appropriate interventions.

Even though the project is oriented towards diseases that are not transmitted by IMS, it constitutes a clear paradigm of a set of control measures employed against the transmission of new diseases. In addition, the implementation of the project has contributed significantly towards the know-how and capacity building of mosquito control strategies. Consequently, part of its costs has been incorporated into the present estimations.

Table 2-5. MALWEST Control Program Costs

MALWEST Control Program Categories	Costs
1. Bird Surveillance	
Pets	
External Supplies	7.000 €
Equipment	- €
Total Cost	**7.000 €**
Wild Birds	
External Supplies	37.251 €
Equipment	24.566 €
Total Cost	**61.818 €**
2. Surveillance on Horses	
External Supplies	6.130 €
Equipment	- €
Total Cost	**6.130 €**
3. Mosquito Surveillance	
External Supplies	65.136 €
Equipment	28.736 €
Total Cost	**93.873 €**
4. Human Surveillance	
External Supplies	156.119 €
Equipment	26.005 €
Total Cost	**182.123 €**
Active Search for disease cases	
External Supplies	60.643 €
Equipment	18.732 €
Total Cost	**79.375 €**
Sum Total	**248.196 €**

The total estimated costs of selected activities of the MALWEST management project for the years 2012 and 2013 are around 248,196 €.

The total estimated cost of mosquito control programmes in Greece in the years 2011, 2012, and 2013 reaches 21.2 million €. The average annual cost for mosquito control and management programmes is estimated to be approximately 8 million €. However, as has been already mentioned, there is no clear separation between costs incurred for IMS and costs for other mosquito species.

Lastly, a separate cost category, "the cost for blood safety testing", arose as a result of the 2010 WNV outbreak. Costs per year for this category were provided directly through representatives of the National Centre of Blood Control which conducted relevant actions.

Table 2-6. Costs for Blood Safety Testing

	National Centre of Blood Control Costs for 2010 WNV outbreak	**COST in €**
1	Costs for 2010	596.000 €
2	Costs for 2011	2.100.000 €
3	Costs for 2012	N/A
4	Costs for 2013	210.00 €
5	Total Costs	2.906.000 €

2.2 Survey Results on the private household impacts for Greece

The emergence of the Invasive Mosquito Species (IMS) problem is associated with various socioeconomic implications and costs both for the public and private level. The aim of this sub section is an initial estimation of the private prevention costs (against IMS and other mosquito species) for households in selected parts of Greece and Italy. Due to the difficulty of the separation of the costs caused by various

mosquito species a first questionnaire has been designed for the elicitation of the average costs of households against the IMS in relation to overall mosquito problem. The difficulty of separation of costs (present also at the public expenses level) incurred by invasive and other mosquito species is apparent also at the level of households (private costs). As concluded in the sub-section on public expenses, nuisance is the main factor of mosquito disturbance and based on the literature citizens are willing to pay higher amounts (through the implementation of public control programs) for further reductions of the mosquito nuisance (Barber, 2010; von Hirsch et al., 2009). A further analysis of these costs is presented later on Chapter 5, with the "elicitation" of the benefit levels that certain management plans may have on households, through the careful design of specialized questionnaires (based on stated preferences tools).

2.2.1 Methodology

A targeted questionnaire has been designed (Annex 8.2) for the identification of private costs incurred by households for the confrontation of the mosquito problem. The questionnaire aimed to elicitate costs incurred for the Asian tiger mosquito and costs for other species, both by questioning awareness of the particular mosquito (Asian tiger mosquito) and by asking the main hours of disturbance. It is known that the Asian tiger mosquito is more active during the daytime (Becker et al., 2010). In addition, the survey was conducted in early November, a period during which the Asian tiger mosquito is still active (Giatropoulos et al, 2012). A direct question has been asked regarding the average cost for private mosquito control by household. More questions were added regarding the main months during which mosquito expenses are incurred as well as the main cause of requiring protection (e.g. nuisance vs. disease).

The questioning process took place in two different stages and areas. In the first stage, the Greek questionnaire was distributed in hard copy format to a sample of university students of the Department of Regional and Economic Development of Panteion University. Students come from a broad range of demographic backgrounds and their

answers could provide a sample of different geographical areas of Greece. Students were asked to fill in the questionnaire along with the "main payers" of their households. 38 completed questionnaires were returned filled in from the total of 150 distributed questionnaires. A similar questionnaire (in Italian) had been distributed among the various employees of the Sanitary Agencies and other organizations participating in the LIFE CONOPS Project, in order to conduct the same survey in Italy. A total of 99 completed questionnaires were returned for the Italian case. In the second stage, an electronic questionnaire was distributed to the electronic database of the LIFE CONOPS electronic mailing list (approximately 2400 contacts) in Greece. Recipients were informed through email and they were asked to complete the questionnaire online (via Google docs). A total of 235 questionnaires was filled and collected (Table 2.7).

Table 2-7. Printed or electronic (internet-based) survey

	Frequency	Percent
Printed	38	13,9
Internet-based	235	86,1
Total	273	100,0

2.2.2 Survey Results on the private household impacts for Greece

As Table 2.8 shows Attica has been the Region from which most of the answers were received (68%). This seems in accordance with the population distribution of the country (as its biggest percentage appears in Attica). Crete and Central Macedonia represented about 20% of the whole sample and fewer answers were received from the rest of the Regions.

Table 2-8. Data collection (number of observations) from various Regions

		Frequency	Percent
	East Macedonia & Thrace	7	2,6
	Attica	185	67,8
	Western Greece	9	3,3
	Western Macedonia	1	,4
	Epirus	2	,7
	Thessaly	4	1,5
	Ionian Islands	1	,4
	Central Macedonia	22	8,1
	Crete	27	9,9
	Southern Aegean	3	1,1
	Peloponnese	3	1,1
	Central Greece	9	3,3
	Total	273	100,0

The biggest percentage of households (30%) consisted of 4 members followed by 3 and 2 member households. It is shown that expenses were higher for 4 member households than for other categories (Table 2.9).

Table 2-9. Number of household members

		Frequency	Percent	Cumulative Percent
	1	37	13,6	13,6
	2	64	23,4	37,0
	3	68	24,9	61,9
	4	84	30,8	92,7
	5	15	5,5	98,2
	6	3	1,1	99,3
	7	1	,4	99,6
	9	1	,4	100,0
	Total	273	100,0	

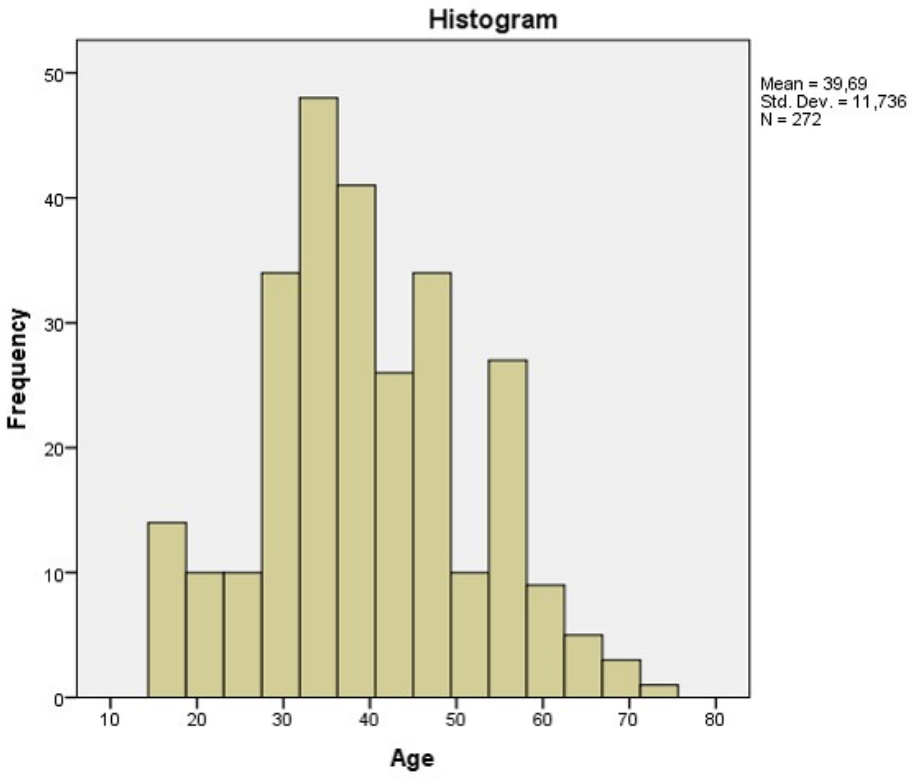


Figure 2-1. Histogram of the age data of our sample

As shown in Figure 2.1 the biggest percentage of the age of respondents ranges from 30 to 50 years old.

As pointed out earlier a ”test” question was asked regarding the awareness of respondents regarding the existence of the Asian tiger mosquito. It seems that most of the sample population (90%) is aware of the specific problem while only 10% is unaware (Table 2.10).

Table 2-10. Prior knowledge about the Asian tiger mosquito

		Frequency	Percent	Cumulative Percent
	Lack of knowledge	27	9,9	9,9
	Prior (to the questionnaire) knowledge	246	90,1	100,0
	Total	273	100,0	

An additional question was asked regarding the awareness of activity of the Asian tiger mosquito in the area of residence. It seems that 52% of the respondents are aware of the activity of the particular mosquito in their residential area (Table 2.11).

Table 2-11. Knowledge about the existence of Asian tiger mosquito in the residence area of respondents

		Frequency	Percent	Cumulative Percent
	Lack of knowledge	129	47,3	47,3
	Knowledge of existence	144	52,7	100,0
	Total	273	100,0	

Two separate questions were asked regarding the intensity of the mosquito problem:

a) *during the night* and b) *during the day*. Respondents in both cases were asked to rank the problem on a scale from nonexistent (1) to intolerable (5). As shown in Table 2.12, 33% of the sample identified the problem during the night as *medium* intensity, and 32% of *high* intensity. This indicates that the mosquito problem appears to be mostly of medium to high importance during the night. On the other hand, Table 2.13 shows that approximately 64% of the sample identified the problem during the day as medium to low importance.

Table 2-12. Nuisance level during the night

		Frequency	Percent	Cumulative Percent
	Non-existent	11	4,0	4,0
	Low	54	19,8	23,8
	Medium	90	33,0	56,8
	High	87	31,9	88,6
	Intolerable	31	11,4	100,0
	Total	273	100,0	

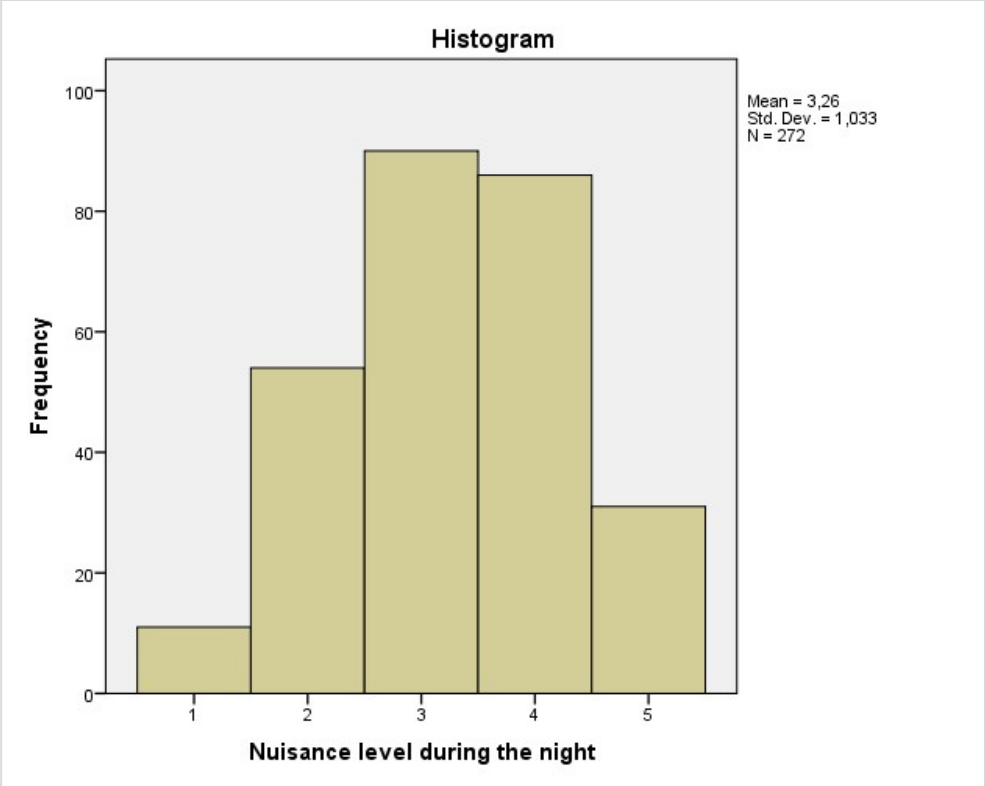


Figure 2-2. Histogram of the nuisance level during the night

Table 2-13. Nuisance level during the day

		Frequency	Percent	Cumulative Percent
	Non-existent	22	8,1	8,1
	Low	84	30,8	38,8
	Medium	91	33,3	72,2
	High	48	17,6	89,7
	Intolerable	28	10,3	100,0
	Total	273	100,0	

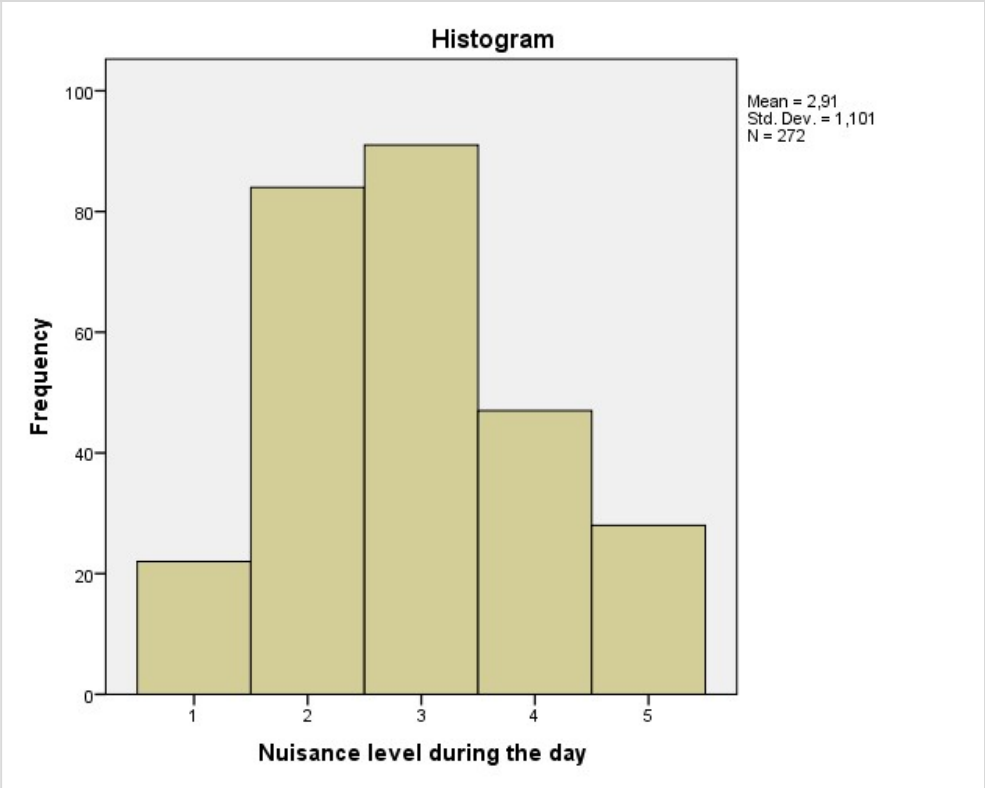


Figure 2-3. Histogram of the nuisance level during the day

Tables 2.14 and 2.15 show the starting and ending months of the mosquito problem. On average it seems that the mosquito problem starts to become noticeable from May to June while its symptoms seem to be fading out after October.

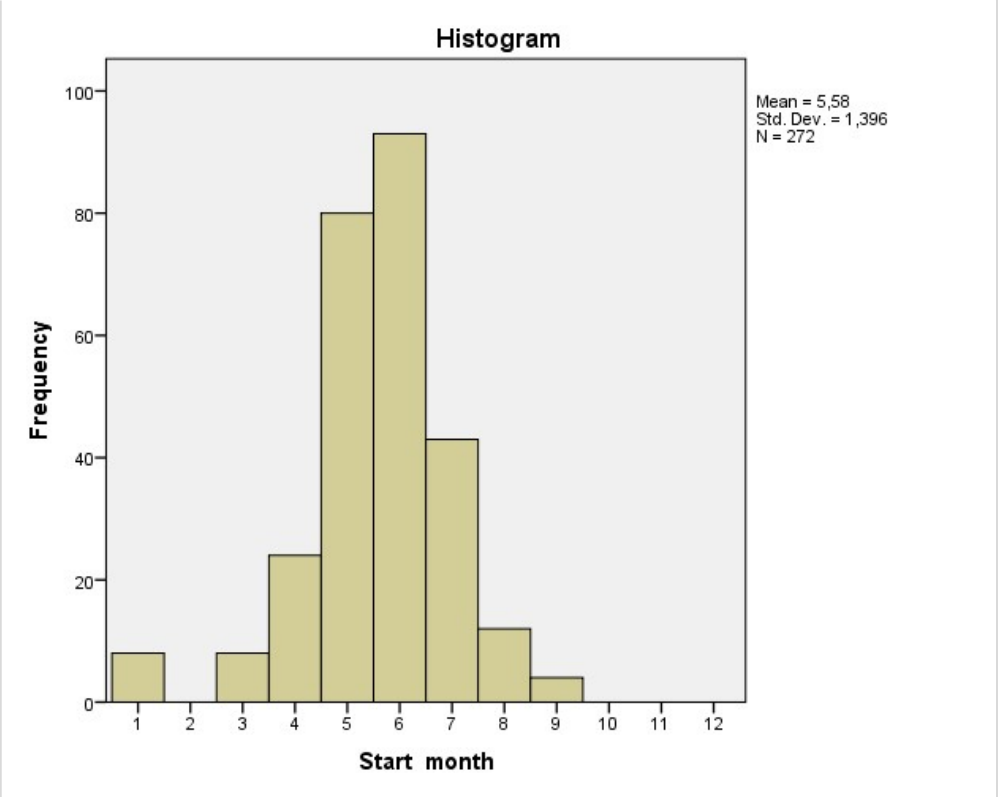


Figure 2-4. Histogram of the start month of mosquito nuisance

Table 2-14. Starting month of mosquito nuisance

		Frequency	Percent	Cumulative Percent
	January (1)	8	2,9	2,9
	March (3)	8	2,9	5,9
	April (4)	24	8,8	14,7
	May (5)	80	29,3	44,0
	June (6)	93	34,1	78,0
	July (7)	43	15,8	93,8
	August (8)	12	4,4	98,2
	September (9)	4	1,5	99,6
	December (12)	1	,4	100,0
	Total	273	100,0	

Table 2-15. End month of mosquito nuisance

		Frequency	Percent	Cumulative Percent
	August (8)	13	4,8	4,8
	September (9)	90	33,0	37,7
	October (10)	97	35,5	73,3
	November (11)	53	19,4	92,7
	December (12)	20	7,3	100,0
	Total	273	100,0	

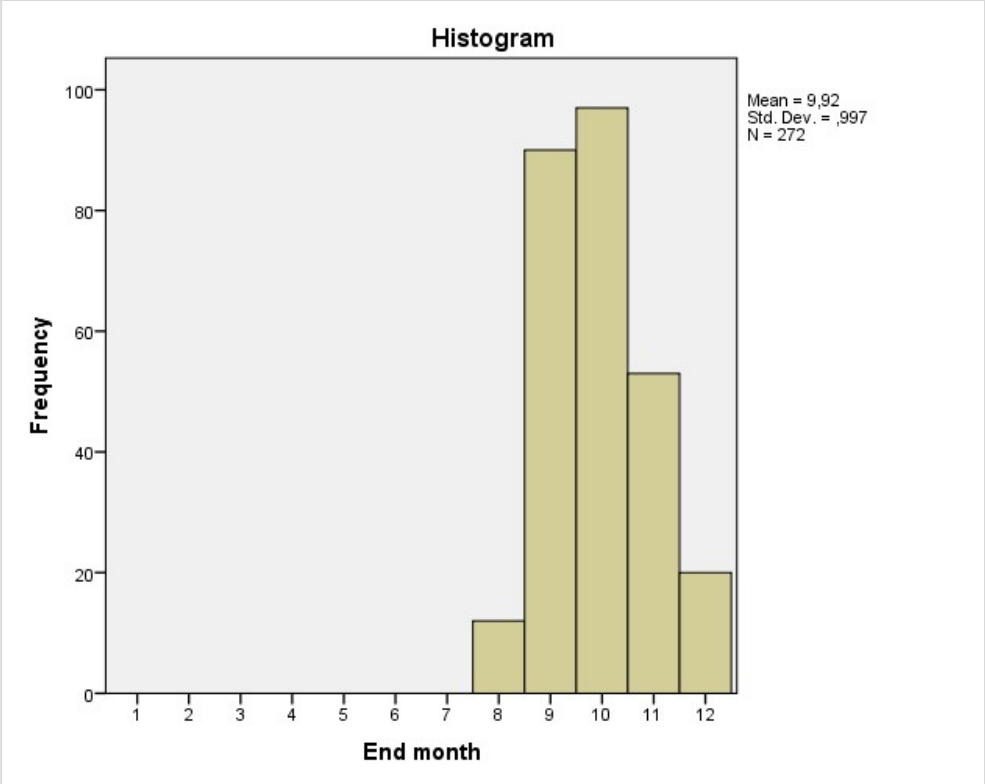


Figure 2-5. Histogram of the end month of mosquito nuisance

According to the Tables and Figures above, a duration of 3-5 months appears in the highest percentages as the period for which households are found to incur expenses for the overall problem of mosquitoes. Findings are presented in Table 2.16.

Table 2-16. Duration of the nuisance period (in months/year)

		Frequency	Percent	Cumulative Percent
	0	1	,4	,4
	1	12	4,4	4,8
	2	28	10,3	15,0
	3	57	20,9	35,9
	4	66	24,2	60,1
	5	49	17,9	78,0
	6	26	9,5	87,5
	7	17	6,2	93,8
	8	8	2,9	96,7
	9	1	,4	97,1
	11	8	2,9	100,0
	Total	273	100,0	

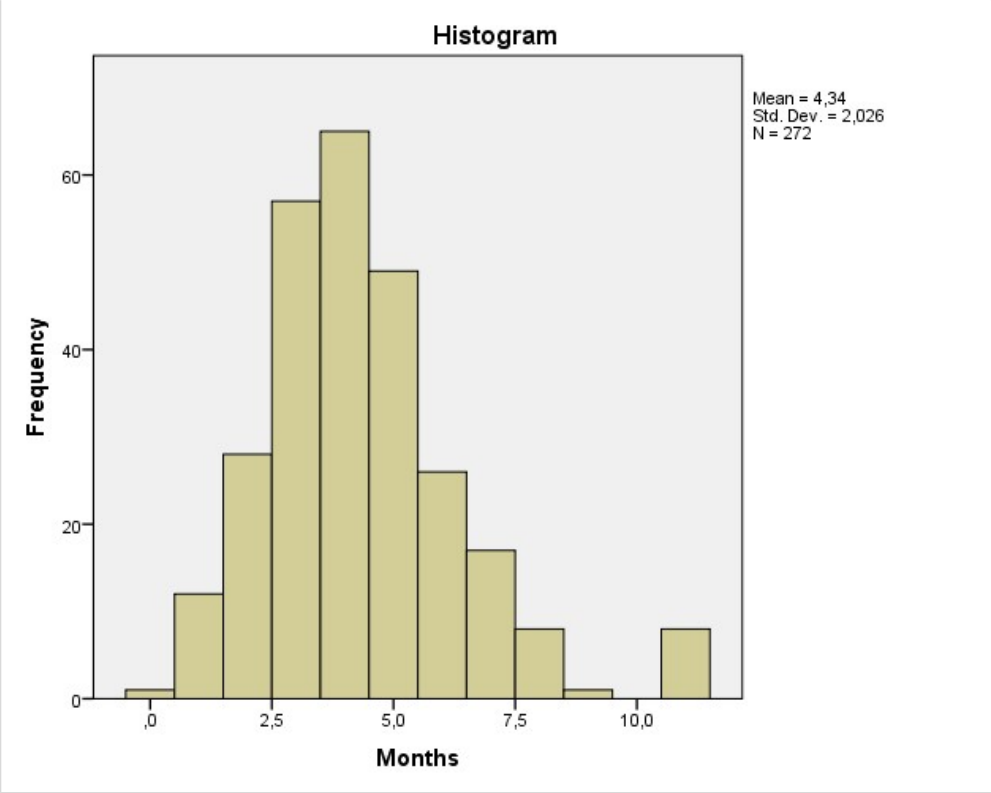


Figure 2-6. Histogram of the nuisance period

The core question of this survey was "the average private prevention cost of households during the months in which the mosquito problem is prevalent". Table 2.17 indicates that 28 % of the sample spend from 6 € to 10 €, while 20% from 11 € to 20 €. About 17% spend from 1 € to 5€, while 7% do not incur any expenses. In addition, 11,5% appears to be spending 21 to 30€, while only 5,5% spends more than 50€.

Table 2-17. Average monthly private prevention cost (€/household/month)

		Frequency	Percent	Cumulative Percent
	Don't spend any money on prevention cost	19	7,0	7,0
	€1 - €5	48	17,6	24,5
	€6 - €10	78	28,6	53,1
	€11 - €20	57	20,9	74,0
	€21 - €30	31	11,4	85,3
	€31 - €50	25	9,2	94,5
	More than €50	15	5,5	100,0
	Total	273	100,0	

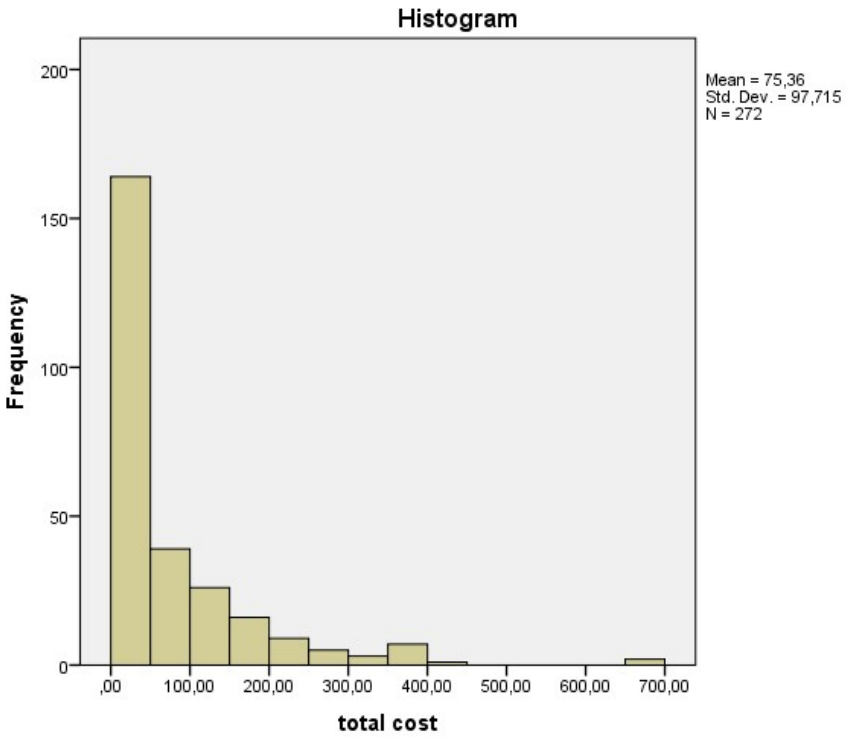


Figure 2-7. Histogram of the total private prevention cost (€/household/year)

The question regarding the hours during which respondents are taking protective measures aims to specify the intensity of the nuisance caused by the Asian tiger mosquito in the respondents' area of residence, as the nuisance from this species is mostly prevalent during the day time. It appears that the majority of respondents (58%) makes use during the nighttime, while 22% uses protective measures during specific hours of the day and night. 12% of the sample responds that they make use during all hours of the day (Table 2.18).

Table 2-18. Hours during the day that respondents are using individual protective measures

		Frequency	Percent	Cumulative Percent
	zero (not using measures)	19	7,0	7,0
	During nighttime	159	58,2	65,2
	During both nighttime and daytime	62	22,7	87,9
	During all day	33	12,1	100,0
	Total	273	100,0	

Nuisance reduction seems to be the primary reason factor for respondents' taking measures. The findings of Table 2.19 are in accordance with similar findings from the world bibliography (Halasa et al. 2014; Dickinson et al. 2012) which show that the nuisance factor is the main factor for which citizens are willing to pay higher amounts of money for enhanced protection via public mosquito control programs. Table 2.20 shows that sleep is the main activity affected by the problem, with home leisure and outdoor recreation following.

Table 2-19. Main reason for using individual protective measures

		Frequency	Percent	Cumulative Percent
	Risk Reduction in Health	66	24,2	26,2
	Nuisance Reduction	186	68,1	100,0
	Total	252	92,3	
	Not using measures	21	7,7	
Total		273	100,0	

Table 2-20. Activities affected by mosquitoes

		Frequency	Percent
	Home leisure	186	68,1
	Sleep	197	72,2
	Outdoor recreation	126	46,2
	Work activities	39	14,3
	None	21	7,7

The findings of Table 2.21 show that only 5 people had relatives who were infected by mosquito-borne diseases in the past, which probably indicates the intensity of the nuisance factor from various mosquito species.

Table 2-21. People became ill in the past (themselves or their family) from diseases caused by mosquitoes

		Frequency	Percent	Cumulative Percent
	0	268	98,2	98,2
	1	5	1,8	100,0
	Total	273	100,0	

2.2.3 Survey Results on the private household impacts for Italy

The results of the survey for the Italian case are based on a sample of 99 respondents. It should be noted that there might be several biases regarding the results as the Italian sample consisted mainly of members and delegates of Sanitary Services and Organizations involved with the problem of mosquito.

Table 2-22. Number of household members

		Frequency	Percent	Cumulative Percent
	1	9	9,1	9,1
	2	28	28,3	37,4
	3	32	32,3	69,7
	4	25	25,3	94,9
	5	3	3,0	98,0
	6	2	2,0	100,0
	Total	99	100,0	

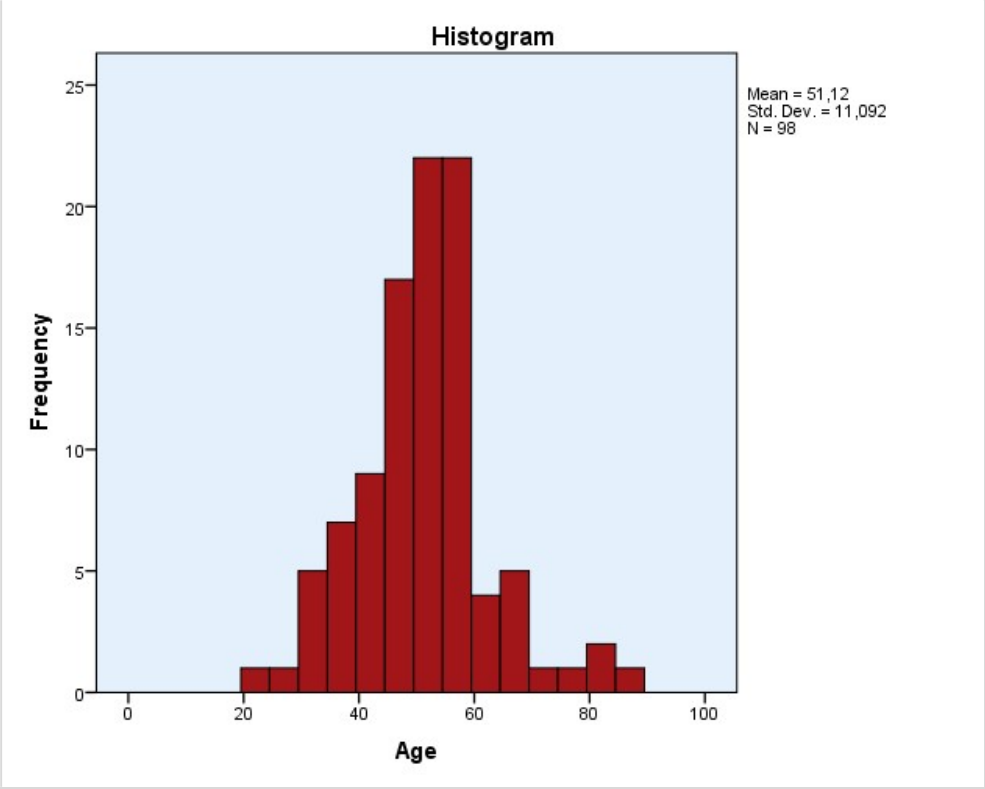


Figure 2-8. Histogram of the age data of our sample

Results regarding knowledge about the Asian tiger mosquito differ significantly from the Greek case, as Italy, and particularly the Region of Emilia Romagna, has been affected by the Chikungunya outbreak associated with this mosquito species (Angelini et al., 2008). Therefore, it appears (Table 2.23) that almost all respondents were aware

of the Asian tiger mosquito. Similarly, most of the respondents (90%) were aware of the presence of the Asian tiger mosquito in their area of residence (Table 2.23).

Table 2-23. Knowledge about the existence of Asian Tiger Mosquito in the residence area of respondents

		Frequency	Percent	Cumulative Percent
	Lack of knowledge	10	10,1	10,1
	Knowledge of existence	89	89,9	100,0
	Total	99	100,0	

Table 2-24. Prior knowledge about the Asia Tiger Mosquito

		Frequency	Percent	Cumulative Percent
	Lack of knowledge	1	1,0	1,0
	Prior (to the questionnaire) knowledge	98	99,0	100,0
	Total	99	100,0	

Tables 2.25 and 2.26 present the findings of the nuisance levels during the night and day, respectively. It is interesting to note that in comparison to the Greek case, the nuisance during the day appears to be concentrated in the medium to intolerable levels, while in the Greek case it is medium to low. This might imply a higher presence and nuisance from the Asian tiger mosquito in Italy.

Table 2-25. Nuisance level during the night

		Frequency	Percent	Cumulative Percent
	Non-existent	5	5,1	5,1
	Low	24	24,2	29,3
	Medium	44	44,4	73,7
	High	19	19,2	92,9
	Intolerable	5	7,1	100,0
	Total	99	100,0	

Table 2-26. Nuisance level during the day

		Frequency	Percent	Cumulative Percent
	Non-existent	3	3,0	3,0
	Low	7	7,1	10,1
	Medium	37	37,4	47,5
	High	19	19,2	66,7
	Intolerable	33	33,3	100,0
	Total	99	100,0	

As also shown in Figures 2.9 and 2.10 the nuisance during the night seems to be capturing medium to low levels, in contrary to nuisance levels in the daytime.

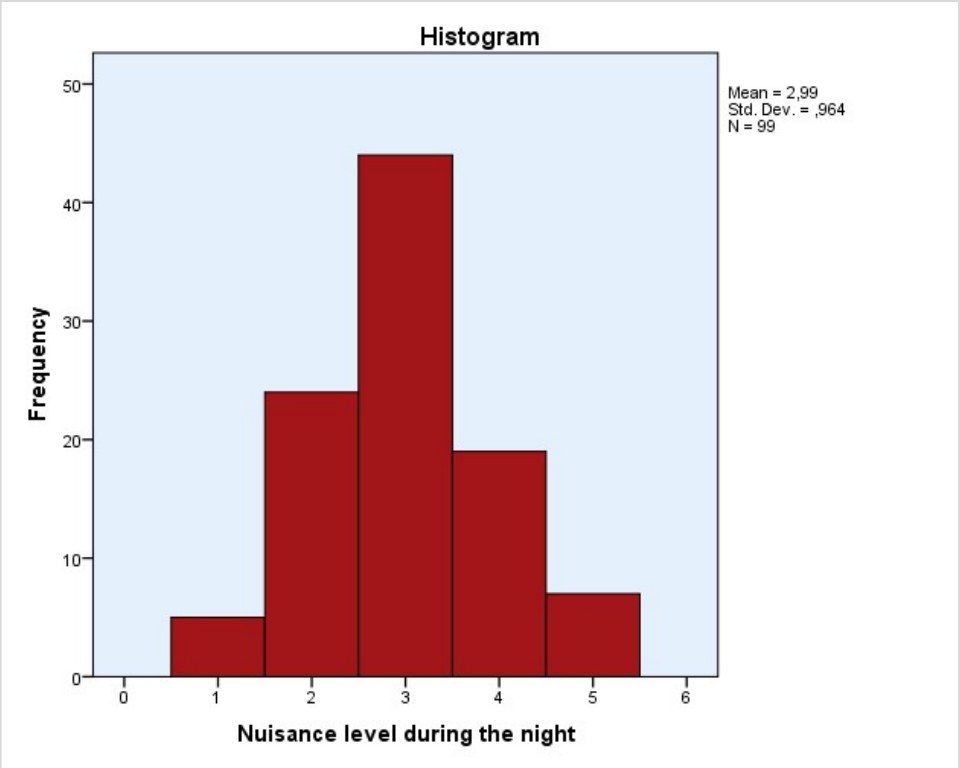


Figure 2-9. Histogram of the nuisance level during the night

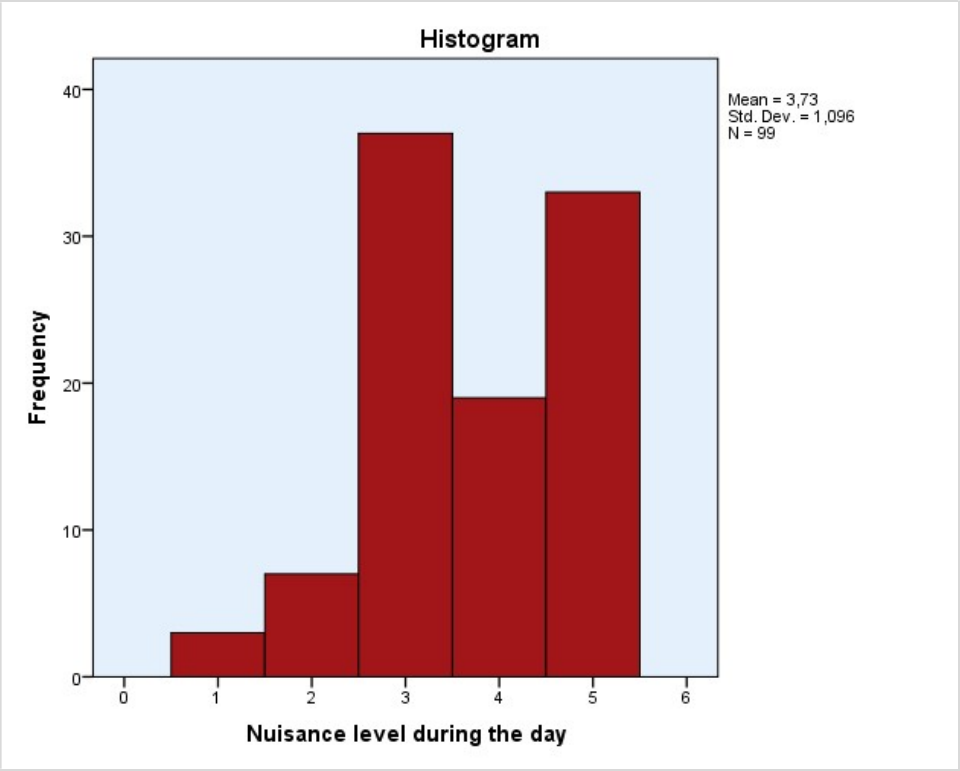


Figure 2-10. Histogram of the nuisance level during the day

Results regarding the starting and ending months of the mosquito nuisance are quite similar to the Greek case, a fact which is also justified by the close geographical proximity of the two areas.

Table 2-27. Start month of mosquito nuisance

		Frequency	Percent	Cumulative Percent
	January (1)	1	1,1	1,1
	March (3)	2	2,3	3,4
	April (4)	14	16,1	19,5
	May (5)	31	35,6	55,2
	June (6)	29	33,3	88,5
	July (7)	6	6,9	95,4
	August (8)	4	4,6	100,0
	Total	87	100,0	

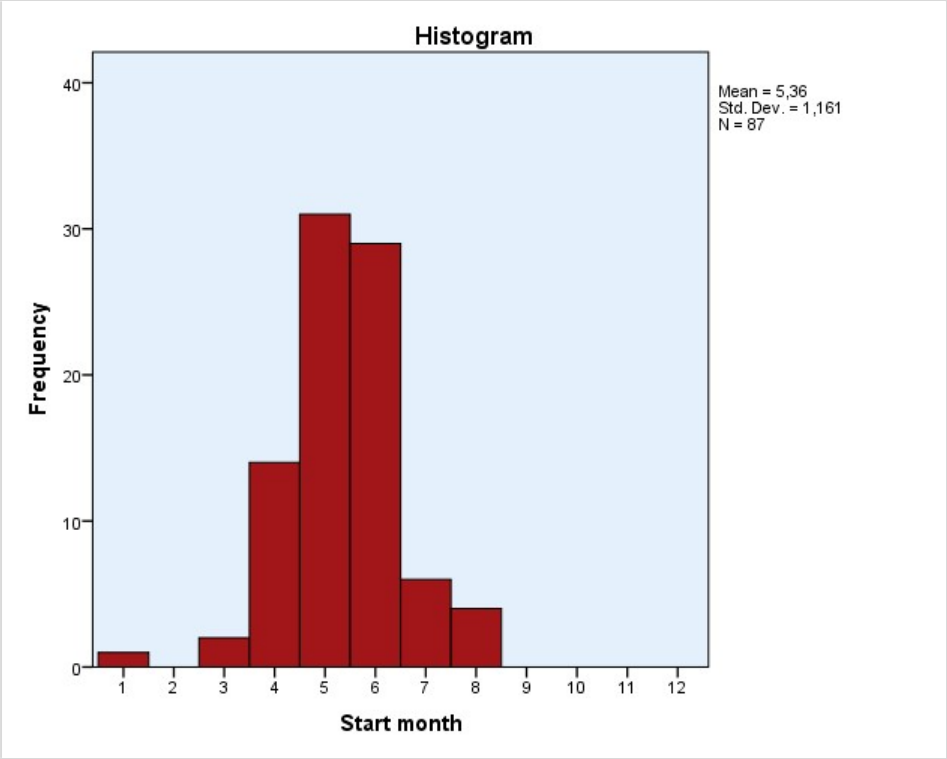


Figure 2-11. Histogram of the start month of mosquito nuisance

Table 2.27 and Figure 2.11 indicate that May and June are the primary months for the start of the presence of the mosquito problem. Table 2.28 and Figure 2.12 show that the problem begins to fade from September to November.

Table 2-28. End month of mosquito nuisance

		Frequency	Percent	Cumulative Percent
	August (8)	1	1,1	1,1
	September (9)	28	32,2	33,3
	October (10)	36	41,4	74,7
	November (11)	18	20,7	95,4
	December (12)	4	4,6	100,0
	Total	87	100,0	

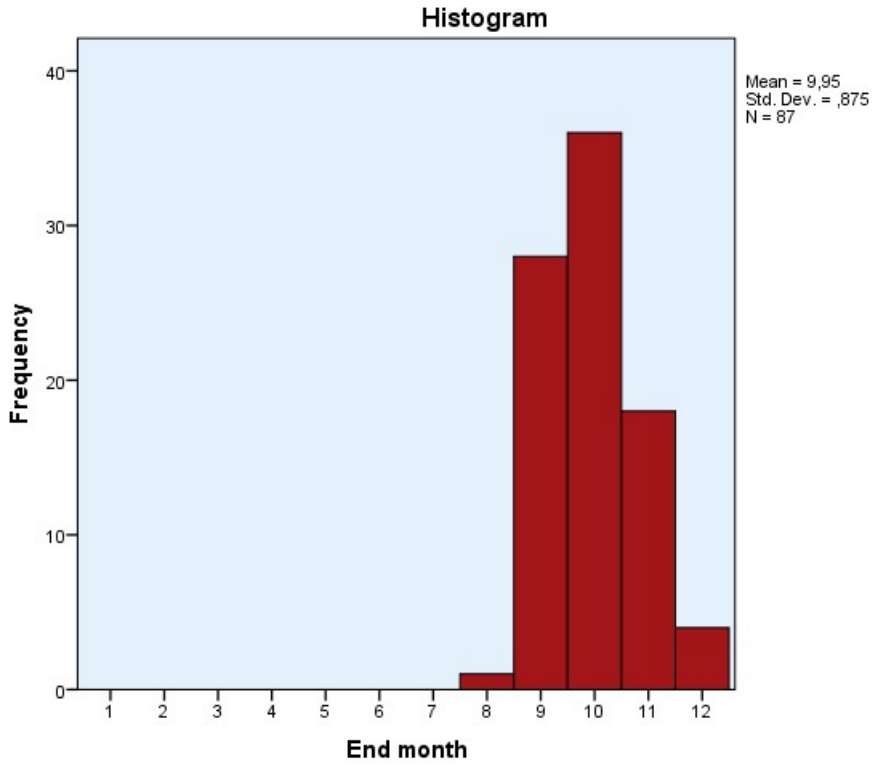


Figure 2-12. Histogram of the end month of mosquito nuisance

Similarly to Greece, the prevalence of the mosquito problem is shown to last from 4 to 6 months in total (Table 2.29).

Table 2-29. Duration of the nuisance period (in months/year)

		Frequency	Percent	Cumulative Percent
	1	2	2,3	2,,3
	2	5	5,7	8,0
	3	14	16,1	24,1
	4	25	28,7	52,9
	5	16	18,4	71,3
	6	15	17,2	88,5
	7	7	8,0	96,6
	8	2	2,3	98,9
	11	1	1,1	100,0
	Total	87	100,0	

Table 2-30. Average monthly private prevention cost (€/household/month)

		Frequency	Percent	Cumulative Percent
	Don't spend any money on prevention	7	7,4	7,4
	€1 - €5	5	5,3	12,5
	€6 - €10	17	17,9	30,5
	€11 - €20	23	24,2	54,7
	€21 - €30	15	15,8	70,5
	€31 - €50	14	14,7	85,3
	More than €50	14	14,7	100,0
	Total	95	100,0	

Concerning the core question of the survey, "average monthly prevention cost", findings indicate that the majority of the sample's answers are concentrated from 11 € to more than 50 €. Specifically, 11€ to 20€ seems to be the range of what most of the respondents pay for the problem of mosquito (Table 2.30). In contrast to the Greek case, higher percentages appear in the categories 21 to 30, 31 to 50 and more than 50 euro. However, it should be reminded that these findings might be biased by the fact that most of the respondents were aware of various consequences related to the mosquito problem, in general as well as the various consequences of the Asian tiger mosquito.

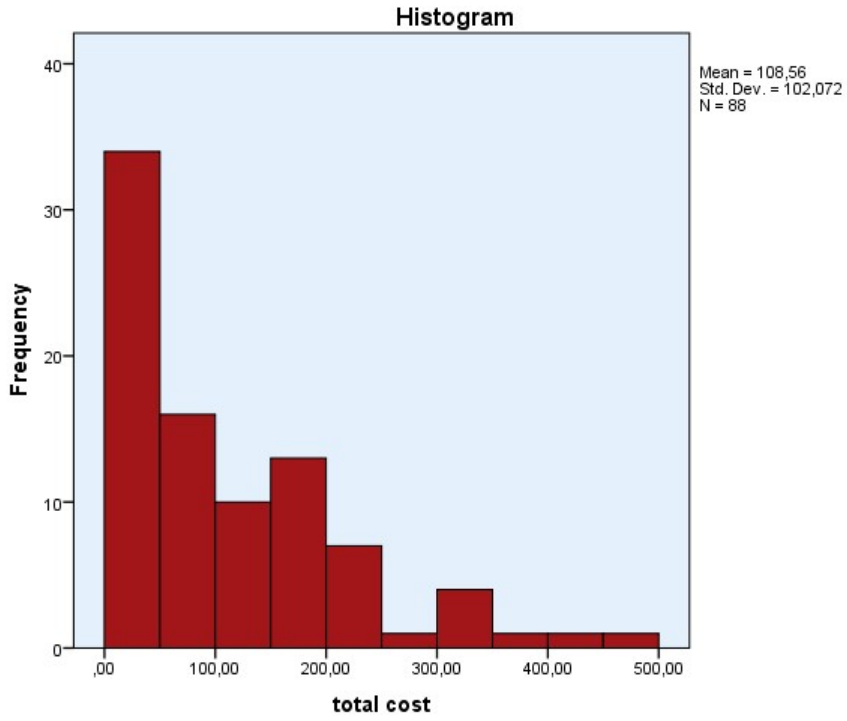


Figure 2-13. Histogram of the total private prevention cost (€/household/year)

Findings regarding the hours of the day for which protective measures are used are also important. Most of the respondents (75%) take protective measures during both day and night.

Table 2-31. Hours during the day that respondents are using individual protective measures

		Frequency	Percent	Cumulative Percent
	zero (not using measures)	6	6,1	6,1
	During nighttime	18	18,2	24,3
	During both nighttime and daytime	43	43,4	67,7
	During all day	32	32,3	100,0
	Total	99	100,0	

Table 2.32 shows that nuisance reduction is, also in Italy, the primary cause for which households take protective measures, while the main disturbances are associated with

outdoor recreation fact which could possibly be attributed to nuisance from the Asian tiger mosquito (Table 2.33).

Table 2-32. Main reason for using individual protective measures

		Frequency	Percent	Cumulative Percent
	Risk Reduction in Health	28	28,3	31,5
	Nuisance Reduction	61	61,6	100,0
	Total	89	89,9	
Missing	(not using measures)	10	10,1	
	Total	99	100,0	

Table 2-33. Activities affected by mosquitoes

		Frequency	Percent
	Home leisure	69	29,3
	Sleep	41	41,4
	Outdoor recreation	53	53,5
	Work activities	10	10,1
	None	1	1.0

Lastly, regarding the association of respondents with family experience of mosquito-borne illnesses only one answer showed a positive relation (Table 2.34).

Table 2-34. People became ill in the past (themselves or their family) from diseases caused by mosquitoes

		Frequency	Percent	Cumulative Percent
	0	98	99,0	99,0
	1	1	1,0	100,0
	Total	99	100,0	

2.3 Conclusion

The calculation of socioeconomic costs associated with IMS is not the final objective of this thesis' contribution. Further economic analysis applied in later chapters contributes to the evaluation of the effectiveness of the application of various control and management programmes and other expenses, and to defining the extent to which the benefits of these programmes outweigh the overall costs presented by the problem of IMS. Correct estimation of these costs is essential in order to provide the correct input to lead to reliable conclusions of the economic analysis and contribute towards the design of informed policy interventions.

The results of the small scale survey on private household costs, indicate a higher disturbance during the night time and an average private spending of 6€ to 20€ for the confrontation of the mosquito problem. Regarding the Greek case, it is difficult to draw conclusions regarding the percentage of expenditures (at the private level) for the problem of the Asian tiger mosquito both in the public and private level, however considering the results of the present chapter there seems to be a low association of costs with the specific problem. On the other hand, the main results of the private expenses survey for the Italian case show a higher association with the problem of the Asian tiger mosquito. This is implied not only by the almost complete awareness of the sample regarding the Asian tiger mosquito, but also by the higher intensity of the mosquito nuisance during the daytime as well as by the reluctance to take measures both during the day and night. Therefore, the average costs per household from 11€ to 50€ seem to be more closely associated with the problem of the Asian tiger mosquito in Italy. However, particular attention should be given to the fact that Italy and specifically the Region of Emilia Romagna have been affected by recent Chikungunya virus epidemics and also by the fact that most of the respondents were well aware of the problem before the conduct of this survey.

The separation of control and prevention costs of public control programs is an issue of high public health importance. It should be noted that the control of the native species is mainly carried out through annual activities which include monitoring and

surveillance of the mosquito larvae population, implementation of larvicidal, adulticidal and surface residual ground treatments, and application of larvicidal and small scale adulticidal treatments by aerial spraying. On the other hand, controlling the Asian tiger mosquito calls for a more complex management plan and coordinated actions which has only recently has been designed by the LIFE CONOPS research initiative (http://www.conops.gr/management-plan-for-aedes-albopictus-in-greece/?lang=en) and includes a series of actions such as standardized quantitative monitoring by special ovitraps, the recording of mosquito population density data, the involvement of the local population in the control campaign in private areas, residual door-to-door control interventions and the use of larvicides in the road drains of public areas throughout the whole breeding season.

The separation of the overall socioeconomic effects, on the private level, of the various mosquito species is a challenging and demanding issue which requires an interdisciplinary collaboration and in many cases the employment of specialised methodologies. The main limitations of the survey on private costs presented in this chapter are associated mainly with a confined non-random sample. However, within the flow of this thesis an estimation of more precise indexes of the economic magnitude of the Asian tiger mosquito is implemented through the use of various survey tools (Chapters 5 and 6) and specialised methodologies (Chapters 3 and 4) in order to achieve a more methodoligically sound and holistic approach of the problem at hand.

Chapter 3: Cost of Illness of mosquito borne diseases in Greece

3 The Cost of Illness of Mosquito borne diseases in Greece

The aim of Chapter 3 is to analyse an important part of the socioeconomic costs related to mosquito-borne diseases that of the cost of illness. As already mentioned various mosquito species are responsible for the transmission of various diseases (West Nile Virus, Malaria, Chikungunya, Dengue fever). *Ae. albopictus* was responsible for the over 200 laboratory-confirmed cases of chikungunya in Italy in 2007 and local dengue transmission in Croatia and France in 2010. The 2007 Chikungunya outbreak in Emilia Romagna (Italy) represents a clear illustration of the medical costs begot by Invasive mosquito species. Even though there are still no estimates for the medical cost of this outbreak, estimates for similar cases can be detected in recent bibliography (Soumahoro et al., 2011).

West Nile Virus (WNV) is one of the most widely distributed arboviruses in the world, with endemic foci in Africa, the Middle East, West Asia, North and Central America, and some parts of Europe and Australia. Its natural transmission cycle is between mosquitoes and birds, but mosquito bites can infect other species, notably humans and horses. Most people infected with WNV show no symptoms and the infection therefore remains undetected. However, about 20% develop a mild disease, usually referred to as West Nile fever (WNF). In less than 1%, the virus causes a neuroinvasive disease (WNND) with serious neurological manifestations, i.e. encephalitis, meningitis, meningoencephalitis or acute flaccid paralysis (Pervanidou et al., 2014).

The first recorded outbreak of WNV infection in Greece was in 2010, when 262 cases were identified. The administrative region principally affected was Central Macedonia (population 1.9 million), where 250 cases were recorded. WNND developed in 197 (75%) and 33 (17%) of these patients died (Pervanidou et al., 2014, Danis et. al., 2011). The outbreak continued in the succeeding years with 100 cases recorded throughout Greece in 2011, 161 cases in 2012 and 86 in 2013. In Central Macedonia, the numbers were 30, 18 and 22, respectively. The reduction in WNV

cases over this period in Central Macedonia might be due to the implementation of integrated mosquito control and prevention programmes aiming to reduce the various impacts associated with the mosquito problem. However, there is significant uncertainty regarding the effectiveness of these programmes in preventing the transmission of WNV disease, as no models have been developed that provide long-term predictions of how, when and where the various relevant factors will combine to produce outbreaks (CDC, 2000).

Table 3.1 presents the categorization of costs for medical impacts. Medical impacts are divided between direct impacts which include cost categories such as hospitalization, medication, physical therapies, etc., and indirect impacts which include mainly productivity losses and costs for caretakers.

Table 3-1. Main Cost Categories of Medical Impacts

Medical Impacts	**Cost Categories**
	Direct Impacts
Inpatient Economic Impacts	
	Hospitalization
Outpatient Economic Impacts	
	Medication
	Consultations
	Outpatient Physical Therapy
	Other Family Costs
	Indirect Impacts
	Productivity Losses
	Caretakers

In this context, a specific methodology has been developed, in collaboration with HCDCP, for the estimation of other mosquito-borne diseases highly prevalent in particular regions of Greece (Annex 8.4). Specifically, the Cost of Illness has been evaluated for the 2010 West Nile Virus (WNV) outbreak in Central Macedonia, the 2011 Malaria outbreak in Lakonia and imported cases of Zika Virus, Chikungunya and Dengue Virus for the years 2010-2017. It should be noted that the costs of illnesses induced by other mosquito species, such as Malaria and West Nile Virus, consistitute very important indicators regarding the economic burden of the problem

of mosquitoes. They can provide valuable indications on the cost effectiveness of various prevention measures as well as the benefit that such control programs offer to the general population.

3.1 Methodology for the estimation of the Cost of Illness for the recorded mosquito borne disease cases

The methodology used for the evaluation of the costs imposed by mosquito borne disease outbreaks was based on the Cost of Illness (Human Capital Approach), (Segel, 2006, Staples et al, 2014). In a cost-of-illness (COI) study, the burden of a disease on society is estimated in economic terms. Costs are divided into two major categories the Direct Costs and the Indirect Costs. Direct costs (which mainly comprise Medical Care, whether inpatient or outpatient) are estimated on the basis of market prices. In this study, only the inpatient costs associated with hospitalization were evaluated as there was insufficient information regarding outpatient costs related to physiotherapies, speech therapy, etc. On the other hand, indirect costs are interpreted as the costs related to loss of productivity due to morbidity.

3.2 Estimation of Direct Medical Costs in Greece

The estimation of Medical Care Costs was based on the evaluation of the Hospitalized Cases diagnosed with WNV, Malaria, Zika, Dengue and Chikungunya that were treated in public hospitals of Greece. Only the cases suspected to have been infected in Central Macedonia and Lakonia were estimated in order to have a clear indication of the effect of the disease in the specific area. Estimation was carried out according to the National DRGs (Diagnosis Related Groups) Indicators as published in the 3054/18-11-2012 Official Government Gazette of the Hellenic Parliament. The Average Daily Hospital Care Cost (according to DRG) in public hospitals of Greece equals approximately 207€/ per day and was multiplied by total inpatient care days outside intensive care. Further estimation was carried out for those cases that needed intensive care treatment (mainly for WNND cases); according to National DRGs Indicators, the cost from day 1 to day 3 the cost is 700€/day, from day 4 to day 15 the cost is 500€/day and from day 16 onwards the cost is 350€/day.

3.3 Evaluation of Indirect Medical Costs: Productivity Losses

The evaluation of productivity losses is based on the assumption that earnings reflect productivity, thus indirect costs are often restricted to earnings lost during the days of sickness. The total absenteeism cost was evaluated only for age groups >18 years and the value of a lost work day were multiplied by total sick days. In order to evaluate the cost of a lost work day for unskilled workers and people over 65 years old, a calculation was made according to Median Hourly Earnings (Eurostat, 2013b), for all employees (other activities), 2010, and the prices were adjusted to 2011, 2012 and 2013 by the Consumer Price Index, multiplied by 8 working hours. According to this approach the cost of a work day loss for unskilled workers and people over 65 years old was assumed to be approximately equal to 74,65€. The cost of a work day loss for all other categories was calculated according to Median equivalised net income (Eurostat, 2013a) for the years 2011, 2012, 2013, divided by 220 working days. Thus, the cost of a work day loss for this category is assumed to be approximately equal to 99,86€.

3.4 Results of Medical costs and Productivity losses for the recorded Malaria cases

The total medical costs for the treatment of 53 diagnosed cases in the Prefecture of Lakonia in public hospitals for 2011 was about 0,05 mil € while productivity losses were estimated around 0,04 mil € causing a total cost of 0,09 mil € (Table 3.2). Costs reduced significantly in the following years as the recorded cases treated were 8 in 2012 and 2 in 2013. The average COI per case ranges from around 1.700€/case (2011) to 2.750€/case (2013).

Table 3-2. Cost of Illness for Malaria Outbreak in Lakonia (2011-2013)

	2011	2012	2013
Hospitalisation Costs	51.500 €	6.292 €	3.523 €
Productivity Losses	40.061 €	10.793 €	1.971 €
Total Cost of Illness (Medical Cost and Productivity Losses)	**91.561 €**	**17.085 €**	**5.494 €**
Hospitalised Cases	53	8	2
Cost Per Case	**1.728 €**	**2.136 €**	**2.747 €**

3.5 Results of Medical costs and Productivity losses for the recorded WNV cases

The total medical costs for the year of WNV outbreak (2010) were estimated at about 0,5 mil €. These costs included the hospitalization of 260 recorded WNV cases of which 25 needed further hospitalization in intensive care unit which added an extra cost of 0,16 mil €. The losses in productivity for all category groups were calculated to be approximately 0,23 mil €. The total COI for the year of outbreak was estimated at about 0,9 mil € while the total COI for the whole country was around 0,94 mil €. The total COI for the following year was estimated at about 0,11 mil € for the hospitalization of 30 cases, 2 of which were in intensive care. Eighteen cases were recorded and treated in 2012 and only one case needed further hospitalization in intensive care, with the total COI for this year amounting to about 0,07 mil €. In 2013, 22 cases were diagnosed, 2 in intensive care, and the COI was approximately 0,07 mil €. According to these data the average COI per case and year has been estimated as the total COI divided by the number of cases for each of the 4 years. The health costs averted per year were calculated based on the total COI per year minus total COI of the outbreak year. (Table 3.3)

Table 3-3. Cost of Illness for WNV outbreak in Central Macedonia (2010-2013) (Kolimenakis et al., 2016)

	2010	2011	2012	2013
Hospitalised Cases	260	30	18	22
Cases treated in Intensive Care Units	25	2	1	2
Hospitalization Costs	524.576 €	74.070 €	44.878 €	38.916 €
Hospitalization Costs in Intensive Care Units	162.300 €	14.200 €	7.100 €	20.700 €
Total Medical Costs	**686.875 €**	**88.270 €**	**51.978 €**	**59.616 €**
Productivity Losses	229.553 €	30.636 €	19.047 €	17.195 €
Total Cost of Illness (Medical Cost and Productivity Losses)	**916.429 €**	**118.905 €**	**71.025 €**	**76.811 €**
Cost Per Case	**3.524 €**	**3.963 €**	**3.946 €**	**3.491 €**

3.6 Estimation of hospitalization costs associated with the outbreak of Chikungunya in Emilia Romagna, summer 2007, Italy

The estimation of hospitalization costs was based on a retrospective study on 250 persons identified as confirmed or possible Chikungunya cases (Moro et al., 2012) in which the long-term Chikungunya infection clinical manifestations after an outbreak in Italy are analysed. The method for the estimation of the hospitalization costs related to the Chikungunya infection was based on an analysis of hospital stay of the cases (231) living in the Ausl Ravenna District and Ausl Cesena District, from 4 July 2007 to 28 September 2007 (epidemic period), which accounts for 90% of all confirmed or possible CHIKV cases.

The number of hospitalized cases was derived from the Ausl Ravenna and Ausl Cesena database of hospital stays. The cost of hospitalization was determined on a Diagnosis-Related Groups (DRG) basis (Annex 8.6). The classification of a patient in

a given DRG is determined according to the final diagnosis and management. All hospitalization stays, occurred between the 4th July 2007 and the 28th September 2007. The hospital stay was attributed to CHIKV when the ICD9 CM code 066.3 appeared in the diagnoses (principal DRG Annex 8.6), or when at least two codes of the signs that may be related to CHIKV acute phase of the disease appeared in all the diagnoses (principal or related diagnosis).

Table 3-4. Costs related to 2007 Chikungunya virus infection in the Region of Emilia Romagna

	Number of Hospitalized Cases	**n. hospitalized cases hospital length 0-6 days**	**n. hospitalized cases hospital length 7-14 days**	**n. hospitalized cases hospital length more than 15 days**	**avg length of stay**	**Total Costs (€)**
Hospital stays attributed to CHIKV	21	12	7	2	9 (min.2 days - max. 58 days)	**56.256**
Hospital stays that might be related to CHIK	20	7	7	6	14 (min. 1 day - max.77 days)	**89.454**
All hospitalization stays, occurred between 4 July 2007 to 28 September 2007	41	19	14	8	11 (min.1 day – max.77 days)	**145.710**

Results indicate that the hospitalization costs attributed to the 2007 Chikungunya outbreak are approximately 145.710 €. Even though the economic results of this outbreak cannot be directly compared to the results of the Greek outbreaks, mainly because of a slightly different calculation method due to lack of complete medical

data and non availability of certain data concerning productivity losses, they provide an initial estimation of relevant costs in Southern Europe. Specifically, the average cost for one hospitalized case of Chikungunya is approximatelly 3.500€, a figure which is not too far from the average cost of an imported case of Dengue, Chikungunya, Zika as it will be seen in the next sub-chapter.

3.7 Estimation of health impact costs for the imported cases of Dengue, Chikungunya and Zika virus in Greece for the period 2013-2017

The calculation of medical costs for all reported cases of Dengue, Chikungunya and Zika virus in Greece for the period 2013-2017 was based on the methodology of the cost of illness approach as described in the previous subchapters 3.1, 3.2, 3.3. Anonymized data on the duration of hospitalization of reported cases, including intensive care treatment, if any, were provided through the official records of Hellenic Centre for Disease Control and Prevention.

As information was lacking on the total number of working days lost, the indirect costs of productivity losses could be estimated only for earnings lost during the known days of hospitalization.

According to the results Table 3.5 the average health cost for an imported case of Dengue was estimated to be approximately 3.842 €, the average cost for a case of Chikungunya approximately 1329 €, at the average cost for a case of Zika virus reached almost 3770 €. However, it should be noted that these costs would possibly increase in an epidemic outbreak, causing additional severe additional burdens such as the effect of Zika virus on the pregnant population. In addition, according to the bibliography, the morbidity rates from Dengue fever increase rapidly in the case of a second infection in the same subject, causing notably higher medication costs and increasing the mortality rate. Therefore, even though the overall socioeconomic costs in the case of epidemic outbreaks for this group of diseases cannot be estimated with high precision, it seems that they would significantly outweigh the present costs of treating the diagnosed imported cases.

Table 3-5. Cost of Illness for reported imported cases of Dengue, Chikungunya and Zika virus in Greece for the period 2013-2017

Virus Cases	Year	Hospitalization Cost	Additional Hospitalization Cost in Intensive Care	Productivity losses (during hospitalization)	TOTAL COSTS
Dengue	2013	1.863 €		899 €	**2.762 €**
Dengue	2014	2.277 €		1.098 €	**3.375 €**
Dengue	2014	828 €	7.100 €	1.997 €	**9.925 €**
Dengue	2014	1.035 €		499 €	**1.534 €**
Chikungunya	2014	1.242 €		599 €	**1.841 €**
Dengue	2015	207 €		100 €	**307 €**
Dengue	2015	1.449 €		699 €	**2.148 €**
Chikungunya	2016	414 €		200 €	**614 €**
Dengue	2016	828 €		399 €	**1.227 €**
Dengue	2016	-		-	**-**
Chikungunya	2016	1.035 €		499 €	**1.534 €**
Zika	2016	-		-	**-**
Zika	2016	1.449 €		699 €	**2.148 €**
Dengue	2017	2.277 €		1.098 €	**3.375 €**
Zika	2017	-	4.600 €	799 €	**5.399 €**

3.8 Conclusion

The 2010 West Nile Virus (WNV) outbreak in Central Macedonia and the 2011 Malaria outbreak in Lakonia were associated with certain medical impacts which demanded the implementation of public health prevention and control strategies (Danis et al. 2011; Pervanidou et al. 2014). These strategies possess the characteristics of public goods and are usually examined for their effectiveness in achieving specific health outcomes and their capacity to boost social welfare (John et al. 1987; von Hirsch et al. 2009). Their application aims to contribute significantly towards protecting the public against the outbreak of epidemic diseases, improving quality of life and reducing losses in various economic activities.

The calculation of medical costs presented in this chapter, in combination with the estimation of prevention costs presented also in Chapter 2, offer the possibility of conducting cost-effectiveness analysis (WHO, 1993; WHO, 2003) on specific cases, in order to evaluate preliminary indicators of "benefit" or "potential benefit" (Barber et. al., 2010) that certain control and management programs may induce. In this study a few different approaches to the estimation of Cost Benefit and Cost Effectiveness Analysis of the prevention costs against Malaria and WNV outbreaks in Greece are presented in the following Chapter. The indicators of these analyses can work as a first guide to the Assessment of the socio-economic impacts of the Prevention and Control Strategies, and a preliminary assessment of the extent to which the benefits of applying certain management plans outweigh their costs. An outline of the strategic plan for the estimation of the societal welfare of the management plans is presented in Annex 8.8.

Chapter 4: Cost-Benefit, Cost-Effectiveness Approaches and Policy Dimensions

4 Cost- Benefit, Cost- Effectiveness Approaches and Policy Dimensions

The target of this chapter is to estimate the efficiency of public health control interventions under different evaluation frameworks such as the welfarist (Cost-Benefit Analysis; CBA) and extra-welfarist (Cost-Effectiveness Analysis; CEA) approaches and evaluate their ability to inform public policy advisors. Prevention and control cost categories as well as data on the health impacts, presented in Chapters 2 and 3, were collected and analyzed in collaboration with the Hellenic Centre for Disease Control and Prevention (HCDCP), the Hellenic National Blood Centre, public health agencies and private companies specializing in mosquito control activities, indicating the multi-disciplinarity of the issue at hand.

4.1 Estimation of Cost Benefit and Cost Effectiveness Criteria

The most common approaches for evaluating health-related prevention programs are cost analysis, cost-effectiveness analysis (CEA), and cost-benefit analysis (CBA) (WHO, 2003). Cost Benefit Analysis (CBA) is a popular method for the appraisal of the "efficiency" of public goods and policies (e.g. mosquito control programs (John et al., 1987) and is actually employed in order to evaluate their net economic outcome (total net benefits). The main scope of a CBA is to measure the welfare levels obtained from the implementation of a program/strategy by examining the associated Costs and Benefits arising through its implementation. Thus, by appraising whether the Benefits outweigh the Costs, CBA informs policy makers whether a given program-policy-intervention should be undertaken or continued and evaluates any arising social betterment that amounts to a potential Pareto improvement (Mishan, 1975). CBA may be the most appropriate form of analysis if a program has significant non-health or intangible benefits. A specific type of CBA is cost offset analysis, which compares the cost of prevention to reductions in health care and related costs resulting from the prevention program. The idea is that the cost of prevention is offset by savings in future disease costs (WHO, 2003). In this case a "limited" Cost Benefit Analysis was conducted by comparing the Costs of Public Prevention Programs with the associated benefits resulting from: a) avoided health

impacts and b) the levels of avoided nuisance in households due to the implementation of these programs.

CEA goes a step beyond cost analysis by comparing both the costs and effectiveness of two or more prevention strategies (one of which may be a "no program" baseline). Results from CEA allow program managers to answer questions about whether a particular program produces outcomes that are worth the program investment (i.e., is cost-effective) or which of several related programs is the most cost-effective. In CEA, the effectiveness of a program is measured in terms of health or behavioral outcomes (WHO, 2003). For example, a work site based influenza immunization program might measure program effectiveness in terms of "cases of influenza averted" or "number of employees vaccinated" (Tilson et al., 2006). To facilitate comparisons of cost-effectiveness across prevention programs, even those designed to achieve different health outcomes, some CE studies convert health outcomes to a common measure (WHO, 2003).

In a separate attempt, a Cost -Effectiveness Analysis (CEA) of the WNV Prevention Strategy was conducted. The main difference between CEA and CBA is that the former considers only one criterion (effectiveness) out of many that influence public decision-making, while the latter is a better tool for the evaluation of overall Welfare Criteria and informs about optimal allocation of resources among different uses (health, education, housing, food etc). CEAs are an aid to public decision making and their main importance lies in their efficiency to evaluate and rank prevention programs and policies on the basis of the "costs required for achieving a target". In this study, two CEA tests were employed in order to evaluate: a) the number of potentially avoided WNV cases on the basis of the total prevention costs and b) the hypothetical number of households served, by the average prevention costs, in terms of avoided nuisance on the basis of willingness to pay (WTP) for a public program that averts the mosquito nuisance per household. It should be noted that more precise results on the WTP per household, based on a survey conducted at the Athens Metropolitan Area, are presented analytically in Chapter 5 of the present thesis.

4.2 Results of a Cost Benefit Analysis of the WNV prevention strategy

Based on the findings (Table 4.1) of the main cost categories (prevention costs, COI, WTP), a CBA test was employed in order to evaluate the benefit of these programs in the following years. The benefit was estimated on the basis of averted health costs and avoided mosquito nuisance costs (WTP) in the total population of Central Macedonia's households. The assessment of averted nuisance costs was based on a Contingent Valuation Method (CVM) study conducted in 2004 in the Region of Eastern Macedonia and Thrace for the purpose of eliciting residents' Willingness to Pay (WTP) for improving the public mosquito control programme through the application of more efficient methods of controlling mosquito populations. The CVM survey was applied in a sample of 1049 households interviewed from July to September 2004. Respondents first gave a simple yes or no response expressing their willingness to contribute to a mosquito control programme. Those who responded positively were then asked "What is the maximum amount of money (V/household/year) that you would be willing to pay in order to eradicate the mosquito problem in your area?". According to the results of this CVM survey, the average WTP to eradicate the mosquito problem in the study area ranged between 22 and 27 €/year/household, depending on the estimation method. In order to evaluate the maximum potential benefit (i.e. the total averted costs if the mosquito problem were completely resolved), an average WTP price (24.5 €/ household) was adjusted for inflation using the Consumer Price Index (Kolimenakis et al., 2016).

Table 4-1. WNV Economic costs per category and year from 2010 to 2013

Year	2010	2011	2012	2013
Total Prevention Costs (including costs for blood safety for C. Macedonia)	3.700.000 €	3.388.768 €	3.065.675 €	2.600.000 €
Hospitalised Cases	260	30	18	22
Total Cost of Illness (Medical Cost and Productivity Losses)	916.429 €	118.905 €	71.026 €	76.811 €
Cost of Illness per Case	3.524 €	3.963 €	3.945 €	3.491 €
Health Costs Averted Per year		797.524 €	845.403 €	839.618 €
Nuisance Costs (WTP per Household * number of households)	15.710.087 €	15.710.087 €	15.710.087 €	15.710.087 €

As Table 4.2 shows, when prevention costs per year are evaluated only on the basis of averted health costs per year, a net cost ranging from 2,9 mil € to 2,2 mil € results for all the following years. A clear socioeconomic benefit, of around 14 mil €, for all 3 years following the outbreak, is obtained when avoided nuisance costs are included in the analysis (Table 4.3). It should be noted that, according to recent studies (Dickinson et al. 2012, Halasa et al. 2014) the mosquito nuisance (instead of the disease factor) constitutes the main factor for which citizens are willing to pay. The category of nuisance reduction seems to be capturing a major role in citizens' perceived benefit levels, which implies that mosquito control programmes could potentially capture a higher value in citizens' formation of marginal benefit from mosquito control programs.

Table 4-2. Net economic outcome of prevention costs in relation to avoided health impacts

Years	2010-2011	2011-2012	2012-2013
Prevention Costs (per year)	3.700.000 €	3.388.768 €	3.065.675 €
Avoided Health Impacts	797.524 €	845.403 €	839.618 €
Net Costs	**2.902.476 €**	**2.543.365 €**	**2.226.057 €**

Table 4-3. Net economic outcome of prevention costs in relation to avoided health impacts and avoided nuisance costs

Years	2010-2011	2011-2012	2012-2013
Prevention Costs	3.700.000 €	3.388.768 €	3.065.675 €
Avoided Nuisance Costs	15.708.550 €	15.708.550 €	15.708.550 €
Avoided Health Impacts from 2010	797.524 €	845.403 €	839.618 €
Net Benefit	**14.911.026 €**	**14.863.147 €**	**14.868.932 €**

4.3 Cost-Effectiveness Analysis (Test 1) of the WNV prevention strategy

The first "test" aims to evaluate the effectiveness as the number of potentially hospitalized cases avoided. Specifically the effectiveness index is the result of the division of the average public prevention costs (3,1 mil € for all 4 years) by the average COI per case (3,7 thousand € for all 4 years). This approach seeks to estimate the number of WNV cases that could have potentially been treated (hospitalized) by the average amount of prevention costs induced per year (Barber et al., 2010).

This test indicates that the average prevention costs could have amounted to the treatment of approximately 854 cases, while the recorded cases for 2010 were 260

and ranged from 22 to 30 cases in the following years (Table 4.1). However, as already mentioned, there is a strong uncertainty regarding the size of the epidemic had the prevention measures not been implemented, as well as the number of cases prevented due to the control programmes, mainly because of the physiolology of WNV transmission.

4.4 Cost-Effectiveness Analysis (Test 2) of the WNV prevention strategy

The second test aims to evaluate the hypothetical number of households served by the average prevention costs, in terms of their effectiveness in equalizing the avoid nuisance calculated on the basis of WTP per household. This effectiveness index is estimated as the average prevention costs (for all 4 years) divided by the average WTP derived from the 2004 CVM survey (22€ per household). It turns out that the average prevention costs could have served approximately 145.134 households, while the total number of households in the Central Macedonia Region is 715.070 (El.stat., 2014).

Estimating the effectiveness of prevention costs as the magnitude of nuisance avoidance factor indicates that there is more space for improvement of these programs. As pointed out earlier, nuisance seems to be capturing the major part of citizens perceived benefit and it appears that when considering the nuisance factor the levels for improvement and betterment of control programmes are certainly extending. However, for a more precise definition of the optimum (equilibrium) level of prevention, a well designed survey is needed that encompasses and compares the various associated parameters via the implementation of sound methodological tools.

4.5 Cost-Effectiveness Analysis (Test 1) of the Malaria prevention strategy

A first cost effectiveness test employed is based on the ratio of public prevention costs per year divided by the number of cases averted (in comparison with the base year). In this case the Average Cost Effectiveness Ratio provides an indication of the *"Average Cost for one averted case"*. As can be seen in Table 4.4, this ratio falls from approximately 25.000€ per case for 2012 to approximately 9.500€ per case for

2013. Similar reservations exist regarding the size of the epidemic had the prevention measures not been implemented apply to the Malaria outbreak. However, it is estimated that the use of epidemiological models could predict a multiplication of infected cases had no prevention measures been applied after the initial outbreak. For the present report no such models were applied.

Table 4-4. Calculation of average cost for one averted Malaria case

ANNUAL PREVENTION COSTS (Lakonia_Malaria)	2011	2012	2013
Public Prevention Costs		384.099 €	176.500 €
HCDCP and MALWEST Project Costs		290.954 €	168.107 €
Total Costs		674.099 €	344.607 €
Locally acquired cases	36	10	0
Locally acquired cases Averted per year		26	36
Average Effectiveness/ cost per locally acquired averted case		**25.927 €**	**9.572 €**

4.6 Cost-Effectiveness Analysis (Test 2) of the Malaria prevention strategy

The effectiveness index of the second test is similar to the CE index used in the first test for the WNV outbreak, according to which effectiveness is interpreted as the result of the division of public prevention costs by the average COI per case / year. This approach seeks to estimate the number of Malaria cases that could have potentially been treated (hospitalized) by the average amount of prevention costs induced per year. As appears in Table 4.5, the potentially treated cases for 2012 were estimated at 316 while for 2013 the cases were calculated to be 125.

Table 4-5. Cost effectiveness index for potentially treated Malaria cases

Year	2011	2012	2013
Total Prevention Costs		**674.099 €**	**344.607 €**
Cost of Illness per case	**1.728 €**	**2.136 €**	**2.747 €**
Potential Effectiveness per year		**316**	**125**

4.7 The economic efficiency of improved management practices against invasive mosquito species in Greece

In the framework of LIFE CONOPS project, a detailed design for a management plan has been implemented regarding the control of the Invasive Mosquito Species (IMS) Aedes albopictus which is already established in Greece and Italy (Annex 8.7). These plans have been structured as a comprehensive practical technical guideline to assist local authorities in organizing the field activities in the best possible way. Other IMS not yet present in the two countries or present only in limited areas may deserve different specific approaches.

These plans include the following activities: Standardized quantitative monitoring by specific ovitraps; Public health risk assessment; Community participation; Standard control measures in public areas; Standard control measures in private areas; Emergence control measures in case of detection of imported cases detection of Dengue, Chikungunya and Zika virus; Pilot door-to-door control measures in private areas; Efficacy & Quality control methods; Resistance prevention.

Specifically in the case where Chikungunya or Dengue imported cases (suspected or confirmed) are detected by the public health system it is necessary to implement an

immediate mosquito control activity, beginning within 24 hours from the case report (Table 4.6).

Table 4-6. Control and Epidemic Costs under different outbreak scenarios

	Control Costs (Personnel + Recurrent)/ for 1 Case in each scenario	Control Costs (Personnel + Recurrent)	Cost for 3 Residual Sprayings (Personnel + Recurrent)	Capital Costs & Car Leasing	Total Cost of Illness	Total Costs of Control & Illness (€)
Scenario 1/ 1 case	1765	1765	1762,5	940	2981	**7.449**
Scenario 2/ 6 cases (clustered in a confined locality)	820,25	4921,5	10575	940	17886	**34.323**
Scenario 3/ 6 cases (all spread)	5051,5	30309	10575	3720	17886	**62.490**
Scenario 4/ 20 imported cases (6 in a confined locality and 14 dispersed)	3832,275	76645,5	35250	21600	59620	**193.116**
Scenario 5/ 20 cases dispersed	5064,75	101295	35250	28800	59620	**224.965**
Scenario 6/ 100 cases dispersed	5.090	508.950	176.250	146.800	298.100	**1.130.100**

An entomological investigation in the treated area should be performed in order to confirm the presence of Aedes albopictus and decide upon the necessity of applying control activities. Mosquito control activities are divided into three stages that must be conducted in a synergistic way: adulticide treatments, larvicide treatments and larval breeding sites' removal.

4.7.1 Calculation of Control and Epidemic Costs under different risk levels

The control costs consisting of larvicide / adulticide applications, residual spraying, recurrent/operational costs, monthly wages, capital costs and use of cars through a leasing process, were calculated in collaboration with a private mosquito control company operating in one specific municipality. The average Cost of Illness for one imported case of Chikungunya, Zika and Dengue Viruses are based on the estimates presented in Chapter 3.7.

As can be seen in Table 4.6, the Total Control and Medical Costs could range from approximately 8.000 € for the detection of one imported case, to about 1 million euros in the scenario of 100 dispersed cases. This rate (1 million €) exceeds the current (2016) annual cost of spraying in the whole Region of Attica which amounts almost to 0,8 million euros per year, indicating that a well-designed program to prevent the spread of similar disease outbreaks could achieve a significant saving of costs. It should be however noted that the current annual control programs implemented in Greece are not targeted to IMS and do not follow the structure presented in the above lines. In addition, the costs presented in Table 4.6 refer only to the possible costs in a confined locality or municipality of Athens Metropolitan Area, in the case of different epidemic scenarios. Therefore, the extent and consequences of a real outbreak cannot be foreseen by the present study. However, the economic figures indicate that there is space for the implementation of improved control programs taking into account the hidden associated public health risks. A more detailed economic analysis of the issue of societal welfare from the implementation of improved control programs will be more thoroughly presented in the next Chapter.

4.8 Policy dimensions of CBA and CEA in related health interventions

Some of the limitations of the present chapter are associated with the uncertainty regarding the number of cases prevented due to the control programmes and the actual nuisance reduction that can be attributed to these programmes. As a consequence, through the implementation of both CBA and CEA in the present study, it is difficult to provide precise indicators of benefit and effectiveness levels. In

addition, the application of CVM results in the CBA indicates that substantial social benefits may accrue in the study area from the implementation of improved control programmes, hinting at a higher monetary value of utility over health. However, conducting a well designed survey (Chapter 5) employing sound methodological tools is necessary for a more precise definition of the metric value of utility. On the other hand, considering that the size of the epidemic in the absence of prevention measures is virtually unpredictable, collaboration with public policy makers, such as ECDC (2012), is essential to determine the importance of the application of a post-epidemic strategy mainly on the basis of the public health safety criterion. The employment of different methodologies, such as Quality of Adjusted Life Years (Weinstein et al., 2009) and Value of a Statistical Life (Viscusi et al., 2003), would provide alternative indicators of the monetary valuation of health outcomes. However, which particular evaluation tool to use should be decided in accordance with the demanded outcomes and societal goals (e.g. utility vs. health).

The application of an updated economic analysis on the effectiveness of public health control and prevention programmes seems well timed, bearing in mind a significant restructuring of the public health sector in Greece (e.g. the health care system and the publicly funded strategies) and the fiscal crisis apparent in the European South (Ifanti *et. al.* 2013). The estimation of the societal welfare of the public health strategies, viewed from the perspective of normative economics, is essential in order to assess the necessity of the continuation of the various programmes in the immediate future according to the Paretian welfare criteria. However, the justification for the implementation of public health strategies can be evaluated under the prism of different economic perspectives and criteria; normative vs. positive economics, welfarist vs. extra-welfarist approaches etc. (Hurley 2000, McGuire et. al., 1993). Statements in favor of the importance of public health interventions can be found in seminal works of positive economics: "*Nor is there any reason why the state should not assist the individuals in providing for those common hazards of life against which, because of their uncertainty, few individuals can make adequate provision*" (Hayek 1944: 125), while leading normative economists such as Mishan (1998) remain sceptical about the reception of their contributions by public decision makers.

Chapter 4 : Cost-Benefit, Cost-Effectiveness Approaches and Policy Dimensions

As health care remains the main concern of policy makers, all theoretical perspectives could contribute towards the selection and application of the most appropriate public health interventions. Positive analysis can provide a fruitful ground for normative questions, while a critical self-reflection of normative analysis can shift to a better understanding of the values and perspectives found in society (Hurley 2000). Differences across various theoretical approaches should not be viewed as mutually rejecting but as a contested ground for posing those questions that can ensure a fruitful collaboration among different sectors, especially in times of intense societal crisis.

Chapter 5: A choice experiment for the evaluation of Improved mosquito management plans

5 A choice experiment for the evaluation of Improved mosquito management plans

5.1 Case study description/policy issues/background

The basic purpose of Chapter 5 is to enhance the economic analysis undertaken in Chapter 4, on the effectiveness of public health control and prevention programmes. An updated analysis, contributes to the results concluded in earlier chapters, and specifically these of Chapter 4, by providing more precise estimates of benefit levels from improved mosquito control programs as perceived by citizens. As highlighted in earlier chapters, the establishment of IMS is accompanied by greater risks of mosquito-borne diseases, higher nuisance levels, and increased expenses for the confrontation of the invasive species (ECDC, 2012). In this respect, the need for designing new improved mosquito control programs is already apparent, rendering it essential to take into account more complex parameters such as the protection from new infectious diseases and the avoidance of day nuisance associated with the presence of IMS in Greece.

Most previous studies related to the valuation of the costs associated with invasive species, as well as to the benefits of public programs of mosquito abatement, were focused on the investigation of the cost-efficiency of alternative mitigation strategies (John et al., 1992; Born et al., 2005). Through the methods and survey presented in this Chapter, an effort is made to examine the economic aspects of programs mitigating the disutility associated with both invasive and native mosquitoes in terms of benefits to be gained rather than costs of abatement. Potential benefits by this kind of programs can be classified into two general categories: (1) reductions in the risk of disease transmission and (2) reductions in the (biting) nuisance of mosquitoes.

In this framework, the use of a stated preference approach has been chosen, namely the choice experiment method, to investigate the potential social benefits of improving the public mosquito control program in the Greek Prefecture of Attica. The choice experiment method has its roots in Lancaster's characteristics theory of value, in random utility theory and in experimental design (Hanley et al., 1998).

Chapter 5 : A choice experiment for the evaluation of improved mosquito management plans

Lancaster's theory (1966) implies that consumer decisions are determined by the utility (satisfaction) derived from the attributes of a good or service rather than from the good or service per se. Under the premise that individuals act rationally (by selecting from a choice set the option that yields the highest utility), the probability of selecting a given option (e.g. a public mosquito control program) is higher if the utility provided by this alternative is the highest among the different choices.

A total of 8 municipalities were selected from the Region of Attica, which is the most populated region in Greece (about 35% of the country's population), with approximately 3.8 million citizens (Census 2011). Apart from its significance in terms of demographic and economic activity, this region was selected primarily due to the scientific recording of the presence and spread of the Asian tiger mosquito, in different locations and populations across municipalities and neighborhoods. The first presence of the Asian tiger mosquito in Greece (in Northwest prefectures) dates back to 2003 (Samanidou-Voyadjoglou et al., 2005), while in Athens (Attica Region) it was confirmed for the first time in 2008 (Koliopoulos et al., 2008). In addition, the chosen municipalities present different socio-economic characteristics, which are indicative of the variety and diversity of the selected region. Therefore, the selected study area offered the possibility to analyze citizens' preferences (for further public action) across different experience of the mosquito problems (problems associated either with the Asian tiger mosquito or with native mosquito species) and within a different socio-economic environment. This economic valuation aims to contribute to the overall scope of this thesis, to serve as decision aid for policy advice concerning the ex-ante assessment of alternative mosquito control programs in the study area, as well as possible diseconomies that could arise by the implementation of "too large programs" (Conteh et al., 2010)

5.2 Survey design and administration

5.2.1 Selection of attributes and attribute levels

The first step in choice experiment design is to select an appropriate set of attributes in order to assess the regional benefits from improved mosquito control programs. At the same time, the alternative levels of those attributes should be appropriately determined. The aim of this step is to provide people with the ability to choose the most preferable mosquito control program by comparing hypothetical programs, which differ on the selected set of attributes. This is not a trivial task as it involves – among others – a realistic representation of the good under valuation, clarity of the attributes' content (in terms of meaning and measurement) and a market-based simulation that does not lead to a cognitive burden for the respondents (Hensher et al., 2005; Rodrigues et al., 2016). A typical recommendation for a realistic representation of policy options is to provide a status quo alternative to be chosen if people are not willing to pay for the proposed improvements (Louviere et al., 2000). In this context, all other policy options can be considered as improvements over the current programs and the status quo level can be regarded as a baseline, zero-cost, scenario.

The choice of attributes in this study was initially based on the feedback of experts, as well as on earlier studies that addressed the economic costs from mosquitoes and/or the economic benefits from (public) mosquito control programs. As most previous studies focused on the cost-effectiveness of alternative control methods, only a limited number of studies were specifically designed to assess the non-market benefits from mosquito control programs (e.g. John et al., 1992; von Hirsch and Becker, 2009; Dickinson and Paskewitz, 2012; Halasa et al., 2014). For this reason, an extensive web-based pilot study (180 questionnaires) was conducted in November 2014 in the study area aiming to identify the main factors (attributes) that may influence the local acceptance of future mosquito control programs. Furthermore, a small scale pilot study (30 questionnaires) was also conducted in May 2015, using face-to-face interviews in order to refine the selected attributes and their levels.

In order to reduce the complexity of choice task by participants we tried to limit the number of attributes and their levels only to those that have a clear relationship to the implementation of mosquito control programs. As already mentioned, there are two main categories of benefits (non-use values) deriving from (improved) mosquito control programs: nuisance and health risk reduction. Another classification that was (originally) used in the present study was that between benefits from controlling native mosquitoes and benefits associated to invasive mosquito control (such as the Asian tiger mosquito – *Aedes albopictus*). In order to do so, the nuisance and health risk attributes should vary according to the specific characteristics of the Asian tiger mosquito. On this account, two health risk attributes were used: (a) one related to the health risks that are mainly associated to native mosquitoes (such as the West Nile Virus) and (b) one related to the health risks than are only due to the Asian tiger mosquito (such as the Chikungunya fever). Similarly, the nuisance attributes were also separated into: (a) nuisance during the daytime, which is a problem that can be mainly attributed to the Asian tiger mosquito, as it is characterized as an "aggressive day-time biting mosquito" (Giatropoulos et al., 2012) and to (b) nuisance during the night-time that can be mainly associated with the native mosquito species. Finally, a monetary (cost) attribute was included because it is necessary for the estimation of welfare (WTP, CS) estimates, as well as because it is an important determinant of people's preferences towards alternative mosquito control programs.

Following all the above mentioned procedure, five attributes and their associated levels (Table 5.1) were finally defined aiming to "offer" different public mosquito control programs in Attica Prefecture:

(1) West Nile virus risk level (WNVR): West Nile virus is a mosquito-borne virus/disease, which is caused by native mosquitoes and is usually associated with mild symptoms for humans (usually referred as West Nile Fever). However, in less than 1% the virus can lead to severe neurological diseases such as encephalitis or meningitis (Pervanidou et al., 2014). The first recorded outbreak of WNV infection in Greece was in 2010, with 262 cases, which is the higher annual number of cases recorded so far. In succeeding years the

number of cases ranged between 86 (2013) and 161 (2011) (Kolimenakis et al., 2015), determining an average annual risk (at the national level) of 1 case per 65.000 people. In order to presenting this attribute in a realistic and understandable way, three risk levels were assigned: (a) a high risk level, which is the status quo situation, corresponding to the highest number of confirmed cases (number of patients hospitalized in intensive care units), which can reach up to 300 cases per year, (b) an average risk level, which corresponds to less than 150 cases per year and (c) a zero risk (ideal) level. It should be noted that the WNV epidemiology is quite complex and it is very difficult to predict future outbreaks (with or without new control programs). Therefore, the three attribute levels are only indicative risk levels in order to estimate the marginal willingness to pay for a reduced number of incidents. These WTP estimates may help decision makers to form the future policy scenarios and to prioritize the policy goals of the mosquito control programs.

Table 5-1. Attributes and attribute levels used in the choice experiment (Bithas et al., 2018a)

Attribute	Description (as given to respondents)	Attribute levels
West Nile Virus Risk (WNVR)	Risk of West Nile Virus outbreak related to the number of patients hospitalized in intensive care units. Risk levels were defined according to the actual, highest recorded, level. Public control strategies could implement measures to reduce the risk of WNV outbreaks.	High risk[a] (up to 300 cases/year), Average risk (up to 150 cases/year), Zero risk (no- cases)
Asian Tiger Mosquito Health Risks (TMHR)	Asian Tiger mosquito has the potential to transmit infectious diseases such as the Dengue and Chikungunya viruses. Although such transmissions have not yet been reported in Greece, the country is potentially at risk of future outbreaks. Public control strategies may use additional measures to reduce the associated risks.	Extra measures No-measures[a]
Night Nuisance (N_NUIS)	Public control strategies may affect (reduce) the perceived level of nuisance, caused by mosquitoes, during night-time.	No improvement[a] Improved level - Average nuisance Improved level - Low nuisance
Day Nuisance (D_NUIS)	Public control strategies may affect (reduce) the perceived level of nuisance, caused by mosquitoes, during daytime.	No improvement[a] Improved level - Average nuisance Improved level - Low nuisance
Implementation Cost (COST)	Bi-monthly cost for improved (public) mosquito control measures	€0[a], €5, €10, €15, €20

[a]*Current attribute levels (status quo)*

(2) Asian Tiger Mosquito Health Risks (TMHR): As already remarked the Asian tiger mosquito is a mosquito of great medical importance as it may transmit several human diseases such as the Dengue virus and the Chikingunya virus. Dengue virus is usually detected in tropical and subtropical regions, infecting about 390 million per year (Bhatt et al., 2013). Its common symptoms include among others: fever, lethargy, rash and joint paint, while the more severe forms of dengue virus include dengue hemorrhagic fever and dengue shock

syndrome. On the other hand, Chikungunya virus, causes an acute febrile illness characterized by severe arthralgia (Vega-Rúa et al., 2015). Although these transmissions have not yet been reported in Greece, the country is potentially at risk of future outbreaks, as other European Mediterranean countries, such as Italy (2007) and France (2014), have already experienced outbreaks of autochthonous chikungunya cases. In our study, this attribute is coded as a dummy variable that takes *the value 1* if future public control strategies would involve additional measures to reduce the risks of these diseases (otherwise it takes a *zero value*).

(3) Night Nuisance (N_NUIS): Public control strategies may reduce the perceived level of (biting) nuisance, which is caused by mosquitoes. Native mosquitoes constitute a biting nuisance mainly during the night. In our study this attribute is measured as the difference between the actual level of nuisance and two predetermined "guaranteed" levels that can be reached by the proposed mosquito control program. For this reason, the actual perceived night nuisance (level) was first reported by each interviewee on a 5-point Likert scale (where *1=no nuisance* and *5= intolerable nuisance*). If that level is higher than the proposed level (1=no nuisance or 2=low nuisance) the attribute takes the value: *[actual level]-[proposed level]*. Otherwise it takes a *zero value* as the program is not supposed to decrease the respondent's utility.

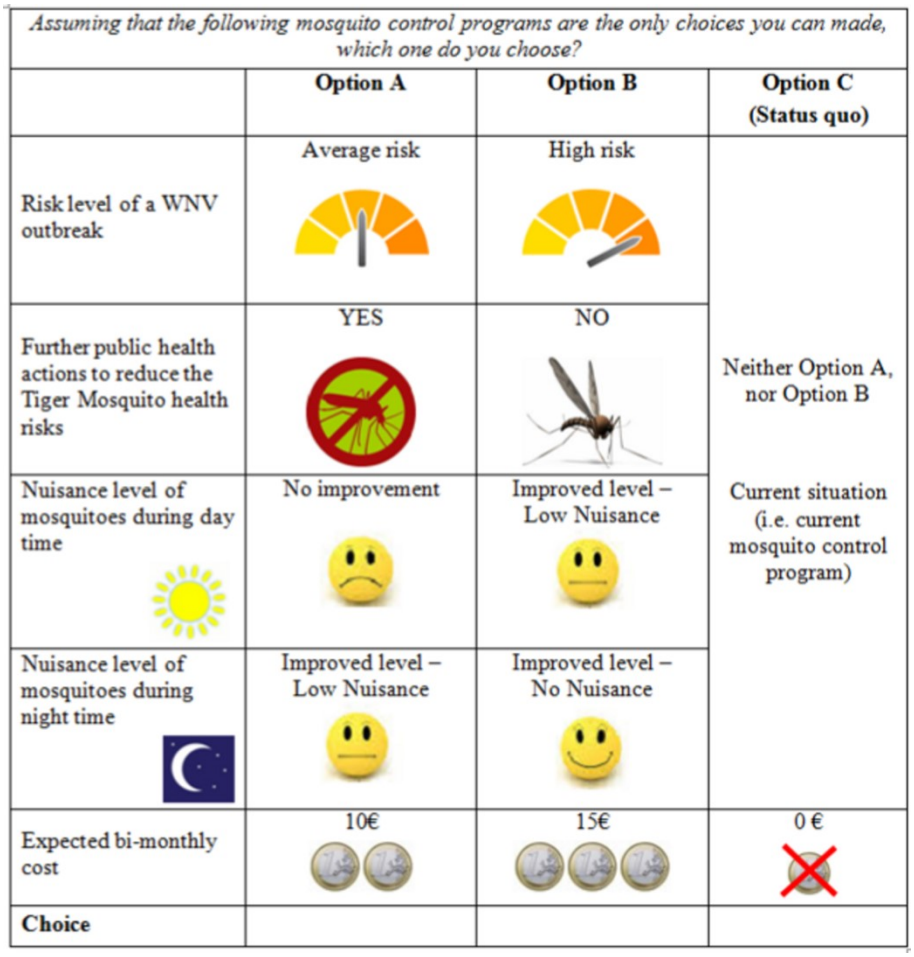
(4) Day Nuisance (D_NUIS): the Asian tiger mosquito, unlike the native mosquito, causes biting nuisance during the day. This nuisance is measured in the same manner as the night nuisance attribute.

(5) Implementation cost (COST): The payment vehicle used is the current study is an additional cost on the household's municipal taxes. It should be noted that in Attica region, Greece municipal taxes are included in the bi-monthly electricity bill. Based on a preliminary survey, already presented in Chapter 2, which was conducted in November 2014 aiming to depict the mosquito problem in the study area, the average "nuisance period" was found to last on average approximately 4 months. So, the surcharge will be imposed only during this period every year. This payment vehicle was considered as the most appropriate, as it is plausible and familiar to the population surveyed.

The cost attribute included five different levels: no increase (current municipal tax levels), and bi-monthly increases of €5, €10, €15 and €20. Respondents were informed that the generated revenues will be used exclusively to finance the improved mosquito control programs.

5.2.2 Questionnaire design and survey implementation

After selecting the attributes and their levels, the next required step is to form a set of alternative policy options with different attribute levels (profiles) and then to pair these profiles in order to construct the "choice cards" (choice sets). This process resulted in 16 choice cards with two (experimentally designed) alternative mosquito control programs (options), as well as with a status quo (no action) option. The status quo option (which is actually an opt-out option), is the baseline alternative, whose inclusion in the choice cards is instrumental in achieving welfare measures consistent with demand theory (Louviere et al., 2000; Bateman et al., 2003; Birol et al., 2006). The other two options are both improvements as compared to the current situation. Since the 16 cards are too many for an individual to evaluate, they were randomly divided into four different versions, each containing four choice cards. So, each respondent was provided with four choice cards and asked to state their preferred option for each card. An example choice card is presented in Figure 5.1.



Assuming that the following mosquito control programs are the only choices you can made, which one do you choose?

	Option A	**Option B**	**Option C (Status quo)**
Risk level of a WNV outbreak	Average risk	High risk	
Further public health actions to reduce the Tiger Mosquito health risks	YES	NO	Neither Option A, nor Option B
Nuisance level of mosquitoes during day time	No improvement	Improved level – Low Nuisance	Current situation (i.e. current mosquito control program)
Nuisance level of mosquitoes during night time	Improved level – Low Nuisance	Improved level – No Nuisance	
Expected bi-monthly cost	10€	15€	0 €
Choice			

Figure 5-1. Example of a choice card used in the questionnaire survey (Bithas et al., 2018a)

The questionnaire (Annex 8.9) consisted of four sections:

(A) This section focused on respondents' knowledge about the Asian tiger mosquito, and their beliefs and practices relevant for mosquito problems (health and nuisance problems). In the set of 11 questions used in this section, were respondents were asked about among other things: their perceived level of nuisance (using a 5-point Likert scale), the period (months) faced with mosquito nuisance, their monthly expenditure (costs) for private prevention measures.

(B) The second section introduced the policy issues, presented the current risk levels of mosquito-borne diseases, described the selected attributes, explained the payment vehicle and prepared the respondents for answering the Choice Experiment questions. This section ended with the four choice cards.

(C) A set of follow-up questions (5 questions) was followed, regarding: (a) respondents' difficulty in understanding or answering the choice formats, (b) the reasons respondents were not willing to pay for any given option (in order to distinguish between 'genuine zero' values and protest responses) and (c) the motivations of respondents who were willing to pay for improved mosquito control programs.

(D) The final section focused on additional information concerning the participants, aiming to obtain a clear image of their socio-economic characteristics (9 questions including among others: age, sex, education level, occupation, annual family income, family status, etc.)

The survey was administered by three trained interviewers (staff of the Research Institute of Urban Environment and Human Resources- Panteion University, Athens), using face-to-face interviews by means of a structured questionnaire. As already mentioned, a first set of 30 pilot questionnaires was conducted in order to enhance the training of the interviewers and the applicability of the survey. Interviews were conducted in the headquarters of each selected municipality (City Halls). Special permission was obtained from each municipality prior to the questioning process after being informed of the survey's objective. The duration of interviews ranged from approximately 10 to 20 minutes.

The main entrances of the eight City Halls were chosen as the main sampling spots. The sample was randomly selected, but stratified based on location sex and age (according to the 2011 Census). Participants were briefly informed on the content of the survey and were asked their willingness to participate. The overall response rate was approximately equal to 35%, which is quite satisfactory, taking into consideration the sampling method. Respondents were mainly inhabitants of the

municipality. The survey started on 15 June 2015 and finished on 30 October 2015. It should be noted that the survey experienced an emergency stop after the imposition of the capital controls measures in the Greeks banks (July, 2015), which severely affected the cash flow of Greek households and disrupted everyday life (with possible impact on individual preferences and welfare measures). It was restarted in mid-September 2015, when (everyday) had life returned to normal. A total of 495 completed interviews were finally collected.

5.3 Results

5.3.1 Individual characteristics of participants

As already mentioned, the full sample consisted of 495 respondents, while after the correction for protest responses the sample was reduced to 388 respondents. Table 5.3 summarizes the personal characteristics of the full sample, as well as of the corrected sample. It is worth noting that the mean values for most of the characteristics are very close in both samples, showing that protest responses are rather randomly distributed across the sample.

The descriptive statistics presented in Table 5.3 are related to the socio-economic characteristics of respondents, as well as to the main mosquito-related characteristics (attitudes, knowledge, problems reported, individual prevention costs, etc.). According to these statistics, about 42% of participants are male, the average age was about 45 years, the average number of children (below 15 years old) per household was equal to 0.5 and the median educational level was that of university education (the average level lies between upper secondary and university education). The annual household income was estimated to be approximately €17,000, while 11-12% of the participants were currently unemployed.

Table 5-2. Personal characteristics of respondents (Bithas et al., 2018a)

Variables	Description	Full Sample	Sample corrected for protest responses
AGE	Age of respondents	46.01 (13.19)[a]	45.26 (13.45)
SEX	Sex 1=male, 0 =female	0.42 (0.49)	0.42 (0.49)
EDUC	Education level 1 = Primary education 2 = Lower level secondary education 3 = Upper secondary education 4 = University education 5 = Post-graduate studies	3.38 (0.87)	3.40 (0.87)
INCOME	Annual household income	17,034.2 (9,993.1)	16,865.1 (10,114.2)
UNEMP	Employment status 1= unemployed, 0 = employed	0.11 (0.32)	0.12 (0.33)
CHILDREN	Number of children (below 15 years) old living in the household	0.52 (0.85)	0.50 (0.85)
DANGER	Mosquitoes considered as a danger to the public health 1= Yes, 0=No	0.69 (0.63)	0.69 (0.61)
QoL	Mosquitoes could negatively affect the quality of life 1= Yes, 0=No	0.54 (0.75)	0.50 (0.77)
KNOW	Knowledge about the existence of Tiger Mosquito 1= Yes, 0=No	0.81 (0.39)	0.81 (0.39)
MONTHS	Number of months (per year) that individuals experience the mosquito problem	3.66 (2.31)	3.58 (2.24)
NL_NIGHT	Nuisance level due to mosquitoes during the night 1= no nuisance, 2= low, 3= average, 4= high, 5 = intolerable	3.40 (1.05)	3.38 (1.06)
NL_DAY	Nuisance level due to mosquitoes during the day 1= no nuisance, 2= low, 3= average, 4= high, 5 = intolerable	2.06 (1.08)	2.04 (1.07)
TIME	Time of nuisance	0.53	0.56

	1= only during night-time, 0 = all day	(0.50)	(0.50)
PREV_COST	Individual prevention costs (€/month)	6.74 (7.41)	6.61 (7.27)
WORK	Contribution of the mosquito control program to outdoor working conditions 1=Yes, 0=No	0.25 (0.44)	0.25 (0.43)
HOME	Contribution of the mosquito control program to effectively reduce indoor (home) nuisance 1=Yes, 0=No	0.58 (0.49)	0.57 (0.50)

[a] *Numbers in parentheses are standard deviations*

Two binary variables were used to capture the perception of participants about the risk of mosquito-based diseases (69% actually viewed mosquitoes as a danger to public health), as well as about the impact of mosquitoes on the quality of life (54% stated that mosquitoes could negatively affect their quality of life). It is worth-noting that the majority of respondents (81%) were informed about the presence of Asian tiger mosquito in their residence area.

In accordance with the results of the first (web-based) pre-test, already mentioned in Chapter 2, the time period during the year that individuals experience the mosquito problems (mainly the nuisance problems) is about 4 months, thus validating the choice of using the payment vehicle (municipal taxes) for that period. Considering nuisance level, it was found relatively higher during the night time, with a mean value equal to 3.4 on the 5-point Likert scale (that is, a nuisance level between average and high), while day-time nuisance was on average considered as low. Figure 5.2 presents the distribution of the perceive nuisance level during the night and day time which can be used as an indicator of the relative nuisance of the Asian tiger mosquito as compared to the native mosquitoes.

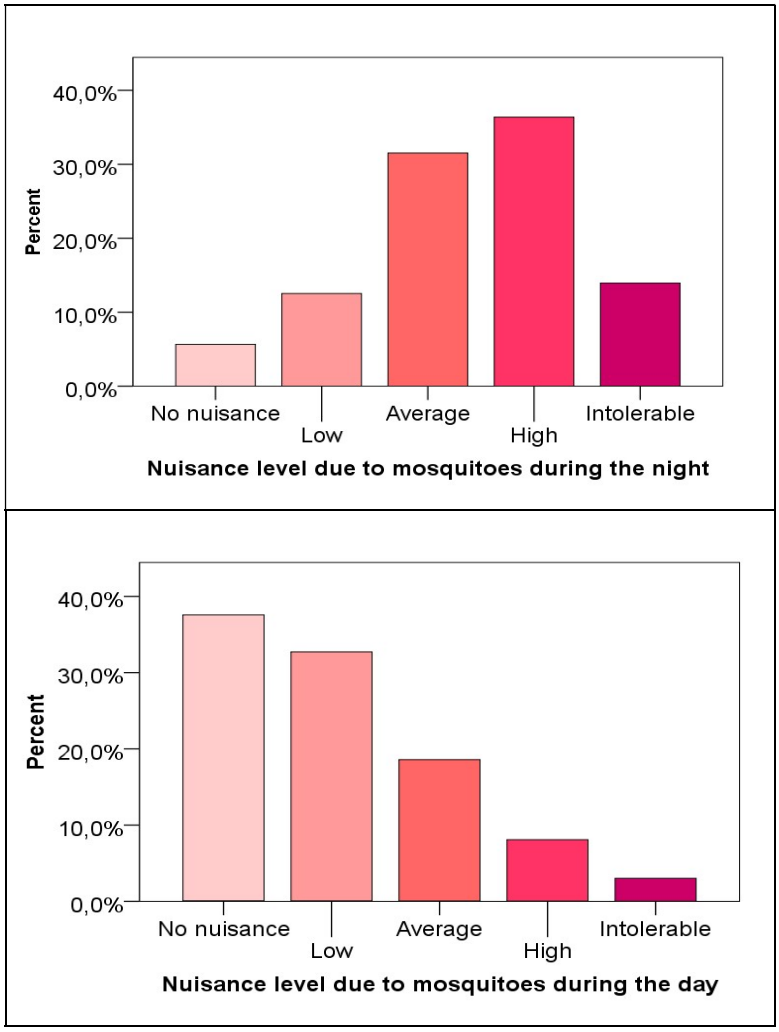


Figure 5-2. Perceived nuisance level of mosquitoes in the study area during night/day time (Bithas et al., 2018a)

Another relevant indicator is the "time of nuisance" variable, which shows that more than half of respondents experience nuisance only during the night hours. Based on the potential contribution of the proposed program in terms of nuisance reduction, 25% considered as an important contribution the improvement of outdoor working conditions, while about 58% stated that they are expecting an effective reduction of the indoor (home) nuisance. Finally, concerning the individual prevention costs, they were found to range between €6.61 and €6.74 per month per household. Future reduction of these costs can be considered –among others – as potential social benefits of the preventive/control measures. So, people with high current costs are expected to have a higher probability of choosing a policy option better that the status quo.

5.3.2 Analysis of reasons for rejecting an improved mosquito control program

In a choice experiment, as also in other stated preference methods (e.g. contingent valuation - CV), a number of participants (respondents) may not state their true value for the good or service that is evaluated. For this reason, it is necessary to examine whether the respondents are protesting against some aspect of the constructed market scenario. In cases that protesting occurs, CE methods may lead to selectivity bias in the estimation process and produce biased welfare estimates (WTP, CE). The treatment of protest responses is thus very important, especially when benefits are going to be aggregated in order to measure the social benefits of a proposed program, policy or plan. If protest voters are included in the sample then the aggregated welfare measures may be underestimated. On the other hand, if all the status quo answers (i.e. the zero bid answers) are removed, then overestimated results may arise (Adamowicz et al., 1998). Because our study aims to estimate aggregate welfare measures from various mosquito control policies, a correct treatment of protest responses is important. Although protest responses have been widely debated in CV studies, no much attention has been given so far to this issue in CE studies (Barrio and Loureiro, 2013).

In order to breakdown the zero-bid responses into true-zero (genuine zero) and protest responses, it is necessary to use a follow-up/debriefing question about the reasons for rejecting any improvement scenario (i.e. about the motives for choosing the status quo option on all choice cards). This type of question was included in the third section of the questionnaire and the results are presented in Table 5.2.

Table 5-3. Reasons for rejecting any improvement scenario (Bithas et al, 2018a)

	Individuals	Choices	%	Classified as Protest votes
Not able to pay/income restrictions	46	184	10.9%	No
There are more important priorities to pay for	54	216	9.3%	No
It is the state's/municipality's responsibility to pay for the proposed program	107	428	21.6%	Yes
Other reasons	7	28	1.4%	No
TOTAL	**214**	**856**	**43.2%**	

Among the reasons for rejecting any improvement scenario, the one that was considered as a protest vote was the following: "It is the state's/municipality's responsibility to pay for the proposed program". So, supposing that this answer is actually a refusal to "trade one attribute for another", we assume who individuals that choose this answer are actually avoiding disclosing their true willingness to pay (Louviere, 2001; Barrio and Loureiro, 2013). For this reason, protest responses were excluded from the following analysis (i.e. were deleted from the sample). As shown in Table 5.2, in our sample, 43.2% of respondents always chose the status quo option. Half of them, i.e. 21.6% (107 respondents) are considered as protest voters. This percentage is within the range of values which is described as normal in many CV studies.

5.4 WTP estimates and welfare impacts of mosquito control program scenarios

As shown in Table 5.5, MWTP estimates are quite similar across the three models, but there is a decreasing trend as we move from model 1 to model 3. Furthermore, as expected, the $MWTP_{D\_NUIS}$ estimate is statistically significant only in the main effects model. In detail, the estimated WTP values for the average respondent – according to the best fit model (3rd model) – indicate that:

(1) Households are willing to pay about 0.0346€ per case averted from being hospitalized with WNV infection (by using more effective mosquito control measures). This estimate corresponds to annual payments equal to 5.19€/household and €10.38/household in order to face an average or a zero risk level respectively (compared with the current high risk situation).

(2) The implementation of measures that will reduce the risks associated with diseases transmitted by the Asian tiger mosquito (e.g. Dengue virus, Chikungunya virus) was also a significant determinant of WTP for improved mosquito control strategies and management practices. Namely, the average annual WTP for implementing these measures is equal to 13.86€/household, which seems to be higher than the WTP for the WNVR attribute.

(3) WTP for mosquito nuisance control differs substantially between night and day hours. Specifically, according to the 3rd model, people are not willing to pay for nuisance reduction during the day-time. On the contrary, a household in the study area is willing to pay on average 3.54€/year for a one unit change on the 5-point Likert scale.

Table 5-4. MWTP estimates for better mosquito control program (€/two months) (Bithas et al., 2018a)

Attribute	1st model (Main effects model)	2nd model (ASC interactions)	3rd model (multiple interactions)
West Nile Virus Risk (WNVR)	-0.0390*** [-0.052, -0.026]	-0.0380*** [-0.052, -0.024]	-0.0346*** [-0.046, -0.022]
Tiger Mosquito Health Risks (TMHR)	16.74*** [12.90, 20.56]	16.04*** [12.24, 19.86]	13.86*** [10.52, 17.22]
Night Nuisance (N_NUIS)	4.70*** [3.20, 6.22]	3.94*** [2.42, 5.42]	3.54*** [2.20, 4.88]
Day Nuisance (D_NUIS)	2.66** [0.48, 4.84]	1.38 [-0.88, 3.62]	1.20 [-0.86, 3.24]

*Note: ***significant at 1% level; **significant at 5% level; *significant at 10% level.*

[a] *In brackets: 95% confidence intervals.*

Within the analysis if the results four scenarios have been used to explore the potential benefits (i.e. the overall willingness to pay) from improved mosquito control programs:

Scenario 1 (high impact scenario for all mosquito species): In this (optimistic) scenario, public mosquito control programs will be able to achieve a zero risk for WNV, a zero nuisance level for both day and night hours, and will also take extra measures for the Asian tiger mosquito health risks.

Scenario 2 (high impact scenario only for the native mosquito species): Mosquito control programs will deal effectively with the WNV risk (zero level of

risk) and with the night nuisance (zero level of night nuisance), while the other two attributes (related to the Asian tiger mosquito) will maintain their current levels.

Scenario 3 (medium impact scenario for all mosquito species): In this (more realistic) scenario, public mosquito control programs will be able to achieve a low risk for WNV, a low nuisance level for both day and night hours and will also take extra measures for the Asian tiger mosquito health risks.

Scenario 4 (medium impact scenario only for the native mosquito species): Improvements will only occur on the WNV risk level (low level) and the night nuisance (low level), while the other two attributes (related to the Asian tiger mosquito) will maintain their current levels.

It is easy to figure out that the differences between scenarios 1 and scenario 2, as well as between scenario 3 and scenario 4, may provide the added value (AV) estimates from implementing specific policies targeting not only the native but also the Asian tiger mosquitoes. CS and aggregate annual benefits estimates for all models are reported in Table 5.6.

Table 5-5. CS estimates (€/household/year) and aggregate social benefits (€/year) from different policy scenarios (Bithas et al., 2018a)

Attribute	1st model (Main effects model)	2nd model (ASC interactions)	3rd model (multiple interactions)
CS estimate SC1	17.39	16.49	15.65
CS estimate SC2	7.60[43.73%][a]	7.74 [46.93%]	8.07 [51.61%]
Aggregate social benefits SC1	52,583,949	49,867,375	47,315,243
Aggregate social benefits SC2	22,997,458	23,402,509	24,417,582
Added value from implementing SC1	29,586,491	26,464,866	22,897,660
CS estimate SC3	10.77	10.99	10.67
CS estimate SC4	2.32 [21.57%][a]	2.92 [26.64%]	3.70 [34.64%]
Aggregate social benefits SC3	32,573,742	33,243,928	32,279,788
Aggregate social benefits SC4	7,028,677	8,857,897	11,182,983
Added value from implementing SC3	25,545,065	24,386,031	21,096,805

[a] *numbers in brackets are percentages as compared to the best policy scenario (SC1)*

According to the results, social benefits from the optimum strategy (SC1) could reach up to 50 million euro per year, while according to a more realistic scenario (SC3) social benefits are estimated to be on the order of 32-33 millions euro per year. The relative importance (relative contribution to the social welfare) of taking measures against the Asian tiger mosquito was found to be substantial as it usually accounts for more than 50% of the aggregate benefits. As shown in Table 5-6, this benefit can be

attributed mainly to the high health risks posed by the introduction of new invasive species into the study area.

Table 5-6. Choice experiment monetary indexes of benefit levels and their confidence intervals

	Benefits (€/household/year) and their confidence intervals				
	West Nile virus risk reduction	Tiger mosquito health risk reduction	Night nuisance reduction	Day nuisance reduction	**Total benefits**
High prevention scenario against all mosquito species	10.38 [6.6, 13.8]	13.86 [10.5, 17.2]	5.76 [3.6, 7.9]	1.3 [-0.9,3.9]	**31.30 [19.8, 42.8]**
Medium prevention scenario against all mosquito species	5.19 [3.3, 6.9]	13.86 [10.5, 17.2]	2.21 [1.4, 3.0]	0.10 [-0.1,0.3]	**21.36 [15.1, 27.4]**
High prevention scenario against native mosquito species	10.38 [6.6, 13.8]	-	5.76 [3.6, 7.9]	-	**16.14 [10.2, 21.7]**
Medium prevention scenario against native mosquito species	5.19 [3.3, 6.9]	-	2.21 [1.4, 3.0]	-	**7.40 [4.7, 9.9]**

5.5 Discussion and conclusions

This chapter attempts to present a more precise estimation of the potential benefits of improved mosquito control programs in Greece. Generally, mosquito control programs and prevention strategies aim to contribute towards protecting against the outbreak of epidemic diseases, improving quality of life and reducing losses in economic activities. As also mentioned in Chapter 4, it is in the nature of the problem that it is difficult to provide precise estimates of the benefit arising from the implementation of improved control programs. The economic valuation presented in the present chapter was consequently based on a stated preference technique that offers the respondent easily understood and operationally defined choices of future control programs, varying in attributes related to health impacts, nuisance levels and private (household) costs. The present study adds to the only choice experiment applied to mosquito control of which we are aware, conducted in Madison, USA in

order to assess WTP for both West Nile Virus vector and nuisance mosquito control (Dickinson and Paskewitz, 2012; Brown et al., 2015).

This chapter offers substantive conclusions regarding both individual and aggregate (social) benefits that may accrue in the Athens Metropolitan area from the implementation of improved mosquito control programs against native or invasive mosquitoes. Findings show a higher preference for health protection than for nuisance reduction. This differs from previous results from Germany (von Hirsch and Becker, 2009) and the USA (Dickinson and Paskewitz, 2012), in which nuisance was the main or the only attribute studied. However, those studies followed a different approach to the valuation of nuisance reduction. Von Hirsch and Becker (2009) implemented a contingent valuation study that focused almost exclusively on nuisance avoidance without particularly taking into account the health risks. On the other hand, Dickinson and Paskewitz (2012) used a different framing of the nuisance reduction; instead of using a "nuisance scale" attribute, they presented a choice of mosquito control programs that could target mosquito nuisance (this verbal expression may be considered as a nuisance safety oriented attribute). Therefore, the observed differences in WTP for nuisance and disease risk reduction may not be attributed exclusively to the relative importance of the current nuisance and health risk in each study area, but to differences in survey design as well.

The results of the present chapter contribute to the evaluation of public policies aimed at the provision of public goods, in this case, mosquito control programs. It should be noted that similar techniques and methods to those employed in the current chapter, such as stated preference methods, are under debate in the literature (Gsottbauer et al., (2015), Kallis et al., 2015). Therefore, the present results could be perceived as indicating trends, rankings and hierarchies, and valuable for the evaluation of public health policies and the design of future public actions.

A possible limitation of the methodology of this chapter is that due to the unknown actual health risks of invasive mosquitoes a verbal description was used, based on the action taken to prevent transmission of chikungunya and dengue in the future. Consequently, only the perceived (subjective) risk reduction provided by improved mosquito control programs (i.e. new management plans) could be estimated. Despite

this limitation, this study revealed that citizens are willing to pay considerable amounts of money for protection against the spread of diseases as yet unknown to them, implying a risk-averting behavior against invasive mosquito species. In addition, respondents – who were generally aware of the invasive mosquito problem - are willing to pay more for programs that may protect them from the associated health risks. Concerning WTP for reducing the WNV risk, our results are consistent with the study of Dickinson and Paskewitz (2012), who also found that the WTP for control of disease-carrying mosquitoes increases as the health risk increases. From this perspective, as climate change trends seem to worsen the problem by increasing the risk of transmission of new diseases (e.g. Zika virus), more efficient mosquito control strategies in the coming years are likely to provide increasing benefits (Attaway et al., 2016).

Concerning the mosquito nuisance control, it was found that there are significant differences between WTP estimates for nighttime nuisance (attributed to native mosquitoes) and daytime nuisance (attributed to the Asian tiger mosquito). The latter WTP was found to be insignificant, indicating that the presence of invasive species has not yet significantly altered the willingness to pay for nuisance reduction in the study area, possibly due to the currently relatively low biting nuisance.

Even though it is very difficult to provide precise estimates of the total costs and the aggregate social benefits of mosquito control programs, our findings suggest that the benefits of mosquito control in terms of reduced nuisance and reduced health risks are likely to exceed the associated implementation costs. According to data presented in Chapter 2, the average annual public mosquito control costs in the Athens Metropolitan area amount to approximately 800,000 €/year, an average annual cost of 0.56 €/household. On the other hand, results suggest that the aggregate benefits from improved control programs could reach 11.2 million € per year under the most conservative scenario, representing an aggregate benefit of 7.4 €/household/year.

These figures provide a further evaluation of the cost-benefit ratio, presented in Chapter 4. Specifically, the benefit-cost ratio will be greater than one (and thus the programs will be economically justified) for programs that achieve at least the target levels of Scenario 4 as long as the extra implementation cost is no more than 13 times

the current mosquito control costs. This cost may increase up to 56 times the current cost if a high prevention scenario effective for all mosquito species is implemented. In addition, considering the risk levels analysed in chapter 4.7, the cost in the case of an epidemic attributed to IMS would be hard to evaluate but could possibly exceed current estimates significantly and could also be associated with losses in other economic sectors such as tourism. On the other hand, the expected added value of taking measures not only against native mosquitoes but also against the Asian tiger mosquito was found to be substantial in both medium and high prevention scenarios, representing a benefit of about 15€/household/year. As already noted, this benefit can be mainly attributed to the high health risk induced by the introduction of new invasive species in the study area.

With regard to the validity and generalizability of these estimates it could be argued that the survey respondents could differ systematically from the general population according to characteristics that were not used in our sample stratification (e.g. income, education), or according to some unobservable characteristics that may influence the decision to participate (e.g. interest/concern with mosquito-borne disease). For this reason we have also assessed an extreme "underestimated" case, assuming that 65% of the non-respondents place a zero value on both health risk and nuisance reduction, in order to place a lower bound on the total WTP. In the most conservative scenario (SC4), the average WTP would be at least 2.59€/year/household, while the total aggregate benefits from the improved control program would be at least 4.16 million €. Based on these findings, the benefit-cost ratio will be greater than one for programs that achieve the SC4 targets at a cost 5.2 times less than the current mosquito control costs.

Similar results favoring mosquito control policies were found in all previous valuation studies. For example, John et al. (1987), using a contingent valuation method (CVM), found that the total benefits from mosquito control programs are twice the associated costs. Farmer et al. (1989), also employing a CVM, found that benefits were 3.4 times higher than costs. Von Hirsch and Becker (2009) recently estimated a mean WTP 3.8 times higher than the associated costs. In the present study, our findings cannot provide a precise benefit-cost ratio. However, they can be

used in order to inform future benefit-cost studies that will examine specific and detailed mosquito control programs, which will be fully costed. Citizens' preferences as recorded in the current study comprise an essential component of such an evaluation.

Chapter 6: A holistic approach for the evaluation of mosquito abatement strategies from citizens and experts

6 A holistic approach for the evaluation of mosquito abatement strategies from citizens and experts

In chapter 2 the basic prevention and control costs and data were presented and analyzed while in Chapter 3 a separate Cost of Illness approach was carried out to estimate medical costs and productivity losses, from the West Nile Virus (2010) and Malaria (2011) outbreaks in Greece (Kolimenakis et al., 2016). In Chapter 4 an attempt was made to implement certain cost-benefit and cost-effectiveness tests and Chapter 5 provided a clearer figure of the citizens' benefit levels from the impementation of improved mosquito control programmes based on the discrete choice method (Bithas *et al.,* 2018a). In this chapter two additional surveys are presented which were conducted in order to evaluate the overall socioeconomic impact of implementing improved prevention strategies. The first was a web questionnaire aimed at citizens nationwide and the second was a small scale survey of experts involved in mosquito control activities in Greece. The targets of this chapter are: (i) to estimate the costs associated with these problems in various categories, (ii) to evaluate the level of citizens' well-being from averting the problem and (iii) to record their preferences regarding control measures. Evidence shows that experts tend to place a high value on mosquito control when associated with serious health risks, while citizens are more sensitive and concerned about the environmental impacts of control methods. The synthesis of results produced by the current chapter act as a preliminary guide for the estimation of societal welfare from the confrontation of similar problems in a holistic- ecosystemic context.

Chapter 6 : A holistic approach for the evaluation of mosquito abatement strategies from citizens and experts

6.1 A web survey of Greek households conducted through the website of www.meteo.gr

The implementation of a web questionnaire follows a process of surveys and evaluations (Kolimenakis et al., 2016; Bithas et al., 2018a) aiming to elicit citizens' preferences for mosquito control strategies as well as to evaluate the effectiveness level of prevention programs in Greece. The specific questionnaire was designed to address qualitative dimensions not previously recorded in the surveying processes and to extend the sampling of answers at the national level through the distribution of a web questionnaire for cost-saving purposes. For this reason collaboration was established with an online meteorological platform of high visiting frequency (www.meteo.gr) in order to increase the geographical dispersion of the sample. It should be noted that the specific web platform had already implemented a real time monitoring application for the identification of mosquito presence, covering the whole Greek territory.

The questionnaire (Annex 8.10) was specifically designed to elicit citizens' opinions on certain socio-economic aspects of the mosquito problem. The overall aim was to examine and then to validate at the national level a set of parameters related to the private prevention costs for IMS and to investigate individual preferences between various mosquito control programs. The questionnaire contained an introductory page explaining the purpose of the study and some general information about the Asian tiger mosquito and its associated health risks. The first questions focused on the respondents' knowledge of the Asian tiger mosquito. The following questions concerned: (a) the current perceived level of nuisance during daytime as well as during nighttime (using a 5-point Likert scale), (b) the portion of the year (months) with significant mosquito nuisance, (c) the monthly household expenditure for private prevention measures, and (d) the main reasons for taking individual prevention measures (i.e. respondents had to choose between health risk reduction and nuisance reduction). Participants were next asked about the importance of taking further public measures for mosquito control (using a 5-point Likert scale). Further questions were then included to identify the main targets of future public control measures/programs.

The final section of the questionnaire focused on participants' demographics (age, residence area, family status).

For the purpose of our survey, a special banner appeared on the home page of the host web platform (www.meteo.gr), from which visitors followed a link to the web survey. The banner appeared randomly to visitors, but a selection bias could arise due to (i) the non-representative nature of the internet-using population, and (ii) self-selection of participants (also known as the `volunteer effect', Eysenbach, 2004) which was possibly related to their interest in mosquito control and their perceived intensity concerning the mosquito problem. The survey took place between September and October 2016 with a total of 1,204 responses from all over the country. The final sample follows the regional distribution presented in Table 6.1. This distribution is quite representative of the population but it is also a first indicator of regional differences in people's attitudes and experience of mosquito-associated problems.

Table 6-1. Sample distribution per region (Bithas et al., 2018b)

	Sample		Population[1]	
	Frequency	Percent	Residents	Percent
Attica	664	55.1%	3,827,624	35.39%
Central Greece	43	3.6%	547,390	5.06%
Central Macedonia	131	10.9%	1,881,869	17.40%
Crete	57	4.7%	623,065	5.76%
Eastern Macedonia and Thrace	49	4.1%	608,182	5.62%
Epirus	35	2.9%	336,856	3.11%
Ionian Islands	33	2.7%	207,855	1.92%
North Aegean	12	1.0%	199,231	1.84%
Peloponnese	49	4.1%	577,903	5.34%
South Aegean	26	2.2%	308,975	2.86%
Thessaly	60	5.0%	732,762	6.78%
Western Greece	38	3.1%	679,796	6.29%
Western Macedonia	7	0.6%	283,689	2.62%

[1] *Data from population census in Greece, conducted by the Hellenic Statistical Authority (2011)*

6.1.1 Results of the Web survey

According to the results of the web questionnaire, most of the respondents (89.5%) had prior to the survey knowledge of the Asian tiger mosquito and to its health risks. It is interesting to note that about 66% of the respondents reported that the Asian tiger mosquito is established in their residence area. Regional differences in this response are relatively small (ranging from 55% to 71 %) and are not significantly correlated with the actual detection of this mosquito species over Greece (Badieritakis et al., 2018). Therefore, public perception cannot be used as a safe indicator of the presence of *Aedes aldopictus* in a region/area.

In contrast to the study of Bithas et al (2018), which reported a relatively higher nuisance during the night hours for the region of Attica, we found that, at the national level, night nuisance levels are almost identical with the daytime levels, with a mean

value of 3.6 on the 5-point Likert scale (indicating a nuisance level between average and high). Figure 6.1 presents the distribution of the perceived nuisance level during the night (following the individual responses), as well as the spatial (regional) variation of the mean nuisance value. On the other hand, Figure 6.2 presents the perceived nuisance levels during daytime, which can be taken as an indication of the relative nuisance caused by the Asian tiger mosquito which, unlike native mosquitoes, causes biting nuisance during the day. According to these results, it can be concluded that respondents living in the regions of Eastern Macedonia and Thrace, Peloponnese, Central Greece and Western Greece experience a higher day-time biting nuisance that can be attributed to the presence of the Asian tiger mosquito.

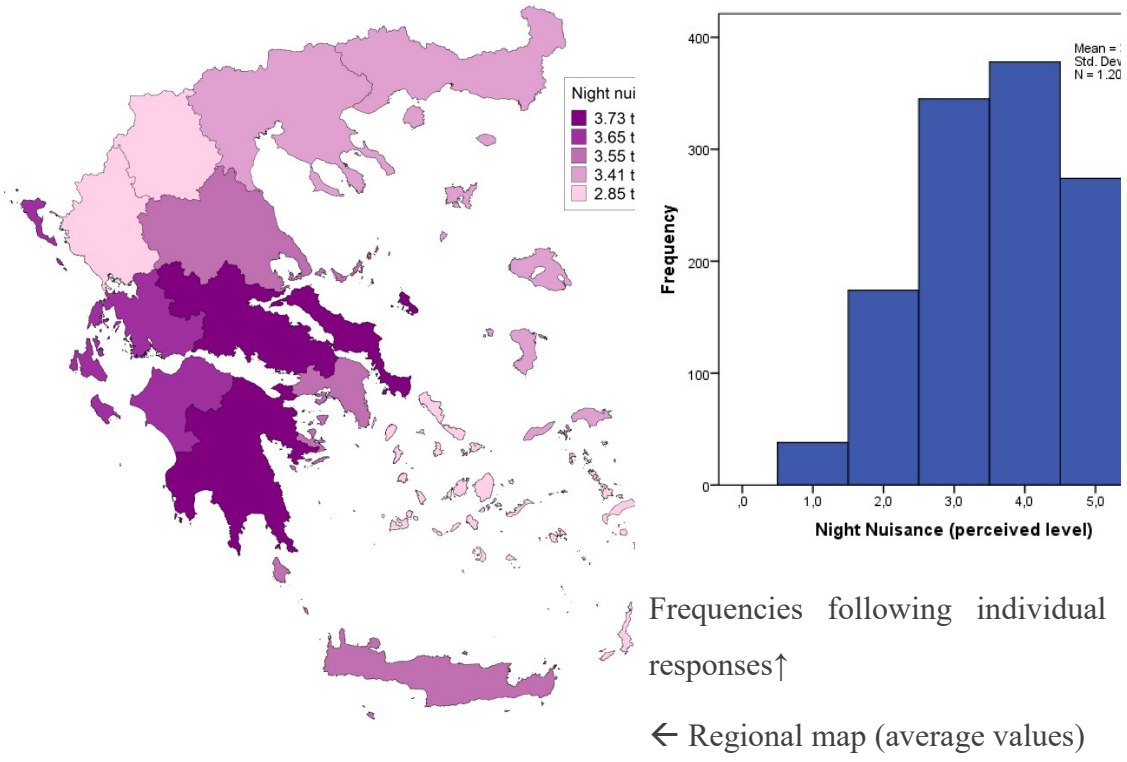
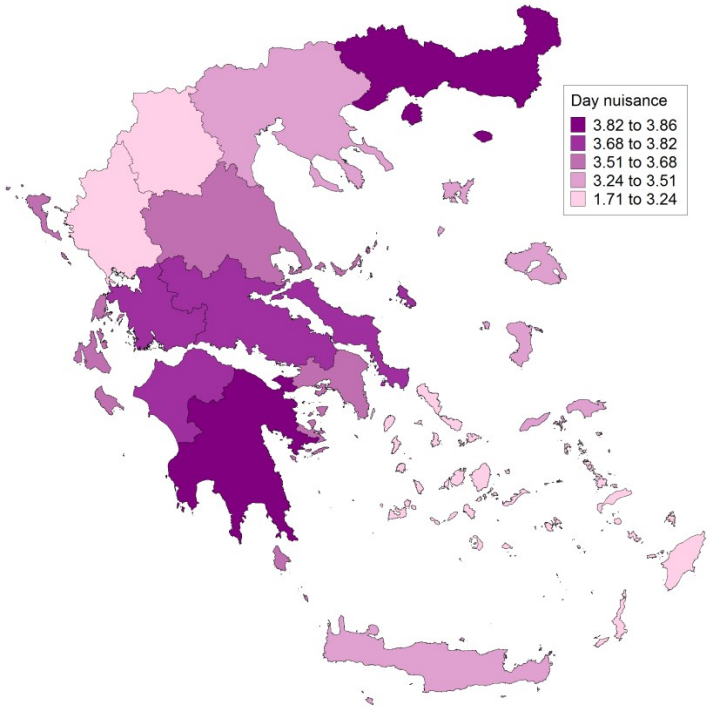
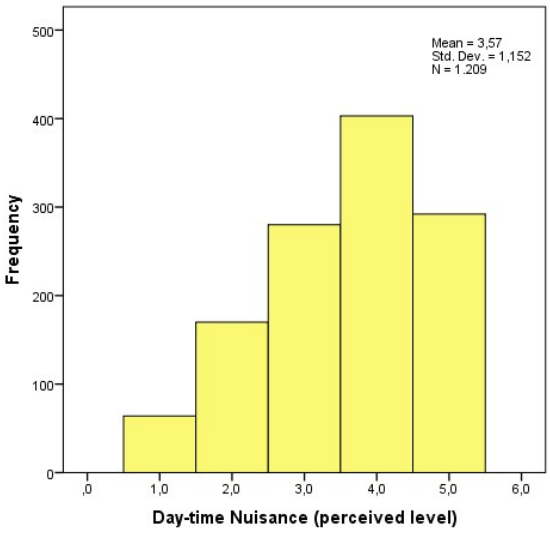


Figure 6-1. Night nuisance *(Likert scale 1-5: 1= no nuisance, 5= intolerable nuisance* (Bithas et al., 2018b)





Frequencies following individual responses↑

← Regional map (average values)

Figure 6-2. Day nuisance *(Likert scale 1-5: 1= no nuisance, 5= intolerable nuisance)* (Bithas et al., 2018b)

As shown in Figure 6.3, the average "nuisance period" according to the survey respondents follows a normal distribution and lasts, on average, approximately 5.7 months (i.e. about 5 months and 21 days). The regional variation of this period is depicted in the corresponding thematic map (Figure 6.3), revealing a longer nuisance period in South and South-eastern regions.

Concerning the private (individual) prevention costs, it was found that households are paying on average about 17.6 € per month when mosquitoes are active. This estimate is much higher than the one found by Bithas et al (2018) for the case of the Attica Region (6.6 €/month). This difference may be attributed to the self-selection of participants, which is likely to be related to their interest in mosquito control, which in turn may depend on the nuisance level. Therefore, these results are likely to be overestimates, but can be used in order to explore the regional variation with regard to prevention costs. In order to do so, we estimated the annual prevention costs by multiplying the monthly costs by the nuisance period. The average annual cost of our

sample was found equal to 100.1€/household (Figure 6.4). Significant spatial variations were observed in these estimates (Figure 6.4), as values (annual costs) range from below 80€ in some regions (e.g. Thessaly and the North Aegean) to over 125€ in others (e.g. Eastern Macedonia and Thrace, and Central Greece). This variation may be an indirect indicator of the magnitude of the mosquito problem, which is strongly associated with the nuisance conditions in each area. It should be also noted that this revealed behavior concerning prevention can be used as a proxy of individuals' potential benefits from improved control measures in each region.

Figure 6.5 shows which of health and nuisance appears to be the main reason reported by respondents for taking individual prevention measures. According to the responses provided, nuisance seems to be the main reason for about 73% of respondents, while health risks are stated as the main reason by only 27% of the sample. It should be also noted that: (1) nuisance was considered more important than health risks in all regions, and that (2) the two regions where health risks are more highly correlated with individual prevention strategies (costs) are those of Central Greece and Western Greece. This result partly contradicts the findings of Bithas et al., (2018) in which health was found to be the main prevention priority for citizens of the Athens Metropolitan Area, but on the other hand is in accordance with most of the findings in the recent literature. However, as will be seen below when expenses are viewed from a point of view of a public good, citizens are more concerned with the health rather than the nuisance threats.

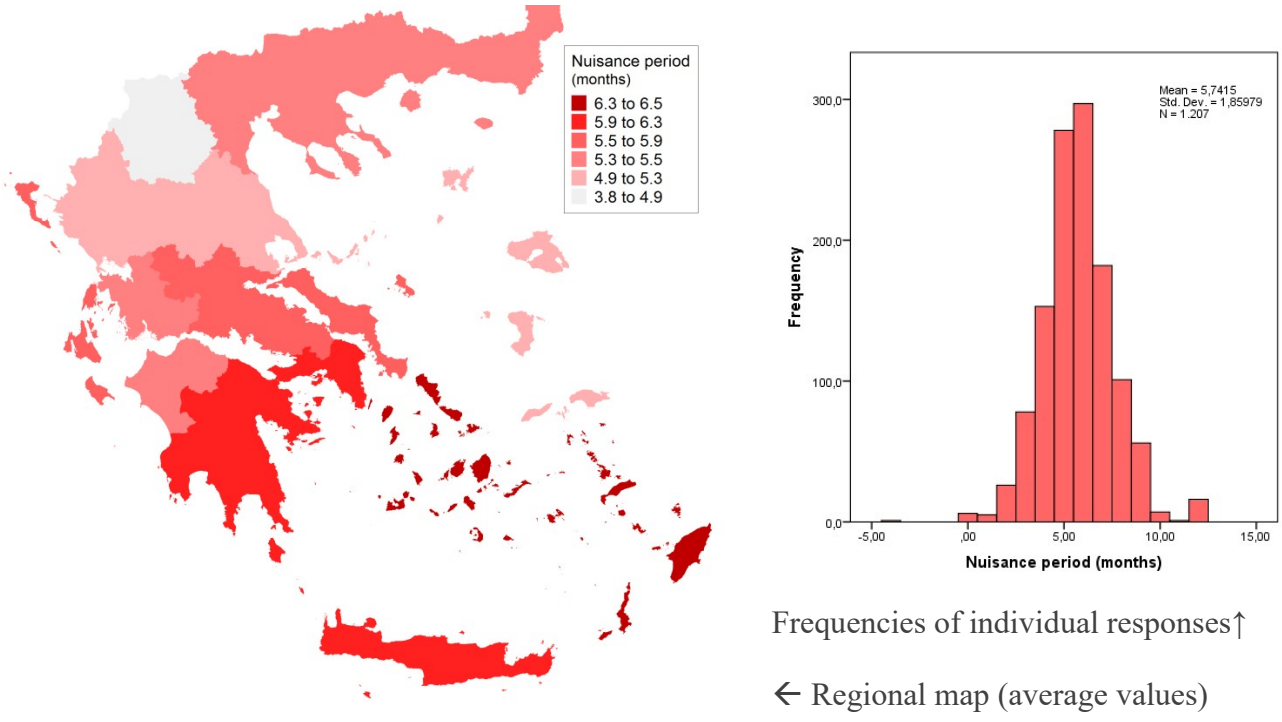


Figure 6-3. Nuisance period (months) (Bithas et al., 2018b)

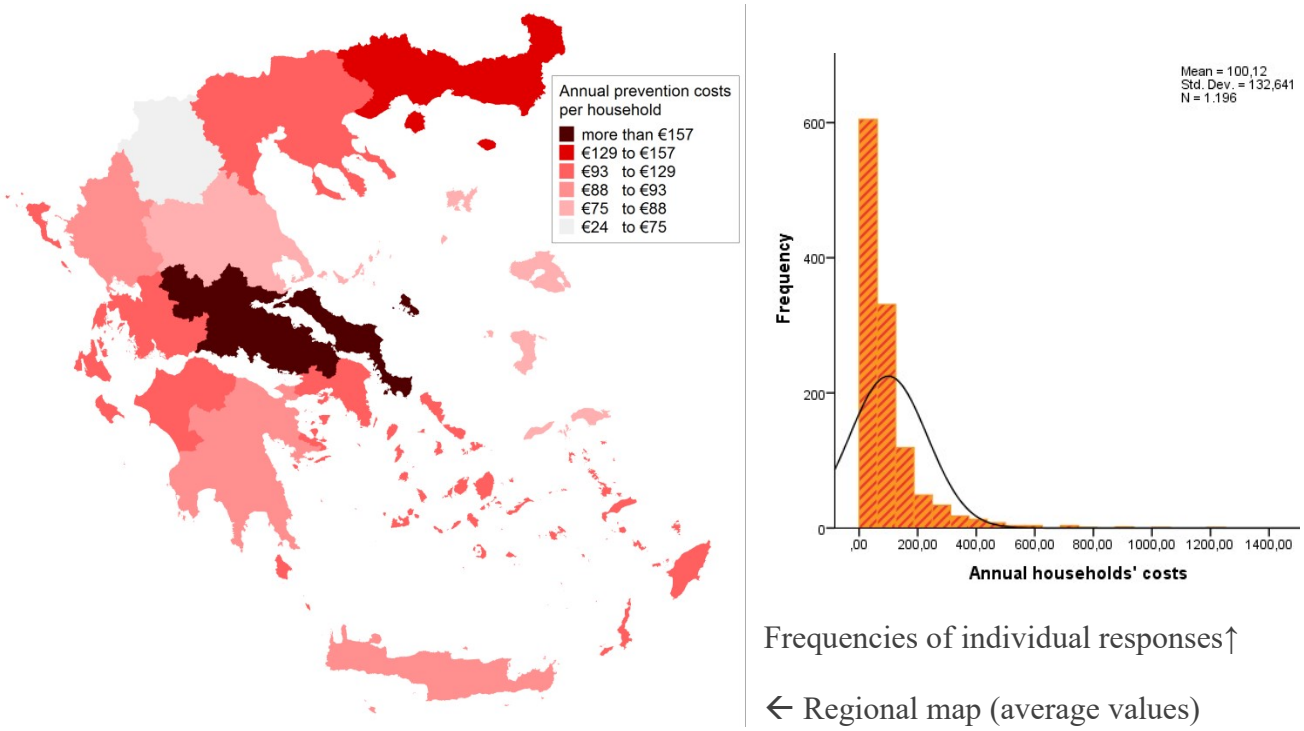


Figure 6-4. Annual Prevention costs (€/year/household) (Bithas et al., 2018b)

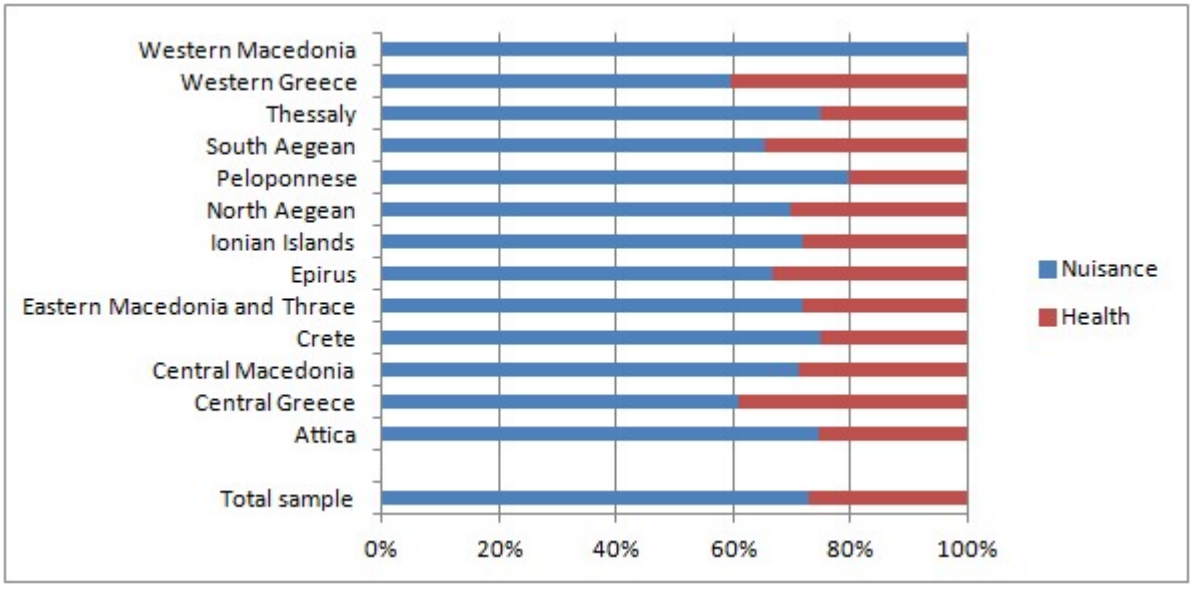


Figure 6-5. Main reasons for taking individual prevention measures (per region) (Bithas et al., 2018b)

Finally, as already stated, the online survey attempted to gather information regarding the preferences of individuals between the diverse mosquito control programs, and particularly about the importance of taking further public measures for mosquito control, as well as about the main targets of future public control measures and programs. In general, about 83% of the survey respondents believe that the actual prevention/control measures are insufficient or inadequate in order to deal with the mosquito problems and therefore there is space for further measures to be taken. Concerning the main targets of these measures, as depicted in Table 6.2, health impacts were considered as more important than nuisance impacts, confirming the findings of previous surveys held in Greece (Kolimenakis et al, 2016; Bithas et al, 2018). Furthermore, as in the other two studies, diseases from invasive species were considered to be a serious threat. On the other hand, nuisance level and the financial burden on households for mosquito control programs were also rated highly, constituting them as important additional decision factors.

Finally, an important finding of this survey was that citizens seem to be aware of the environmental consequences of mosquito control measures. In particular, about 74% of the sample stated their disagreement with measures that may potentially affect the physical environment and ecosystems.

Table 6-2. Individuals' rating of the objectives of mosquito control programs (online survey results) (Bithas et al., 2018b)

	Reduction of mosquito-borne disease risks		**Reduction of nuisance**		**Low cost to households**
	From native species[1]	From invasive species[2]	From native species[3]	From invasive species[4]	From future control programs
Highly important	73.2%	76.7%	47.1%	39.5%	26.8%
Important	19.1%	15.9%	32.3%	25.3%	17.8%
Neutral	5.4%	5.6%	15.7%	20.2%	26.5%
Less important	1.6%	1.2%	4.0%	10.3%	17.4%
Non important	0.7%	0.6%	0.9%	4.7%	11.6%

[1] *for example: malaria, West Nile Virus*

[2] *for example: Chikungunya, Dengue Virus, Zika Virus*

[3] *Night nuisance*

[4] *Daytime nuisance*

6.2 The implementation of a Stakeholders' and Experts' Survey in Greece and Italy

6.2.1 Experts' qualitative survey on the effectiveness of mosquito control programmes

The socioeconomic evaluation of the mosquito control strategies was enhanced through a survey of experts' and relevant stakeholders' opinions (Annex 8.11). This qualitative survey was designed for the evaluation of the socioeconomic impacts of the mosquito control plans by key stakeholders, public policy makers, medical practitioners, public health experts and regional delegates. The questions were formulated in order to evaluate the results of the preceding studies (especially the choice experiment) and provide qualitative evaluation of specific policy-related decisions (ecosystem services, adequacy of control programmes, etc.). The questionnaire was distributed to a pool of 100 experts all over Greece, selected on the basis of their experience and involvement in the design and implementation of mosquito control strategies. The survey was conducted through telephone interviewing from May 2016 to May 2017 in collaboration with a delegate of the Ministry of Health and a total of 58 responses were collected. In the corresponding survey in Italy, 23 interviews were distributed collected from delegates responsible for the implementation of mosquito control programs from various public health services and municipalities.

6.2.2 Results of the survey of experts

In the survey of experts, the majority of the respondents considered the financial budget of control programmes as adequate for confronting the problem. In addition, experts judge that the current control programmes achieve balance between cost and effectiveness in their design and implementation. With regard to the potential negative impact of prevention measures on relevant ecosystem services, 65% of the experts stated that there are no negative impacts from these measures. Regarding the

means of obtaining extra funds for supporting mosquito management, experts indicated that: (a) a redistribution of public resources would be necessary, (b) a reallocation of funds within national and regional budgets could improve the financing of mosquito control programmes, and that (c) financial contribution by citizens is equally important for the confrontation of the problem.

It should be noted that the Asian tiger mosquito can exploit water containers in private apartments for their breeding. Therefore, according to the experts, private prevention activities could contribute significantly to the reduction of the problem at a much lower cost. Lastly, regarding the prioritization of the programmes' objectives in regards to their overall objectives (Table 6.3), experts stated that the health impacts should be considered as the primary objective of the control programmes. Specifically, they consider the health threats of native and invasive mosquito-borne diseases as almost equally important, while they treat nuisance from mosquito species as a less important impact factor.

Table 6-3. Experts' rating of the objectives of mosquito control programmes for the Greek case

N=58	Reduction of mosquito-borne disease		Reduction of nuisance	
	from native species	from invasive species	from native species	from invasive species
Highly important	**63%**	30%	4%	0%
Important	32%	**57%**	7%	3%
Neutral	3%	7%	**65%**	12%
Less important	1%	3%	7%	**62%**
Not important	0%	3%	4%	24%

Table 6-4. Experts' rating of the objectives of mosquito control programmes for the Italian case

N=23	reduce epidemic risk	reduce the risk of introduction of new species of mosquito	reduce the degree of harmfulness of mosquitoes	reduce the presence of Aedes albopictus
Highly important	**61%**	22%	4%	**35%**
Important	13%	**22%**	**35%**	22%
Neutral	9%	13%	22%	17%
Less important	4%	13%	4%	13%
Not important	4%	17%	17%	0%
NA	9%	13%	17%	13%

Table 6-5. Experts' rating extra funding sources of mosquito control for the Greek case

Extra Funding Sources for Mosquito Control:
- Redistribution of Annual State's Budget: 50%
- Redistribution of Annual Regional/Municipal Budget: 37%
- Redistribution of Funds from other Regional/Municipal Activities: 22%
- Imposing citizens' tax: 10%
- Citizens' obligation to take charge of the activities by the private: 53%

Table 6-6. Experts' rating extra funding sources of mosquito control for the Italian case

Extra Funding Sources for Mosquito Control:
- State Contribution: 43%
- Redistribution of resources at the regional level: 39%
- Imposing citizens' tax: 35%
- Citizens' obligation to take charge of the activities by the private: 52%

6.3 Conclusions from Meteo and Experts' surveys

The Meteo web survey conducted in Greece and the two surveys targeted at stakeholders were designed to provide an overview of citizens' perceptions and attitudes towards the problem of invasive mosquitoes, as well as the experts' evaluation of the future targets of mosquito control programs. The results of the online survey showed that nuisance from mosquito: (a) is significant all over Greece, although with some regional differences, thus indicating areas of higher priority for future policy actions (b) is similar for both invasive and native species and (c) is the main reason for taking individual prevention measures. The cost of individual prevention measures was estimated to be quite high (about 100€/household/year), which could be a result of selection bias (i.e. the volunteer effect) due to the online nature of the survey. However, this variation may be an indirect indicator of the magnitude of the mosquito problem, which is strongly associated with the nuisance conditions in each area. Furthermore, this revealed behavior concerning prevention can be used as a proxy of individuals' potential benefits from future improved control programs in each region.

In general it can be concluded that Health Impacts are regarded as more important than nuisance impacts in Greek case, while the overall harmfulness of mosquitoes appears to be the most important factor for Italian Stakeholders. Diseases from invasive species were considered a serious threat in both cases. Stakeholders and citizens are aware of the environmental consequences of control methods. In addition, Greek Citizens are prone to consider public authorities as responsible for the health protection and they seem to transfer the responsibility of health protection onto experts and public health practitioners. On the other hand, experts from both countries consider the citizens' participation to door-to-door interventions as very important for the successful implementation of management programs.

One of the most important findings of the present study is that citizens perceive protection against mosquito-borne diseases as an important public good which should

be supported by public expenses. The results of our study indicate that on the one hand citizens are more prone to pay for their personal protection against daily nuisance from mosquito species and on the other they are willing to pay for an improved control program against disease threats when implemented by public authorities. This might imply that they feel rather insecure in regards to the efficiency of their personal protective measures against the various mosquito associated diseases. However, the example of a structured implementation of annual management plans against invasive mosquito species implemented in Emilia Romagna, Italy, indicates that citizens' participation is highly important in the monitoring and control of invasive mosquito species. What is more, the lack of information from public authorities may increase both the insecurity and lack of information of citizens towards the particular problem. It should be noted that Greek citizens do not appear to be well aware of the personal treatment measures against invasive mosquitoes, also due to the lack of any relevant disease outbreaks in the recent years. However, there are recent ongoing initiatives funded by the EU (LIFE CONOPS) which enhance the public information and lead to collaborations between the scientific community, public authorities and citizens. Therefore, to a certain extent, citizens seem to transfer the responsibility of protection measures for this particular issue mostly onto experts and public health practitioners. In any case, the perception of various relevant attributes across different countries and regions might also be associated with different socio-cultural traits and might differ if examined in diverse contexts.

An important outcome that should be taken into account in future studies is the examination of citizens' perception of the ecosystemic threats associated with mosquito control, an issue not well examined so far in the recent literature. While citizens appear to be sensitive against the environmental consequences associated with the mosquito abatement methods, they also seem to have difficulty in identifying the environmental consequences of mosquito control methods. This raises the complexity of the issue at hand when trying to discern the possible level of citizens' participation in public decision-making for similar problems. The fact that climate change trends may worsen the mosquito problem and increase the risks of the

transmission of new diseases (e.g. Zika virus) making the prevention and control methods even more sophisticated, increases even more the complexity of citizens' participation and the associated dilemmas (e.g. human health versus environmental consequences). The interrelation of a wide set of parameters and multiple public decisions associated with the problem of invasive mosquitoes renders necessary the examination of the ecosystemic dimension of the particular issue from a rather holistic point of view.

Chapter 7: Conclusions

7 Conclusions

The aim of the present thesis is to attempt an appraisal of the *socioeconomic consequences associated with the problem of IMS, to assess the economic effectiveness of ongoing and proposed management plans to control the 'IMS problem and the appraisal of the IMS problem from a holistic point of view taking into consideration the citizens' and experts' view of the problem through.* The already established invasive mosquitoes have increased the risks of outbreaks of mosquito-borne diseases (Badieritakis et. al., 2018). Generally, mosquito control programs and prevention strategies aim to contribute towards protecting against the outbreak of epidemic diseases, improving the quality of life and reducing losses in economic activities. As already mentioned it is in the nature of the problem that it is difficult to provide precise estimates of the benefit arising from the implementation of improved mosquito control programs. The present socio-economic valuation was based on a synthesis of methods, examining attributes related to health impacts, nuisance levels and private (household) costs from both a citizen's and an expert's point of view.

Even though it is very difficult to provide precise estimates of the total costs and the total social benefits of mosquito control programs, our results permit us to conclude that the benefits of mosquito control in terms of reduced nuisance and reduced health risks are likely to exceed the associated implementation costs. According to 2016 national data published online on the governmental Greek Transparency Program Initiative (http://diavgeia.gov.gr), the average annual public mosquito control costs in the Athens Metropolitan area reach approximately 800,000 €/year. This amounts to an average annual cost of 0.56 €/household. On the other hand, our results of Chapter 5, suggest that the aggregate benefits from improved control programs could reach 11.2 million € per year under our most conservative scenario, representing an aggregate benefit of 7.46 €/household/year. These figures provide a kind of evaluation of an improved mosquito control program. Specifically, the benefit-cost ratio will be greater than one (and thus the program will be economically justified) for programs that achieve at least the target levels as long as the extra implementation cost is no more than 13 times the current mosquito control costs. On the other hand, the expected added value of taking measures not only against native but also against the Asian tiger

mosquito was found to be substantial in both medium and high prevention scenarios, representing a benefit of about 15€/household/year. This benefit can be mainly attributed to the high health risk induced by the introduction of new invasive species in the study area.

The present thesis offers substantive indicators mainly regarding the ratio of citizens' perceived benefit from the implementation of improved mosquito control programs. Findings show a higher preference for improved programs targeted at health aversion over nuisance aversion in Greece, while Italian citizens and experts emphasize the overall harmfulness of mosquitoes. As the analysis shows, citizens seem more prone to pay against possible health consequences and specifically against the spread of diseases unknown to them, implying a risk averting behavior against invasive mosquito species. Citizens seem more willing to accept a higher cost (for an improved control program) at the present eliminating possible effects in the future. In addition, it appears that citizens aware of the invasive mosquito problem are even more willing to pay against possible consequences. The fact that climate change trends seem to favor a deterioration of the problem and an increasing risk of the transmission of new diseases (e.g. Zika virus) is likely to provide a higher potential benefit from implementing more efficient mosquito control management plans during the upcoming years (Attaway et al., 2016).

The evaluation of the socioeconomic costs of invasive mosquitoes is a highly challenging task made even more complex by changing climatic conditions, as well as by globalization and urbanization trends. The identification of the correct cost figures is of utmost importance as budget constraints, especially in the nations of Southern Europe, impose the need for economic justification of prevention measures. However, it should be noted that costs per se cannot be regarded as adequate economic indicators and the socioeconomic analysis should be augmented by an evaluation of impacts and costs from an ecosystemic point of view. Taking into account the complexity of the ecological, socioeconomic and biological conditions, a multi-disciplinary and more holistic approach is needed in order to evaluate the effectiveness of the incurred expenses in improving public health and social welfare, yet at the same time ensuring an ecosystemic equilibrium.

In the case of mosquito control, the need for scientific consultation in order to determine the conditions under which ecosystems can bring the desired levels of health, renders it difficult for other social groups to determine the values attributed to this specific service. Space however, should be provided for societal groups in order to participate in mutual decision-making towards the prioritization of disease regulation in comparison with other regulatory ecosystem services, through an integrated sustainability approach (Ingebrigtsen & Jakobsen, 2013). It should be noted that the pattern and extent of incidence of particular infectious diseases depends among others on land-use change, disease-specific transmission dynamics, socio-cultural changes, climate change and the susceptibility of human populations (Repetto & Baliga, 1996; Chowdhury & Haque, 2014). Therefore, manmade processes are to a high degree responsible for the dysfunction of specific ecosystem services, in relation to their capacity for disease regulation. Based on this fact, it would be rational to explore a synthesis of policies and decisions by including all relevant social groups in the decision-making process. Therefore, an informed framework of the socioeconomic cost and benefits of disease regulation programmes should also evaluate the impact of these programmes in ecosystems' functions, so that stakeholders may be able to prioritize different objectives towards the achievement of an ecosystemic equilibrium (Ingebrigtsen & Jakobsen, 2012).

Table 7-1. Institutional approaches to mosquito control

	TECHNICAL APPROACH	HOLISTIC APPROACH
Orientation	Solutions for adaptation to man-made challenges (e.g. Climate Change & Urbanization)	Examination of causes leading to man-made challenges (e.g. Climate Change & Urbanization)
Focus	Impacts on Humans' Quality of Life	Impacts on Ecosystems
Objectives	Reduction in the Number of Disease Cases	Preservation of human health as part of the Ecosystems' Equilibrium
Means	Technology oriented solutions	Inclusive decisioning
Economic Approach	Cost-Benefit investment based Solutions	Allocation of resources according to socio-ecological targets and boundaries

To this extent, the outline of various institutional approaches to invasive mosquito control strategies could be generalized under two broad categories as described in Table 7.1. The first represents a rather "technical", solution-oriented approach which seeks to adapt to man-made challenges. This approach focuses on quality of life, considering human health and disease prevention as the main objectives. The technical approach is favored mostly by innovative technological solutions such as the Sterile Insect Technique (Gubler, 2011), at the lowest investment cost. The second perspective represents a "holistic" approach in which the examination of causes

leading to climate change and urbanization is placed at the center of decision-making. The emphasis on human quality of life is extended towards the impact on ecosystems and their services. Emphasis is placed equally on disease regulation, health provisioning and losses in biodiversity, but also taking into account other complex factors, such as mosquito pesticide resistance and the human population immunity potential (Sutherst, 2004). The final objective of such an approach is the inclusion of various groups and their interests in the decision-making, taking into account the systemic interconnectedness over humans and ecosystems (Capra & Jakobsen, 2017). It should be emphasized that the description of the two approaches is non-exhaustive and should be considered as indicative of different societal trends. However, the final decision for the selection of any approach remains a political decision affected by the priorities, values and information levels of different societies.

The overall findings of this thesis underscore the complexity of the issue at hand when trying to discern the possible level of citizens' participation in public decision making for similar problems. The fact that climate change trends may worsen the mosquito problem and increase the risks of transmitting new diseases (e.g. Dengue fever and Zika virus), making the prevention and control methods even more sophisticated, increases even more the complexity of citizens' participation and the associated dilemmas (e.g. human health versus environmental consequences). The interrelation of a wide set of parameters and multiple public decisions associated with the problem of invasive mosquitoes renders necessary the examination of the ecosystemic dimension of the particular issue from a rather holistic point of view.

According to ecosystem approaches the transmission of infectious diseases is linked to interactions among several factors: *demographic changes*, *poverty*, *urbanization*, *deforestation*, *changes in agriculture models of production*, *changed relationships between people and animals*, *natural resources management*, and *gender differences* and *cultural patterns.* The incorporation of ecosystemic factors into risk anticipation, modeling future scenarios, prevention, and health promotion remain among the most important challenges for similar socioeconomic studies and further research to be conducted in the future. In addition, it is of high policy importance to upgrade the information level of EU & National Authorities also from an ecosystemic perspective.

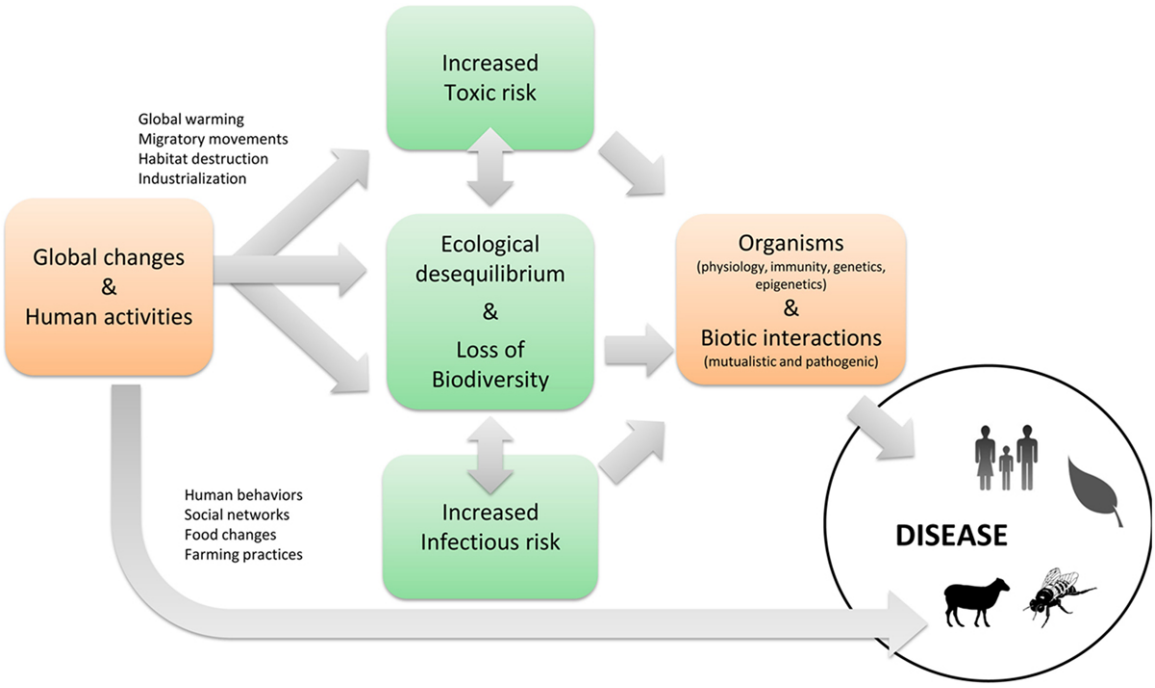


Figure 7-1. The One Health Concept in the transmission of infectious diseases (Source: Destoumieux-Garzón, D., et. al., 2018)

The evidence produced by the current thesis consist of an initial attempt to lead towards bridging of the gaps between “system”, “society”, “health”, and “ecology", improving the information context of future societies towards the adoption of sustainable approaches. When one considers the multiple factors at play and the complexity of public health issues, it is clear that holistic approaches cannot be disassociated from relevant notions such as ecological one health (Figure 7.1). Under current conditions, it is expected that health and well-being of the human population will be more and more difficult to maintain on a polluted planet suffering from social or political instability and ever-diminishing resources. Societal and environmental pressures are expected to add a further burden both in the estimation of future welfare levels and in the design of well addressed policies (Figure 7.2).

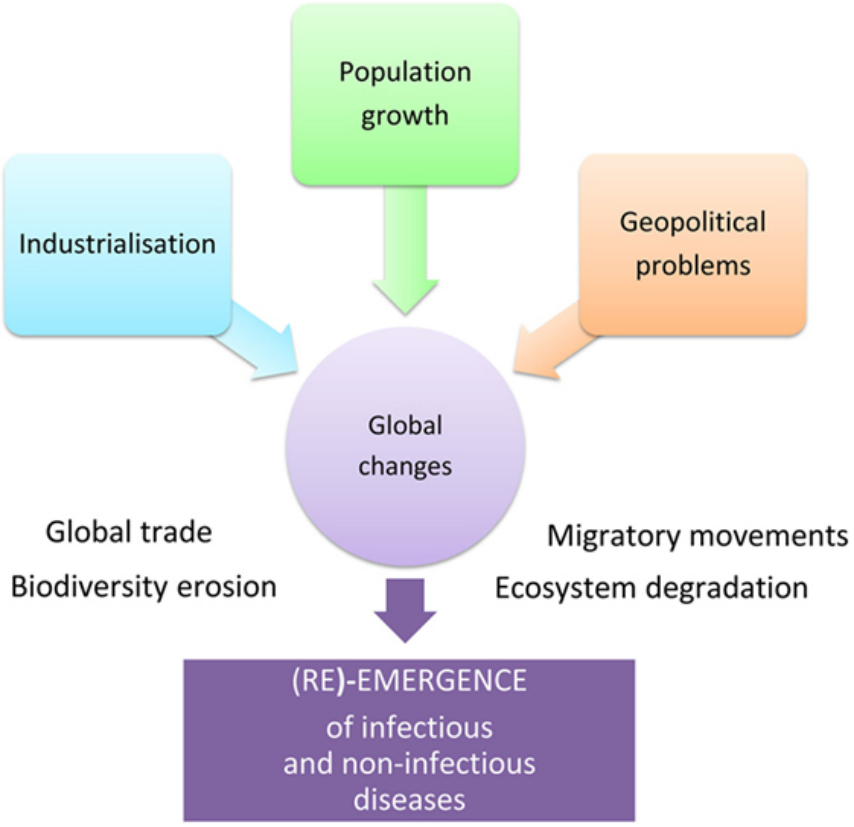


Figure 7-2. Societal and Environmental pressures in the (re)-emergence of infectious diseases (Source: Destoumieux-Garzón, D., et. al., 2018)

As also highlighted in the introduction, the current thesis attempts to contribute to the discourse of a multi parametrical and multidisciplinary issue, such as that of the Invasive Mosquito Species, by providing important indicators of the socioeconomic extent of the problem and of the welfare levels achieved from the implementation of informed public health policies under environmental turbulence. However, further challenges remain open both for public policy and for ecological economics such as the incorporation of ecosystemic factors into risk anticipation, the modeling of future scenarios and the upgrading of the information level of National Authorities also from an ecosystemic perspective. The overall objective of the current thesis is to create the basis of a strategic roadmap for the evaluation of the overall socioeconomic impacts related to the emergence and re-emergence of mosquito-borne infectious diseases in South Europe taking into account the complex socio-ecological factors affecting them.

Chapter 7: Conclusions

As pointed out by WHO (2017 in order to achieve a more holistic estimation of the problem at hand other data such as urban planning, housing, water and sanitation as well as from the agricultural sector such as insecticide usage should be studied in combination with climate and ecosystems data that may also be used for early warning of vector distribution expansion, disease outbreaks, changes in vector populations or transmission dynamics and thereby be used to re-direct vector control services or surveillance activities. Another crucial challenge emphasized in the same WHO report is the association of vector-borne diseases with societal factors such as unplanned urbanization and migration. Further studies could exploit the current findings in order to support new empirical evidence from selected parts of Greece and South Europe that present high rates of associated socio-ecological indicators (migration influxes, urbanization, presence of invasive vectors, etc). In line with the findings of the current study, the overall scope of similar intitiatives would be to promote health and well-being of future societies respecting the ecosystemic equilibrium and the sustainability goals set by societal goals.

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Annexes

8 Annexes

8.1 Budget of Mosquito Control Programs from Regions and Municipalities for 2012 & 2013

BUDGET OF MOSQUITO CONTROL PROGRAMS 2012				
Region	**Regional Unity (R.U.)**	**Contracting Authority**	**Budget (€)**	**Cost/ region**
Attica	Central	Region of Attica	4.977 €	662.680 €
	Nothern	Region of Attica	9.945 €	
	Western	Region of Attica	10.763 €	
	Southern	Region of Attica	8.524 €	
	Western Attica	Region of Attica	39.852 €	
	Pireus	Region of Attica	24.354 €	
	Islands	Region of Attica	191.290 €	
	Eastern Attica	Region of Attica	244.155 €	
	Municipality of Athens	Municipality of Athens	58.900 €	
	Municipality of Philothei	Municipality of Philothéi	8.000 €	
	Municipality of Rafina	Municipality of Rafina	9.100 €	
	Municipality of Papagou	Municipality of Papagou	18.800 €	
	Municipality of Paleó Faliro	Municipality of Paleó Faliro	11.120 €	
	Municipality of Philadelphia	Municipality of Philadelphia	5.900 €	
	Municipality of Nea Smirni	Municipality of Nea Smirni	9.000 €	
	Municipality of Pallini	Municipality of Pallini	8.000 €	
Eastern Macedonia-Thrace	All	Region of Eastern Macedonia-Thrace	713.400 €	1.230.000 €
			516.600 €	

Central Macedonia	Imathía	Imathía Development Agency	259.000 €	3.065.675 €
	Thessaloniki	Development Agency of Thessaloniki	460.000 €	
			755.000 €	
			195.000 €	
	Kilkis	Development Agency of Kilkis	36.275 €	
	Pella	Development Agency of Pella	200.000 €	
	Pieria	Development Agency of Pieria	424.000 €	
	Serres	Development Agency of Serres	215.000 €	
			221.400 €	
			25.000 €	
	Chalkidiki	Development Agency of Chalkidiki	265.000 €	
	Municipality of Evosmos	Municipality of Evosmos	5.000 €	
	Municipality of Dion	Municipality of Dion	5.000 €	
Epirus	Arta	Region of Epirus	40.000 €	140.000 €
	Thesprotia	Region of Epirus	30.000 €	
	Ioannina	Region of Epirus	40.000 €	
	Preveza	Region of Epirus	30.000 €	
Western Macedonia	All	Development Agency of Western Macedonia	108.240 €	108.240 €
Thessaly	Larisa	Region of Thessaly	143.000 €	163.000 €
	Magnisia	Region of Thessaly	- €	
	Karditsa	Region of Thessaly	20.000 €	

Central Greece	All	Region of Central Greece	492.000 €	579.330 €
			87.330 €	
Peloponnese	Argolida,Arkadia,Korinthia,Lakonia	Peloponisos S.A.	290.000 €	592.537 €
	Lakonia	Municipality of Evrotas	311.599 €	
	Messinia	Development Agency of Messinia	231.000 €	
	Nafplion	Municipality of Nafplion	49.938 €	
Western Greece				N/A
Ionian Islands	Kerkyra	Region of Ionian Islands	105.280 €	245.280 €
	Cefallonia	Region of Ionian Islands	60.000 €	
	Leukada	Region of Ionian Islands	30.000 €	
	Zakynthos	Region of Ionian Islands	50.000 €	
Northern Aegean	Samos	Region of Northern Aegean	25.000 €	60.000 €
	Municipality of Limnos	Municipality of Limnos	20.000 €	
	Municipality of Lasvos	Municipality of Lasvos	15.000 €	
Southern Aegean	Municipality of Kos	Municipality of Kos	67.280 €	141.080 €
	Municipality of Naxos	Municipality of Naxos	73.800 €	
Crete	Heraklion	Region of Crete	70.000 €	253.000 €
	Chania	Region of Crete	60.000 €	

	Rethymnon	Region of Crete	61.500 €	
	Lasithi	Region of Crete	61.500 €	
TOTAL				**7.240.822 €**

BUDGET OF MOSQUITO CONTROL PROGRAMS 2013				
Region (region number)	**Regional Unity (R.U.)**	**Contracting Authority**	**Budget (€)**	**Cost/ region**
Attica(8)	Central	Region of Attica	20.000 €	609.000 €
	Nothern	Region of Attica	13.500 €	
	Western	Region of Attica	18.500 €	
	Southern	Region of Attica	24.500 €	
	Western Attica	Region of Attica	39.000 €	
	Pireus	Region of Attica	24.500 €	
	Islands	Region of Attica	199.000 €	
	Eastern Attica	Region of Attica	250.000 €	
	Eastern Attica	Region of Attica	20.000 €	
Eastern Macedonia-Thrace (6)		Region of E.Macedonia-Thrace	1.350.000 €	1.350.000 €
Central Macedonia (7)		Region of Central Macedonia	1.320.000 €	2.600.000 €
			780.000 €	
			500.000 €	
Epirus (4)	Arta	Region of Epirus	40.000 €	100.000 €
	Thesprotia	Region of Epirus	30.000 €	
	Ioannina	Region of Epirus	-	
	Preveza	Region of Epirus	30.000 €	
Western Macedonia(4)	-	.	-	
Thessaly (4)	Larisa	Region of Thessaly	138.000 €	227.000 €
	Magnisia	Region of Thessaly	45.000 €	
	Karditsa	Region of Thessaly	20.000 €	
	Trikala	Region of	24.000 €	

		Thessaly		
Central Greece(5)	All	Region of Central Greece	498.000 €	588.000 €
			90.000 €	
Peloponnese (5)	Argolida, Arkadia, Korinthia, Lakonia	Peloponisos SA	416.000 €	688.000 €
	Messinia	Development of Messinia	232.000 €	
	All	Region of Peloponnese	40.000 €	
Western Greece (3)	Achaía	Region of W.Greece	70.000 €	210.000 €
	Aitoloakarnania	Region of W.Greece	70.000 €	
	Ilía	Region of W.Greece	70.000 €	
Ionian Islands(5)	Kerkyra	Region of Ionian Islands	73.000 €	115.000 €
	Lefkada	Region of Ionian Islands	23.000 €	
	Zakynthos	Region of Ionian Islands	19.000 €	
Northern Aegean (5)	Samos	Region of Northern Aegean	25.000 €	
	Lesvos	Region of Northern Aegean	27.000 €	
	Limnos	Region of Northern Aegean	13.000 €	65.000 €
Southern Aegean (13)	Dodecanese	Region of Southern Aegean	197.000 €	306.000 €
	Cyclades	Region of Southern Aegean	109.000 €	
Crete (4)	Heraklion	Region of Crete	73.000 €	228.000 €
	Chania	Region of Crete	50.000 €	
	Rethymnon	Region of Crete	50.000 €	
	Lasithi	Region of Crete	55.000 €	
			TOTAL	***7.086.000 €***

8.2 Web-Based Questionnaire distributed in Greece (in Greek)

http://goo.gl/forms/AN9d0FYABz

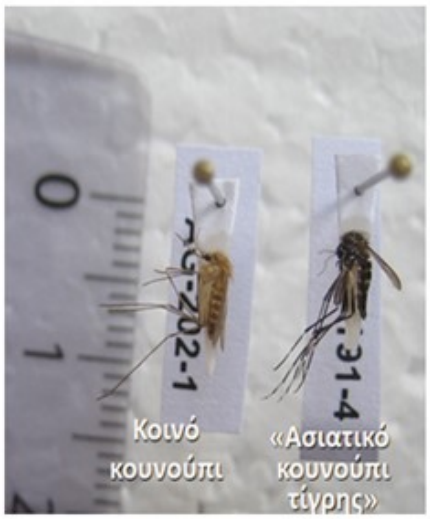
LIFE CONOPS: Ανάπτυξη και επίδειξη διαχειριστικών σχεδίων έναντι των ενισχυόμενων από την κλιματική αλλαγή χωροκατακτητικών κουνουπιών στην Νότια Ευρώπη

Ερωτηματολόγιο για το ιδιωτικό κόστος πρόληψης κατά των επιπτώσεων του Ασιατικού κουνουπιού τίγρη στην ΕλλάδαS

Το παρόν ερωτηματολόγιο γίνεται στο πλαίσιο του έργου LIFE CONOPS το οποίο μελετά τις επιπτώσεις του Ασιατικού κουνουπιού τίγρη (Aedes albopictus) στην Ελλάδα και την Ιταλία. Το έργο "LIFE CONOPS" (LIFE12 ENV/GR/000466) συγχρηματοδοτείται κατά 50% από το Ευρωπαϊκό πρόγραμμα LIFE+ Environment Policy and Governance. Περισσότερες πληροφορίες μπορείτε να βρείτε στην ιστοσελίδα του έργου, www.conops.gr.

Γενικές πληροφορίες για το Ασιατικό κουνούπι τίγρης

Το Ασιατικό κουνούπι τίγρης είναι ένα κανονικό σε μέγεθος κουνούπι με μήκος σώματος παρόμοιο με εκείνο του κοινού κουνουπιού (5-6 mm), ενώ το σώμα του είναι μαύρου χρώματος με λευκές περιοχές στο θώρακα, την κοιλιά και τα πόδια. Τα θηλυκά είναι επιθετικά και τσιμπούν συνήθως κατά τη διάρκεια της ημέρας, με το μέγιστο της δραστηριότητάς τους να παρατηρείται νωρίς το πρωί (06:00 με 08:00) και αργά το απόγευμα (16:00 με 18:00).



Η υγειονομική σημασία του Ασιατικού κουνουπιού τίγρης

Από υγειονομική άποψη το Ασιατικό κουνούπι τίγρης έχει πολύ μεγάλη σημασία καθώς μπορεί να μεταδώσει πολυάριθμες σοβαρές για τον άνθρωπο ασθένειες με σημαντικότερες τους ιούς του Δάγκειου πυρετού και του Chikingunya. Αντίθετα δεν φαίνεται να μεταδίδει άλλες ασθένειες που σχετίζονται με κουνούπια όπως η ελονοσία και ο ιός του Δυτικού Νείλου.

Ανεξάρτητα από την ικανότητα μετάδοσης ασθενειών, η υγειονομική του σημασία έγκειται και στην έντονη όχληση που προκαλεί με τα τσιμπήματά του κυρίως σε αστικές περιοχές όπου καθίσταται δύσκολη η αντιμετώπιση λόγω των πολυάριθμων εστιών ανάπτυξης. Η όχληση που προκαλεί είναι έντονη και πολλές φορές η αντίδραση ευαισθησίας στο δέρμα των θυμάτων είναι εμφανής προκαλώντας κοκκινίλες, φαγούρα ή και εξανθήματα. Τα ευαίσθητα άτομα (μικρά παιδιά) και κυρίως όσοι δεν έχουν συνηθίσει στα «τσιμπήματά» του μπορεί να παρουσιάσουν εξαιρετικά έντονα συμπτώματα που να χρήζουν ακόμη και ιατρικής φροντίδας.

Στην ιστοσελίδα του έργου μπορείτε να βρείτε περισσότερες πληροφορίες που αφορούν στα κουνούπια, www.conops.gr.

Για τη συμπλήρωση του ερωτηματολογίου πατήστε την επιλογή "Συνέχεια"

Συνέχεια »

Ολοκληρώθηκε το 20%

LIFE CONOPS: Ανάπτυξη και επίδειξη διαχειριστικών σχεδίων έναντι των ενισχυόμενων από την κλιματική αλλαγή χωροκατακτητικών κουνουπιών στην Νότια Ευρώπη

Ερωτηματολόγιο για το ιδιωτικό κόστος πρόληψης κατά των επιπτώσεων του Ασιατικού κουνουπιού τίγρη στην ΕλλάδαS

* Απαιτείται

Προσωπικές πληροφορίες

Ονοματεπώνυμο:

Περιοχή κατοικίας *
(Διεύθυνση, Δήμος, Νομός)

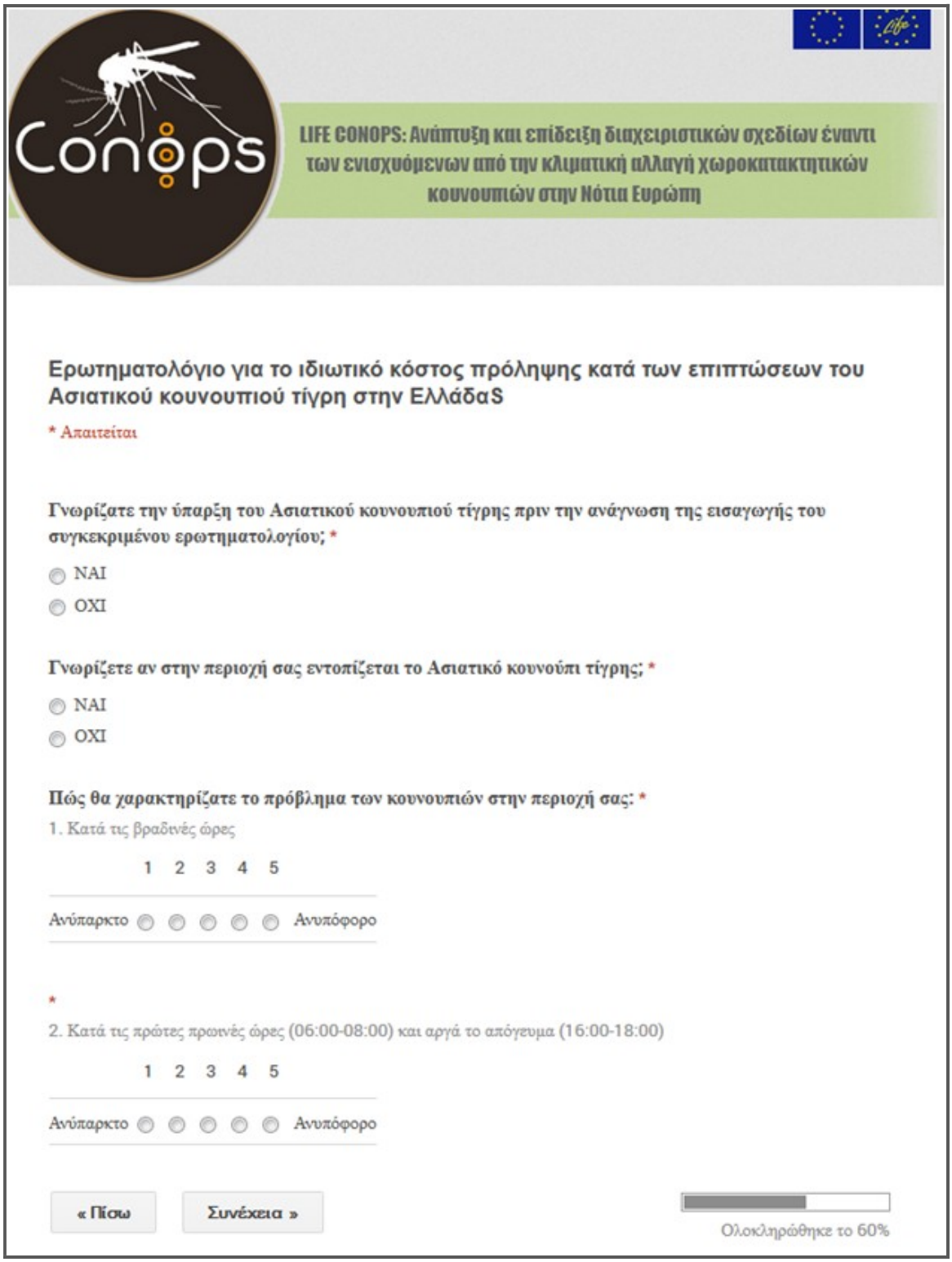
Αριθμός Μελών Νοικοκυριού: *

Ηλικία *

Στοιχεία επικοινωνίας
(τηλέφωνο ή email)

« Πίσω Συνέχεια »

Ολοκληρώθηκε το 40%



LIFE CONOPS: Ανάπτυξη και επίδειξη διαχειριστικών σχεδίων έναντι των ενισχυόμενων από την κλιματική αλλαγή χωροκατακτητικών κουνουπιών στην Νότια Ευρώπη

Ερωτηματολόγιο για το ιδιωτικό κόστος πρόληψης κατά των επιπτώσεων του Ασιατικού κουνουπιού τίγρη στην ΕλλάδαS

* Απαιτείται

Γνωρίζατε την ύπαρξη του Ασιατικού κουνουπιού τίγρης πριν την ανάγνωση της εισαγωγής του συγκεκριμένου ερωτηματολογίου; *

- NAI
- OXI

Γνωρίζετε αν στην περιοχή σας εντοπίζεται το Ασιατικό κουνούπι τίγρης; *

- NAI
- OXI

Πώς θα χαρακτηρίζατε το πρόβλημα των κουνουπιών στην περιοχή σας: *

1. Κατά τις βραδινές ώρες

	1	2	3	4	5	
Ανύπαρκτο	○	○	○	○	○	Ανυπόφορο

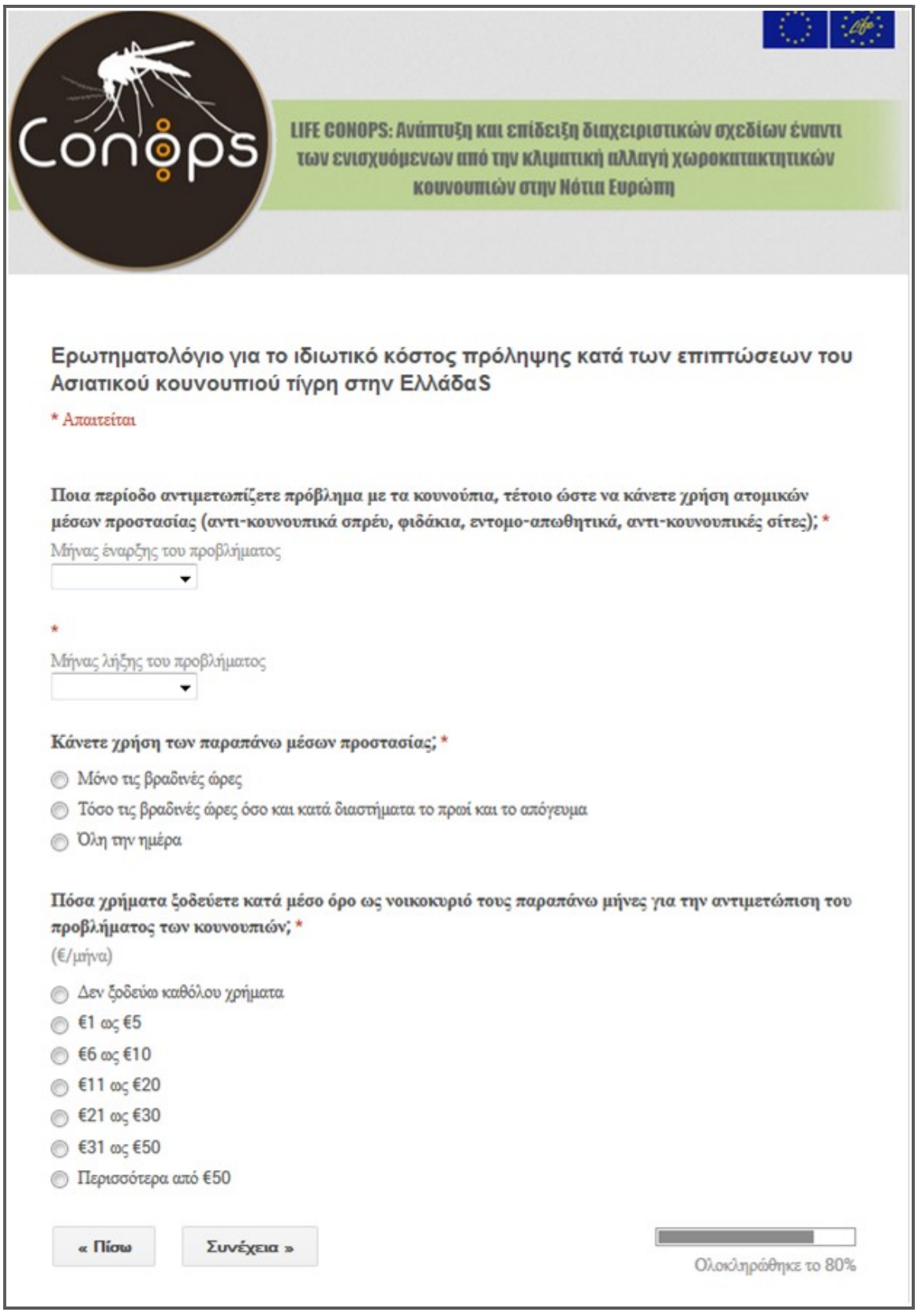
*

2. Κατά τις πρώτες πρωινές ώρες (06:00-08:00) και αργά το απόγευμα (16:00-18:00)

	1	2	3	4	5	
Ανύπαρκτο	○	○	○	○	○	Ανυπόφορο

« Πίσω Συνέχεια »

Ολοκληρώθηκε το 60%



LIFE CONOPS: Ανάπτυξη και επίδειξη διαχειριστικών σχεδίων έναντι των ενισχυόμενων από την κλιματική αλλαγή χωροκατακτητικών κουνουπιών στην Νότια Ευρώπη

Ερωτηματολόγιο για το ιδιωτικό κόστος πρόληψης κατά των επιπτώσεων του Ασιατικού κουνουπιού τίγρη στην ΕλλάδαS

* Απαιτείται

Ποια περίοδο αντιμετωπίζετε πρόβλημα με τα κουνούπια, τέτοιο ώστε να κάνετε χρήση ατομικών μέσων προστασίας (αντι-κουνουπικά σπρέυ, φιδάκια, εντομο-απωθητικά, αντι-κουνουπικές σίτες); *

Μήνας έναρξης του προβλήματος

*

Μήνας λήξης του προβλήματος

Κάνετε χρήση των παραπάνω μέσων προστασίας; *

- Μόνο τις βραδινές ώρες
- Τόσο τις βραδινές ώρες όσο και κατά διαστήματα το πρωί και το απόγευμα
- Όλη την ημέρα

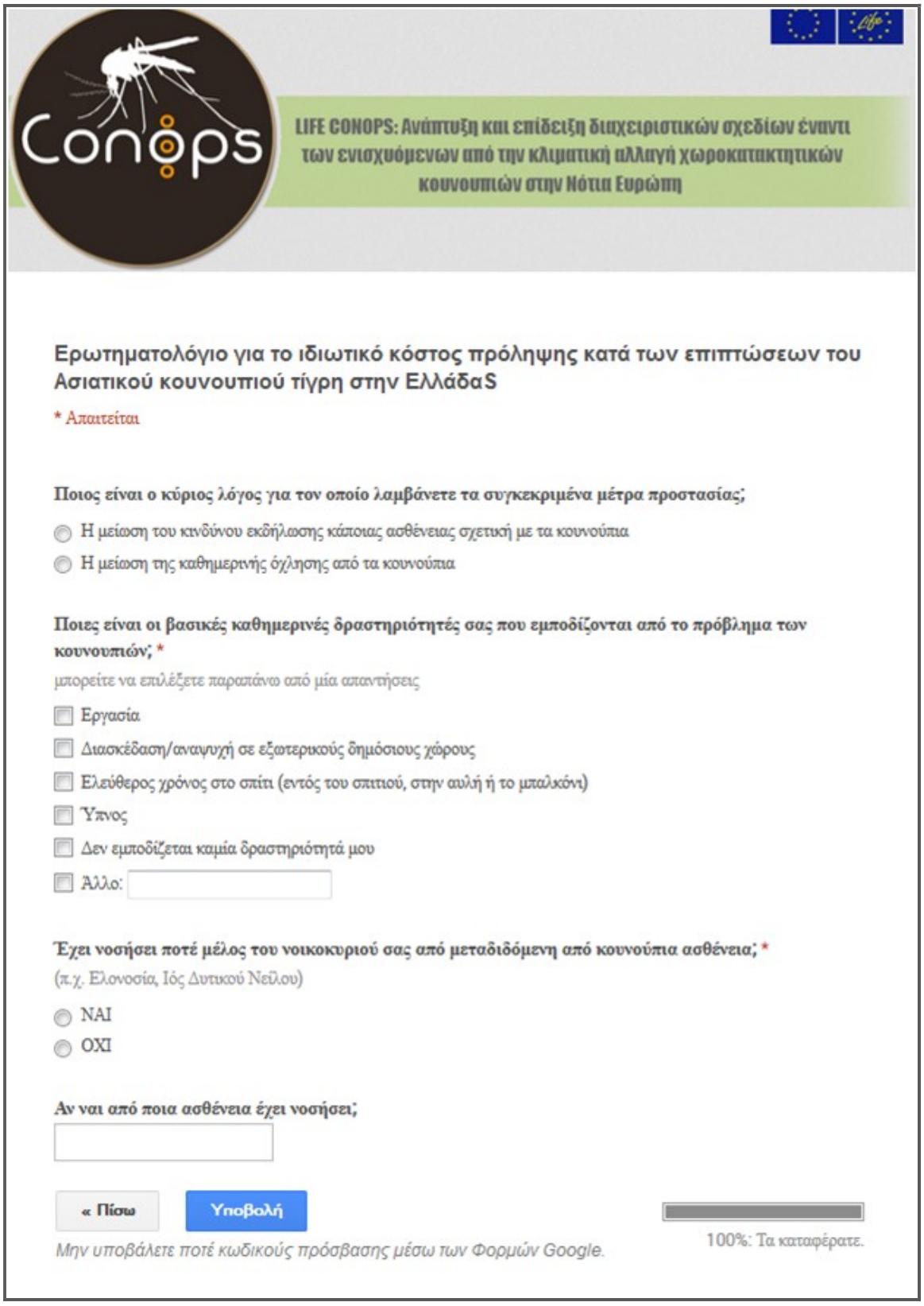
Πόσα χρήματα ξοδεύετε κατά μέσο όρο ως νοικοκυριό τους παραπάνω μήνες για την αντιμετώπιση του προβλήματος των κουνουπιών; *

(€/μήνα)

- Δεν ξοδεύω καθόλου χρήματα
- €1 ως €5
- €6 ως €10
- €11 ως €20
- €21 ως €30
- €31 ως €50
- Περισσότερα από €50

« Πίσω Συνέχεια »

Ολοκληρώθηκε το 80%



LIFE CONOPS: Ανάπτυξη και επίδειξη διαχειριστικών σχεδίων έναντι των ενισχυόμενων από την κλιματική αλλαγή χωροκατακτητικών κουνουπιών στην Νότια Ευρώπη

Ερωτηματολόγιο για το ιδιωτικό κόστος πρόληψης κατά των επιπτώσεων του Ασιατικού κουνουπιού τίγρη στην ΕλλάδαS

* Απαιτείται

Ποιος είναι ο κύριος λόγος για τον οποίο λαμβάνετε τα συγκεκριμένα μέτρα προστασίας;

- Η μείωση του κινδύνου εκδήλωσης κάποιας ασθένειας σχετική με τα κουνούπια
- Η μείωση της καθημερινής όχλησης από τα κουνούπια

Ποιες είναι οι βασικές καθημερινές δραστηριότητές σας που εμποδίζονται από το πρόβλημα των κουνουπιών; *

μπορείτε να επιλέξετε παραπάνω από μία απαντήσεις

- Εργασία
- Διασκέδαση/αναψυχή σε εξωτερικούς δημόσιους χώρους
- Ελεύθερος χρόνος στο σπίτι (εντός του σπιτιού, στην αυλή ή το μπαλκόνι)
- Ύπνος
- Δεν εμποδίζεται καμία δραστηριότητά μου
- Άλλο:

Έχει νοσήσει ποτέ μέλος του νοικοκυριού σας από μεταδιδόμενη από κουνούπια ασθένεια; *

(π.χ. Ελονοσία, Ιός Δυτικού Νείλου)

- ΝΑΙ
- ΟΧΙ

Αν ναι από ποια ασθένεια έχει νοσήσει;

« Πίσω | Υποβολή

Μην υποβάλετε ποτέ κωδικούς πρόσβασης μέσω των Φορμών Google.

100%: Τα καταφέρατε.

8.3 Further Statistical Analysis of selected survey findings in the two cases of Greece and Italy Σφάλμα! Δεν έχει οριστεί σελιδοδείκτης.

The Figures below provide an indication of the geographical distribution of the nuisance levels and cost categories associated with the overall mosquito problem.

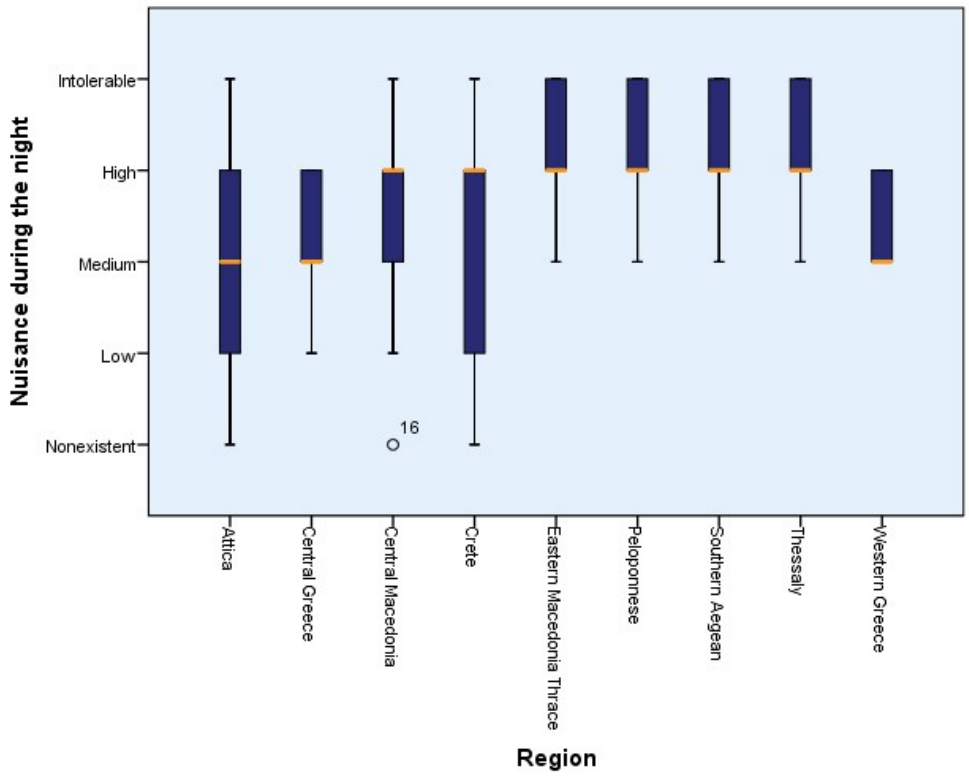


Figure 8-1. Box-plot presenting the distribution of nuisance level during the night-time in various regions of Greece

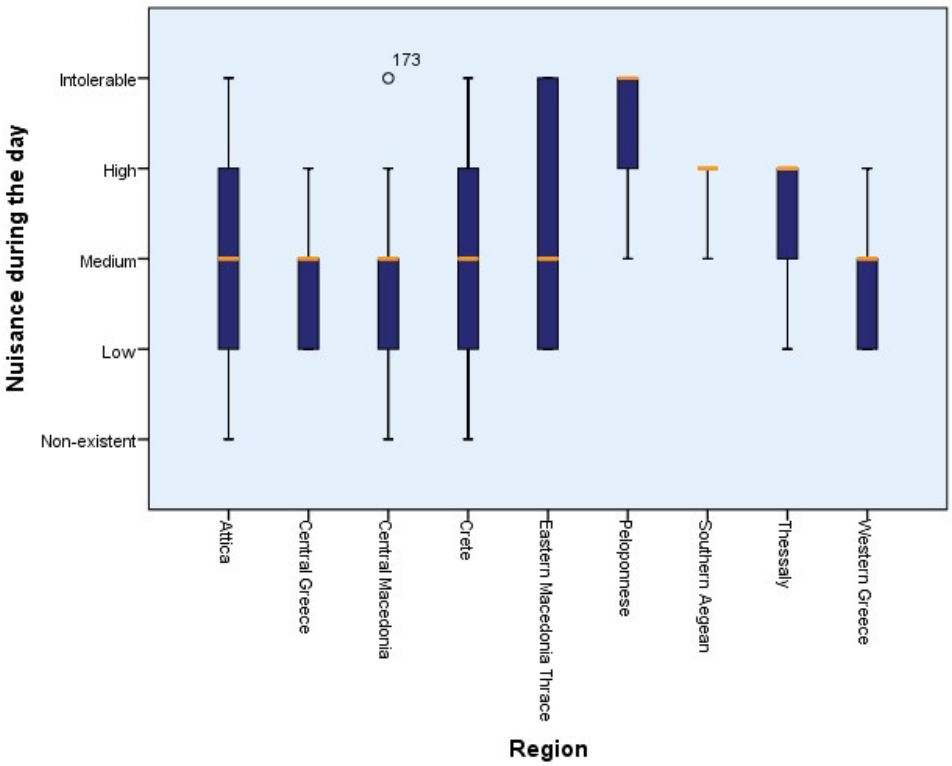


Figure 8-2. Box-plot presenting the distribution of nuisance level during the day-time in various regions of Greece

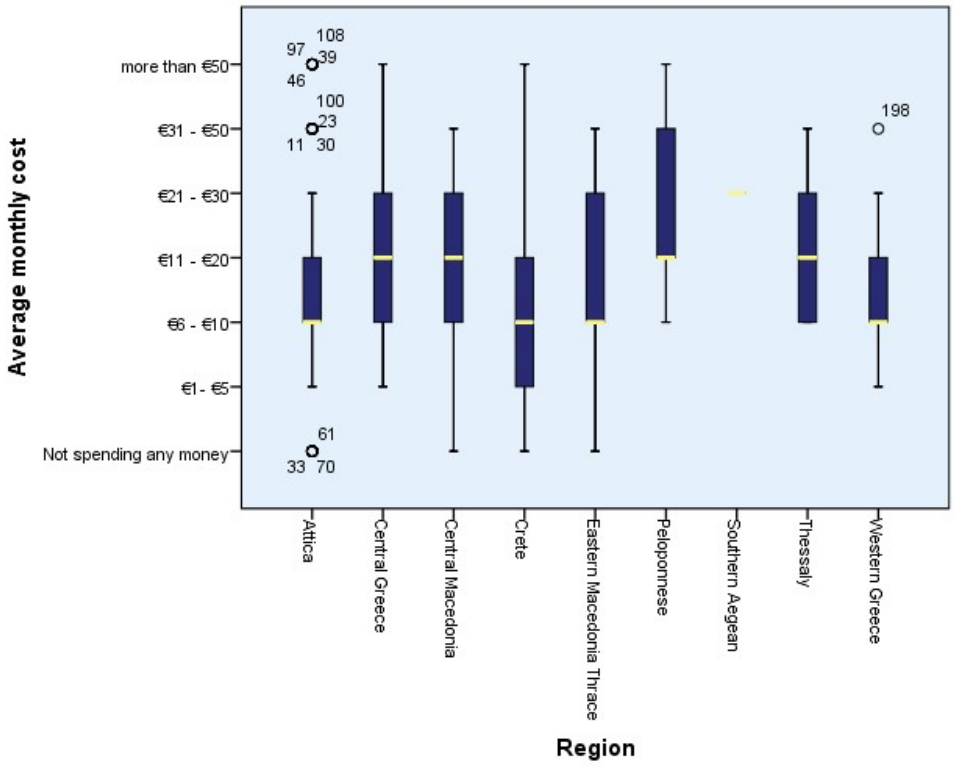


Figure 8-3. Box-plot presenting the distribution of average private prevention cost in various regions of Greece

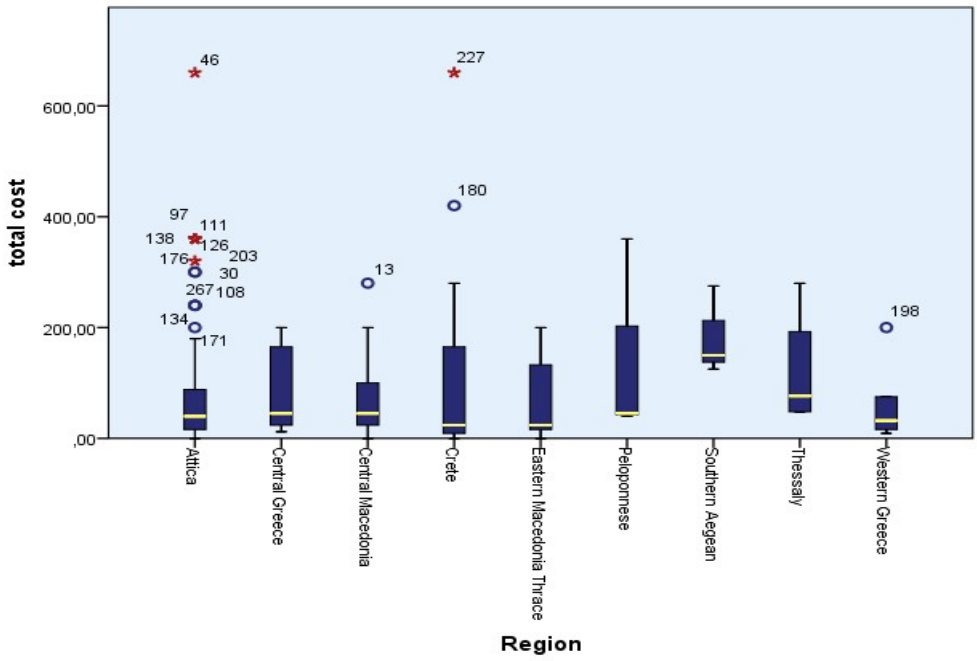


Figure 8-4. Box-plot presenting the distribution of total annual private prevention cost in various regions of Greece

Table 8-1. Correlations between nuisance (disturbance) level and average private cost in Greece

		Nuisance level during the night	Nuisance level during the day	Average private cost
Nuisance level during the night	Pearson Correlation	1	.555**	.348**
	Sig. (2-tailed)		.000	.000
	N	273	273	273
Nuisance level during the day	Pearson Correlation	.555**	1	.270**
	Sig. (2-tailed)	.000		.000
	N	273	273	273
Average private cost	Pearson Correlation	.348**	.270**	1
	Sig. (2-tailed)	.000	.000	
	N	273	273	273

***. Correlation is significant at the 0.01 level (2-tailed).*

Table 8-2. Correlations between nuisance (disturbance) level and average private cost in Italy

		Nuisance level during the night	Nuisance level during the day	Average private cost
Nuisance level during the night	Pearson Correlation	1	.316**	.417**
	Sig. (2-tailed)		.001	.000
	N	99	99	95
Nuisance level during the day	Pearson Correlation	.316**	1	.434**
	Sig. (2-tailed)	.001		.000
	N	99	99	95
Average private cost	Pearson Correlation	.417**	.434**	1
	Sig. (2-tailed)	.000	.000	
	N	95	95	95

***. Correlation is significant at the 0.01 level (2-tailed).*

According to Tables 8.1 and 8.2, there is a positive and statistical significant correlation between the average private cost and the nuisance levels (during nighttime, as well as, during daytime). However, higher nuisance (disturbance) levels

during the day can be mainly attributed to the Asian tiger mosquito, because in contrast to the indigenous species - it is more active during day. Therefore, the presence of the Asian tiger mosquito in a region seems to generate higher private prevention costs.

Table 8-3. T-Test for the difference between the mean private cost (per month) of households that use individual protective measures: (a) during night-time, (b) during all-day – Application in Greece

Group Statistics

	Hours during the day that protective measures are used	N	Mean	Std. Deviation	Std. Error Mean
Cost (€/month)	During nigh-time	159	13.818	13.225	1.049
	During all-day	33	29.121	20.499	3.569

Independent Samples Test

		Levene's Test		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Cost (€/month)	Equal variances assumed	20.835	.000	-5.440	190	.000	-15.30	2.812	-20.852	-9.755
	Equal variances not assumed			-4.114	37.710	.000	-15.30	3.719	-22.835	-7.772

According to the Table 8.3 the null hypothesis that the two samples have equal means (monthly costs) is rejected at the 5% significance level. Therefore, people that use protective measures all day long (i.e. in areas where the Asian tiger mosquito is present) tend to spend more money on private prevention costs. The cost difference

was found to be 15.3€/month, with 95% confidence interval from 9.75 to 20.85 €/month.

Table 8-4. T-Test for the difference between the mean private cost (per month) of households that use individual protective measures: (a) during nighttime, (b) all day – Application in Italy

Group Statistics

	Hours during the day that protective measures are used	N	Mean	Std. Deviation	Std. Error Mean
Cost (€/month)	During nighttime	18	14.944	11.185	2.637
	All day	31	25.355	20.157	3.620

Independent Samples Test

		Levene's Test		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Cost (€/month)	Equal variances assumed	7.521	.009	-2.013	47	.049	-10.410	5.172	-20.814	-0.155
	Equal variances not assumed			-2.325	46.95	.024	-10.410	4.478	-19.420	-1.400

8.4 Collaboration between HCDCP and Research Institute of Urban Environment and Human Resources- Panteion University for the assessment of Medical Costs brought by mosquito borne diseases in selected Greek Regions

1. Accounting of Direct and Indirect Impacts, for which costs have to be estimated

Table 1: Categorization of Medical Impacts for West Nile outbreak in CM (Central Macedonia) 2010-2013

IMPACTS	Categories	No. of cases that impact applies 2010	No. of cases that impact applies 2011	No. of cases that impact applies 2012	No. of cases that impact applies 2013
Direct Impacts					
Inpatient Economic Impacts					
	Hospitalization				
Outpatient Economic Impacts					
	Medication				

	Consultations				
	Outpatient Physical Therapy				
	Other Family Costs				
Indirect Impacts					
	Productivity Loss				

Table 2: Categorization of Medical Impacts for Malaria outbreak in Lakonia 2011-2013

IMPACTS	Categories	No. of cases that cost applies 2011	No. of cases that cost applies 2012	No. of cases that cost applies 2013
Direct Impacts				
Inpatient Economic Impacts				
	Hospitalization			
Outpatient Economic Impacts				
	Medication			
	Consultations			
	Outpatient Physical Therapy			
	Other Family Costs			
Indirect Impacts				
	Productivity Loss			

2. Direct Costs

Table 3: Inpatient treatment costs for Malaria outbreak in Lakonia 2011-2013

Cost Categories	Quantity (No of cases)	Days Of Hospitalization [1]	Total Days of Hospitalization [2]	Disease Coefficient of Daily Cost (Cost per case)	Total Cost
Hospitalization of patients 2011					
Hospitalization of patients 2012					
Hospitalization of patients 2013					
Total Cost for all years 2011-2013					

[1] Estimation of Mean Duration of Hospitalization for specific disease case.

[2] Estimation of Total Days of Hospitalization for all cases (Total Days of Hospitalization = "No. of cases" X "Days of Hospitalization")

Table 4: Inpatient treatment costs for West Nile outbreak in CM 2010-2013

Cost Categories	Quantity (No of cases)	Days Of Hospitalization [1]	Total Days of Hospitalization [2]	Disease Coefficient of Daily Cost (Cost per case)	Total Cost
Hospitalization of patients 2010					
Hospitalization of patients 2011					
Hospitalization of patients 2012					
Hospitalization of patients 2013					
Total Cost for all years 2010-2013					

[1] Estimation of Mean Duration of Hospitalization for specific disease case.

[2] Estimation of Total Days of Hospitalization for all cases (Total Days of Hospitalization = "No. of cases" X "Days of Hospitalization")

Table 5: Outpatient treatment costs for Malaria outbreak in Lakonia 2011-2013

Cost Categories	Quantity (No of cases that cost applies)	Coefficient of Cost Category	Total Cost
Medication in Hospital 2011			
Medication in Hospital 2012			
Medication in Hospital 2013			
Medication Provided by HCDCP 2011			
Medication Provided by HCDCP 2012			
Medication Provided by HCDCP 2013			
Consultations 2011			
Consultations 2012			
Consultations 2013			
Outpatient Physical Therapy 2011			

Outpatient Physical Therapy 2012			
Outpatient Physical Therapy 2013			
Other Family Costs [1] 2011			
Other Family Costs [1] 2012			
Other Family Costs [1] 2013			
Total Cost for all years 2011-2013			

[1] Family Costs include: Nursing Home costs, Transportation costs, Home health aides, Out of pocket payments for drugs

It should be noted that the categorization of cost parameters is identical and could change (add/ subtract categories) according to the appropriateness of the case examined and the availability of data.

Table 6: Outpatient treatment costs for West Nile outbreak in C.M. 2010-2013

Cost Categories	Quantity (No of cases that cost applies)	Coefficient of Cost Category	Total Cost
Medication in Hospital 2010			
Medication in Hospital 2011			
Medication in Hospital 2012			
Medication in Hospital 2013			
Medication Provided by HCDCP 2010			
Medication Provided by HCDCP 2011			
Medication Provided by HCDCP 2012			
Medication Provided by HCDCP 2013			
Consultations 2010			
Consultations 2011			

Consultations 2012			
Consultations 2013			
Outpatient Physical Therapy 2010			
Outpatient Physical Therapy 2011			
Outpatient Physical Therapy 2012			
Outpatient Physical Therapy 2013			
Other Family Costs [1] 2010			
Other Family Costs [1] 2011			
Other Family Costs [1] 2012			
Other Family Costs [1] 2013			
Total Cost for all years 2010-2013			

[1] Family Costs include: Nursing Home costs, Transportation costs, Home health aides, Out of pocket payments for drugs

It should be noted that the categorization of cost parameters is identical and could change (add/ subtract categories) according to the appropriateness of the case examined and the availability of data.

3. Indirect Costs

Table 7: Evaluation of Indirect Medical Costs for *Malaria outbreak in Lakonia 2011-2013*

Productivity Loss	Value Work day Missed [1]	No. work days missed	No. 15<Patients <65	Total Cost
15<Patients<65 2011				
15<Patients<65 2012				
15<Patients<65 2013				

Caretakers 2011				
Caretakers 2012				
Caretakers 2013				
Total Costs for all years 2011-2013				

[1] Annual Gross Salary divided by 220 days/ year

Table 8: Evaluation of Indirect Medical Costs for West Nile outbreak in CM 2010-2013

Productivity Loss	Value Work day Missed [1]	No. work days missed	No. 15<Patients <65	Total Cost
15<Patients<65 2010				
15<Patients<65 2011				
15<Patients<65 2012				

15<Patients<65 2013				
Caretakers 2010				
Caretakers 2011				
Caretakers 2012				
Caretakers 2013				
Total Costs for all years 2011-2013				

[1] Annual Gross Salary divided by 220 days/ year

4. Other Cost Categories

This category includes: various Prevention, Control and other Indirect Impact Costs related to the appearance specific epidemics.

Table 9. Other Cost Categories related to Malaria outbreak in Lakonia 2011-2013.

Cost Categories	Cost for year 2011	Cost for year 2012	Cost for year 2013	Total Cost for all years

Emergency Surveillance Costs (after announcement of epidemics)				
Diagnosis- Pretreatment costs				
Information-Awareness-Campaign Costs				
Emergency Spraying				
Personnel Cost (for HCDCP staff)				
Purchase of specialized machinery equipment				
Blood Transfusion [1]				
Losses on Tourism and other economic sectors [2]				

[1], [2] May require a distinct methodology for their evaluation

It should be noted that the categorization of cost parameters is identical and could change (add/ subtract categories) according to the appropriateness of the case examined and the availability of data.

Table 10. Other Cost Categories related to West Nile outbreak in CM 2010-2013.

Cost Categories	Cost for year 2010	Cost for year 2011	Cost for year 2012	Cost for year 2013	Total Cost for all years

Emergency Surveillance Costs (after announcement of epidemics)					
Diagnosis- Pretreatment costs					
Information-Awareness-Campaign Costs					
Emergency Spraying					
Personnel Cost (for HCDCP staff)					
Purchase of specialized machinery equipment					
Blood Transfusion [1]					
Losses on Tourism and other economic sectors [2]					

[1], [2] May require a distinct methodology for their evaluation

It should be noted that the categorization of cost parameters is identical and could change (add/ subtract categories) according to the appropriateness of the case examined and the availability of data.

8.5 Collaboration between University of Bologna and Research Institute of Urban Environment and Human Resources- Panteion University for the assessment of Medical Costs brought by Chikungunya 2007 in the Region of Emilia Romagna

1. Accounting of Direct and Indirect Impacts, for which costs have to be estimated

Table 1: Categorization of the Impacts of the Chikungunya outbreak in EM 2007.

Impacts	Categories	No. of cases that impact applied
Direct Impacts		
Inpatient Economic Impacts		
	Hospitalization	
Outpatient Economic Impacts		
	Medication	
	Consultations	
	Outpatient Physical Therapy	

	Other Family Costs	
Indirect Impacts		
	Productivity Loss	

2. Direct Costs

Table 2: Inpatient treatment costs for Chikungunya outbreak in EM 2007.

Cost Categories	Quantity (No of cases)	Days Of Hospitalization [1]	Total Days of Hospitalization [2]	Disease Coefficient of Daily Cost (Cost per case)	Total Cost
Hospitalization of patients					
Total Cost					

[1] Estimation of Mean Duration of Hospitalization for specific disease case.

[2] Estimation of Total Days of Hospitalization for all cases (Total Days of Hospitalization = "No. of cases" X "Days of Hospitalization")

Table 3: Outpatient treatment costs for Chikungunya outbreak in EM 2007.

Cost Categories	Quantity (No of cases that cost applies)	Coefficient of Cost Category	Total Cost
Medication in Hospital			
Medication Provided by other Medical Teams			
Consultations			
Outpatient Physical Therapy			
Other Family Costs [1]			
Total Cost			

[1] Family Costs include: Nursing Home costs, Transportation costs, Home health aides, Out of pocket payments for drugs

It should be noted that the categorization of cost parameters is identical and could change (add/ subtract categories) according to the appropriateness of the case examined and the availability of data.

3. Indirect Costs

Table 4: Evaluation of Indirect Medical Costs for Chikungunya outbreak in EM 2007.

Productivity Loss	Value Work day Missed [1]	No. work days missed	No. 15<Patients <65	Total Cost
15<Patients<65				
Caretakers				
Total Costs				

[1] Annual Gross Salary divided by 220 days/ year (the number of average working days in Italy should be adjusted)

4. Other Cost Categories

This category includes: various Prevention, Control and other Indirect Impact Costs related to the appearance specific epidemics.

Table 5. Other Cost Categories related to Chikungunya outbreak in EM 2007.

Cost Categories	Cost for year 2007	Cost for year 2008	Cost for year 2009	Total Cost for all years
Emergency Surveillance Costs (after announcement of epidemics)				
Diagnosis- Pretreatment costs				
Information-Awareness-Campaign Costs				
Emergency Spraying				
Personnel Cost (for other Medical Teams)				
Purchase of specialized machinery equipment				
Blood Transfusion [1]				
Losses on Tourism and other economic sectors [2]				

[1], [2] May require a distinct methodology for their evaluation

It should be noted that the categorization of cost parameters is identical and could change (add/ subtract categories) according to the appropriateness of the case examined and the availability of data.

8.6 ICD-9 codes of signs related to Chikungunya virus infection (in Italian)

CAPITOLO E CATEGORIA DI MALATTIE	CODICE ICD-9
CAPITOLO I: MALATTIE INFETTIVE E PARASSITARIE	
Malattie infettive intestinali	008*, 009*
Altre malattie batteriche	035, 038*, 041*
Malattie virali con esantema	057.9
Malattie virali da artropodi	062*, 064*, 065.4, 065.9, 066.9
Altre malattie da virus e Chlamydiae	070.4, 070.5, 070.6, 070.7, 070.9 079.9
CAPITOLO III: MALATTIE ENDOCRINE, NUTRIZIONALI, METABOLICHE E DISTURBI IMMUNITARI	
Altri disturbi metabolici ed immunitari	276.5
CAPITOLO IV: MALATTIE DEL SANGUE E DEGLI ORGANI EMATOPOIETICI	
Malattie del sangue e degli organi ematopoietici	287*,288.2,288.3, 288.4 , 288.5, 288.6, 288.8, 288.9

CAPITOLO V: DISTURBI MENTALI	
Psicosi	296.2
CAPITOLO VI: MALATTIE SISTEMA NERVOSO	
Malattie infiammatorie del sistema nervoso centrale	323*,
altri disturbi del sistema nervoso centrale	345.9, 346.9
disturbi del sistema nervoso periferico	359.8, 359.9
CAPITOLO XI COMPLICAZIONI DELLA GRAVIDANZA DEL PARTO E DEL PUERPERIO	
Complicazioni principalmente correlate alla gravidanza	647.6, 647.8, 647.9
CAPITOLO XII: MALATTIA DELLA PELLE E DEL TESSUTO SOTTOCUTANEO	
Infezioni della cute e del tessuto sottocutaneo	686*
Altre manifestazioni infiammatorie della cute e del tessuto sottocutaneo	692.9, 694.0, 694.1, 694.8, 694.9, 695.8 , 695.9, 698*
CAPITOLO XII: MALATTIE DEL SISTEMA OSTEOMUSCOLARE E DEL TESSUTO	

CONNETTIVO	
Artropatie e disturbi correlati	711.8, 711.9, 714.9, 716.2, 716.4, 716.5, 716.6, 716.8, 716.9, 719
Reumatismo, escluse le forme dorsali	727.9, 728.8, 728.9, 729*
CAPITOLO XVI SINTOMI, SEGNI E STATI MORBOSI MAL DEFINITI	
Sintomi	780.3, 780.6, 780.7, 781.9, 782.1, 784.0, 787.0

8.7 Table of the Control Response According To Various Risk Levels in the frames of LIFE CONOPS Project

RISK LEVEL	Probability of Human Outbreak	Description	Recommended Response	Indicative Annual Cost
Low Risk Level: A	Unknown/not expected	Ecological condition suitable to VBDs and/or past evidences Indications of IMS Presence or Established IMS Population	Consider and develop a preparedness plan Implementation of the preparedness plan, including surveillance activities and an integrated vector control program Allocate resources	Public Authorities (as a policy) Cost per prefecture Regular vector control programs Estimation of the extra Cost for: 2 Pest Control Technicians/8 hours work (the estimation of the total cost must include the use of the appropriate equipment, the cost of the movement, the cost of the biocides and the

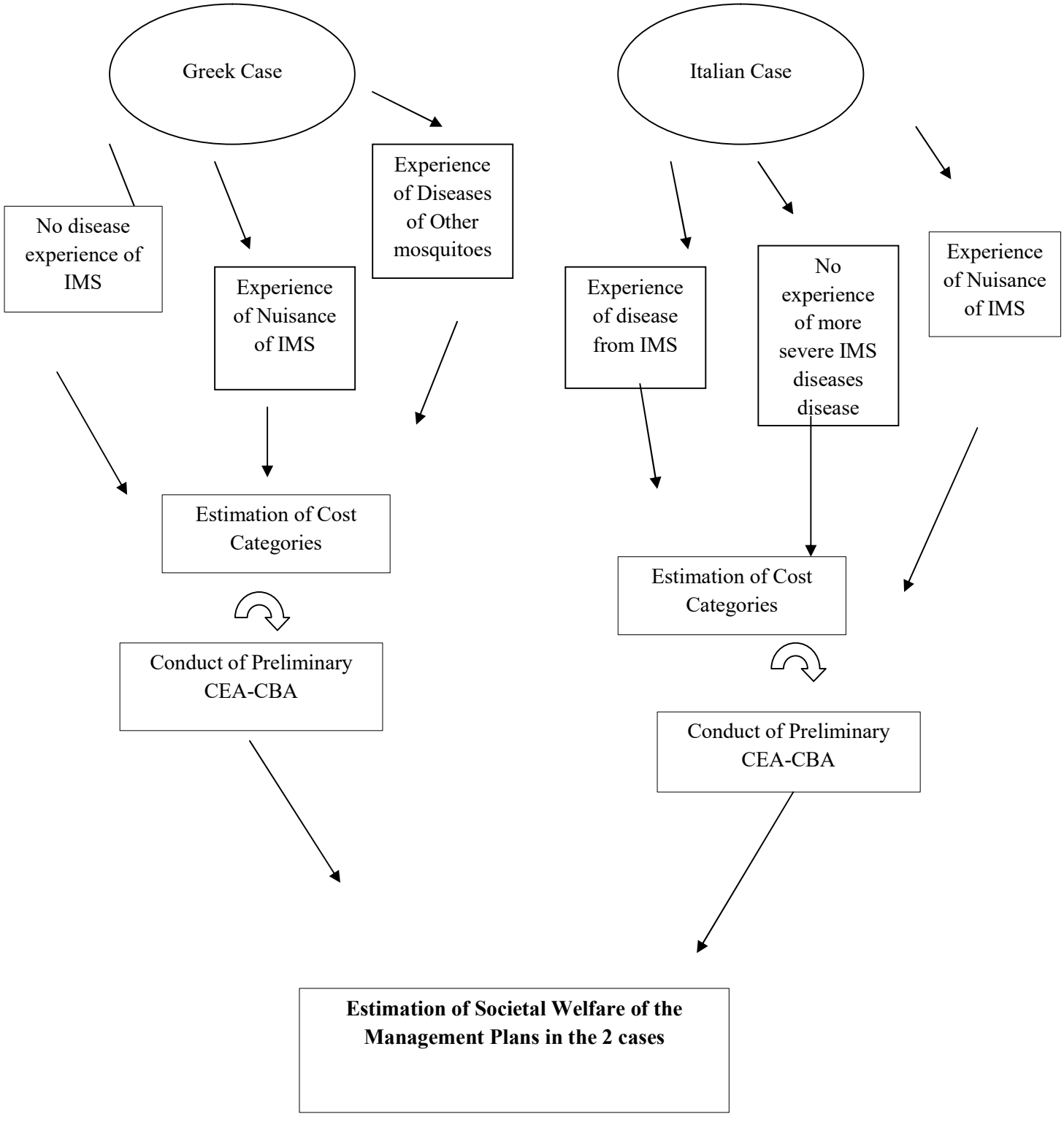
			necessary to enable emergency response. (eg an imported case)	VAT)

Medium Risk Level: B	Low to Moderate	Current surveillance findings (i.e. IMS mosquitoes VBDs activity in the area) Complaints for IMS nuisance from citizens and organizations Presence or establishment of IMS in Neighboring Areas	As in risk level A AND Implement public education programs focused on risk potential, personal protection, and emphasizing residential source reduction Vector control focuses on larval control Standard control measures in public areas If public health authorities have evidences for	Organized by local authorities Estimation of the extra Cost for: 2 Pest Control Technicians/8 hours work (the estimation of the total cost must include the use of the appropriate equipment, the cost of the movement, the cost of the biocides and the VAT) Estimation of the extra Cost for: 2

			possible virus circulation then increasing initiate ground adult control in areas at high risk for humans or in hot spot sites (if known) AND Budget to cover relevant expenses, such as: -evaluation of mosquito control programs and -Resistance prevention -check the virus status in IMS adults	Pest Control Technicians/8 hours work (the estimation of the total cost must include the use of the appropriate equipment, the cost of the movement, the cost of the biocides and the VAT) 5-10% from the final total budget of control programs

High Risk Level: C	High/ongoing outbreak	At least one human case detected (i.e. probable or confirmed human case according to EU case definition) AND/OR Detection of cases of IMS diseases in Neighboring Areas Indigenous case of IMS disease	As in risk level B AND If surveillance indicates virus circulation intensify ground adult mosquito control with multiple applications in areas of high risk AND monitor efficacy of spraying on target mosquito populations Enhance risk communication AND in case a large area is involved coordinate the program by an emergency unit with all authorities involved	Estimation of the extra Cost for: 2 Pest Control Technicians/8 hours work (the estimation of the total cost must include the use of the appropriate equipment, the cost of the movement, the cost of the biocides and the VAT) Public authorities (as a policy)

8.8 Strategic Plan for the Estimation of Societal Welfare of the Management Plans proposed under the LIFE CONOPS Project



8.9 The Complete Choice Experiment Survey Questionnaire to Households in Greek

LIFE CONOPS

"Ανάπτυξη και επίδειξη διαχειριστικών σχεδίων έναντι των ενισχυόμενων από την κλιματική αλλαγή χωροκατακτητικών κουνουπιών στην Νότια Ευρώπη" (LIFE12ENV/GR/0046)

Ερευνά αποτίμησης του ιδιωτικού οφέλους από την εφαρμογή συμπληρωματικών προγραμμάτων καταπολέμησης των κουνουπιών

Το παρόν ερωτηματολόγιο γίνεται στο πλαίσιο του έργου LIFE CONOPS το οποίο μελετά τις επιπτώσεις του Ασιατικού κουνουπιού Τίγρη (Aedes albopictus) στην Ελλάδα και την Ιταλία. Έχετε επιλεγεί τυχαία μαζί με ένα μεγάλο αριθμό κατοίκων της Αττικής που επίσης συμμετείχαν στη έρευνα αυτή. Σκοπός της έρευνας είναι να διερευνήσουμε τις προτιμήσεις σας αναφορικά με τα μέτρα καταπολέμησης των κουνουπιών. Οι απαντήσεις είναι εμπιστευτικές και θα χρησιμοποιηθούν αποκλειστικά για ερευνητικούς σκοπούς.

<u>Περιοχή Μόνιμης Κατοικίας</u> (Δήμος):

Πληροφορίες για το Ασιατικό κουνούπι Τίγρης:

Το Ασιατικό κουνούπι τίγρης είναι ένα κανονικό σε μέγεθος κουνούπι με μέγεθος παρόμοιο με εκείνο του κοινού κουνουπιού, ενώ χαρακτηριστικό της εμφάνισής του είναι το μαύρο χρώμα του σώματός τους με κάποιες λευκές περιοχές. Είναι αρκετά επιθετικά κουνούπια τα οποία τσιμπούν συνήθως κατά τη διάρκεια της ημέρας, κυρίως νωρίς το πρωί και αργά το απόγευμα. Τα τσιμπήματά του προκαλούν έντονη όχληση προκαλώντας κοκκινίλες, φαγούρα ή και εξανθήματα. Επίσης, το Ασιατικό κουνούπι τίγρης μπορεί να μεταδώσει ορισμένες σοβαρές για τον άνθρωπο ασθένειες, δεν ευθύνεται όμως για όλες τις ασθένειες που σχετίζονται με κουνούπια (π.χ. ελονοσία και Ιός του Δυτικού Νείλου).

Α. Ερωτήσεις γνώσης/αξιολόγησης του προβλήματος των κουνουπιών και ειδικότερα του Τίγρη και ερωτήσεις ατομικού κόστους προστασίας

1. Θεωρείτε τα κουνούπια ως κίνδυνο για τη δημόσια υγεία;

☐ Ναι ☐ Ίσως ☐ Όχι ☐ Δεν γνωρίζω

2. Θεωρείτε την παρουσία κουνουπιών σε μια περιοχή ως παράγοντα υποβάθμισης της ποιότητας ζωής;

☐ Ναι ☐ Ίσως ☐ Όχι ☐ Δεν γνωρίζω

3. Γνωρίζατε την ύπαρξη του Ασιατικού κουνουπιού τίγρης πριν την ανάγνωση της εισαγωγής του συγκεκριμένου ερωτηματολογίου;

☐ Ναι ☐ Όχι

4. Γνωρίζετε αν στην περιοχή σας εντοπίζεται το Ασιατικό κουνούπι τίγρης;

☐ Ναι ☐ Όχι

5. Πώς θα χαρακτηρίζατε το πρόβλημα των κουνουπιών στην περιοχή σας;

i) κατά τις βραδινές ώρες;

☐ Ανυπόφορο ☐ Μεγάλο ☐ Μέτριο ☐ Μικρό ☐ Ανύπαρκτο

ii) κατά τις πρώτες πρωινές ώρες και αργά το απόγευμα;

☐ Ανυπόφορο ☐ Μεγάλο ☐ Μέτριο ☐ Μικρό ☐ Ανύπαρκτο

6. Θεωρείτε ότι το επίπεδο όχλησης από τα κουνούπια τα τελευταία χρόνια:

☐ Έχει αυξηθεί ☐ Είναι το ίδιο ☐ Έχει μειωθεί

7. **Ποια περίοδο αντιμετωπίζετε πρόβλημα με τα κουνούπια, τέτοιο ώστε να κάνετε χρήση ατομικών μέσων προστασίας** (αντικουνουπικά σπρέυ, φιδάκια, εντομο-απωθητικά, αντικουνουπικές σίτες, κτλ);

   Μήνας έναρξης του προβλήματος:_____

   Μήνας λήξης του προβλήματος: _____

8. **Κάνετε χρήση των παραπάνω μέσων προστασίας:**

   α. Μόνο τις βραδινές ώρες

   β. Τόσο τις βραδινές ώρες όσο και κατά διαστήματα το πρωί και το απόγευμα

   γ. Όλη την ημέρα

9. **Πόσα χρήματα ξοδεύετε κατά μέσο όρο ως νοικοκυριό τους παραπάνω μήνες για την αντιμετώπιση του προβλήματος των κουνουπιών** (€/ μήνα);

   α. Δεν ξοδεύω καθόλου χρήματα

   β. €1ως €5

   γ. €6 ως €10

   δ. €11 ως €20

   ε. €21 ως €30

   στ. €31 ως €50

   η. Περισσότερα από €50

10. **Έχει νοσήσει ποτέ μέλος της οικογένειάς σας από μεταδιδόμενη από κουνούπια ασθένεια** (π.χ. Ελονοσία, Ιός Δυτικού Νείλου);

Ναι ☐ Όχι ☐

Αν ναι από ποια ασθένεια έχει νοσήσει;.....

11. Θεωρείτε απαραίτητο να ληφθούν παραπάνω μέτρα καταπολέμησης των κουνουπιών στον Δήμο όπου κατοικείτε; Ναι Όχι

Β. Μέθοδος αποτίμησης: περιγραφή – κάρτες επιλογής

Καλείστε τώρα να επιλέξετε την εφαρμογή (ή μη) ενός συμπληρωματικού προγράμματος καταπολέμησης των κουνουπιών το οποίο θα στοχεύει στη μείωση των επιπτώσεων στην υγεία και στη μείωση της όχλησης που προκαλούνται από τα διάφορα είδη κουνουπιών συμπεριλαμβανομένου και του ασιατικού κουνουπιού Τίγρης. Στο πλαίσιο αυτό καλείστε να επιλέξετε μεταξύ εναλλακτικών προγραμμάτων καταπολέμησης, τα οποία θα διαφέρουν στα παρακάτω χαρακτηριστικά:

I. **Μείωση του κινδύνου σοβαρής ασθένειας εξαιτίας του Ιού του Δυτικού Νείλου.** Ο ιός του ΔΝ μεταδίδεται με τσίμπημα μολυσμένων κουνουπιών. Η μεταφορά του ιού γίνεται από το κοινό κουνούπι και όχι από το κουνούπι Τίγρης. Οι περισσότεροι άνθρωποι που μολύνονται με τον ιό δεν παρουσιάζουν συμπτώματα, 1 στους 5 εμφανίζει κάποια ήπια συμπτώματα και λιγότερο από 1 στους 100 παρουσιάζει σοβαρές επιπλοκές (εγκεφαλίτιδα, μηνιγγίτιδα, κτλ). Οι πιο σοβαρές εκδηλώσεις του ιού εμφανίζονται συνήθως σε άτομα μεγαλύτερης ηλικίας και άτομα με σοβαρά προβλήματα υγείας. Τρία είναι τα επίπεδα κινδύνου που μπορεί να προκύψουν από τη μελλοντική καταπολέμηση των κουνουπιών:

- **Μεγάλος κίνδυνος**: Αντιστοιχεί στο σημερινό επίπεδο κινδύνου. Υπολογίζεται με βάση το μέγιστο αριθμό κρουσμάτων που οδηγούνται σε εντατικές μονάδες νοσοκομείων. Ο αριθμός αυτός σύμφωνα με δεδομένα της τελευταίας 5ετίας εκτιμάται περίπου στα 300 άτομα το χρόνο (σε εθνικό επίπεδο).

- **Μέσος κίνδυνος:** Αντιστοιχεί στη μείωση του αριθμού των κρουσμάτων κατά 50% (περίπου 150 κρούσματα/χρόνο)

- **Μηδενικός κίνδυνος:** Αντιστοιχεί σε μηδενικό αριθμό σοβαρών κρουσμάτων.

II. **Λήψη μέτρων προστασίας από ασθένειες που σχετίζονται με το κουνούπι Τίγρης.** Στην Ελλάδα δεν είχαμε ως σήμερα κάποια επιδημία του ιού που μεταφέρεται από το κουνούπι Τίγρης (Chikungunya). Ωστόσο περιπτώσεις μετάδοσης του ιού έχουν παρατηρηθεί σε πολλές χώρες του κόσμου, με πιο κοντινή σε μας την περίπτωση της Ιταλίας (204 σοβαρά κρούσματα και ένας θάνατος το 2007). Η πλειοψηφία των ατόμων (πάνω από 75%) που θα μολυνθεί από τον ιό θα παρουσιάσει έντονα συμπτώματα με υψηλό πυρετό και οξύ πόνο στις αρθρώσεις. Σοβαρότερα συμπτώματα μπορεί να προκύψουν σε νεογνά, άτομα άνω των 65 ετών και άτομα με χρόνια προβλήματα υγείας. Τα μέτρα καταπολέμησης των κουνουπιών στα εναλλακτικά προτεινόμενα προγράμματα μπορούν είτε να περιορίζονται στα **σημερινά μέτρα προστασίας** είτε να περιλαμβάνουν **περαιτέρω μέτρα προστασίας από τις ασθένειες του Τίγρη**.

III. **Βελτίωση του δείκτη όχλησης: (α) κατά τη διάρκεια της ημέρας και (β) κατά τη διάρκεια της νύχτας.** Σύμφωνα με μια προηγούμενη έρευνα που έχει πραγματοποιηθεί στην Αττική, το μέσο επίπεδο όχλησης κατά τη διάρκεια τόσο της ημέρας όσο και της νύχτας (σε αντίστοιχη ερώτηση με αυτή που σας έγινε νωρίτερα) χαρακτηρίζεται ως μέτριο. Τονίζεται ωστόσο ότι υπάρχουν περιοχές με

επίπεδα όχλησης είτε πολύ υψηλότερα είτε και πολύ χαμηλότερα του μέσου όρου. Από τη μελλοντική καταπολέμηση των κουνουπιών μπορούν να προκύψουν τρία επίπεδα μέσης όχλησης:

- **Καμία βελτίωση:** Διατήρηση της σημερινής κατάστασης.

- **Μικρή βελτίωση:** Αντιστοιχεί σ' ένα μέσο επίπεδο όχλησης (σύμφωνα με την ερώτηση που ήδη απαντήσατε) που θα χαρακτηρίζονταν ως μικρό.

- **Μεγάλη βελτίωση:** Αντιστοιχεί σ' ένα μέσο επίπεδο όχλησης (σύμφωνα με την ερώτηση που ήδη απαντήσατε) που θα χαρακτηρίζονταν ως ανύπαρκτο.

IV. **Κόστος εφαρμογής του προγράμματος καταπολέμησης των κουνουπιών**. Την ευθύνη της υλοποίησης των προτεινόμενων προγραμμάτων καταπολέμησης των κουνουπιών θα την έχει η Τοπική Αυτοδιοίκηση (Δήμοι της Αττικής). Για να μπορέσουν ωστόσο οι Δήμοι να τα καλύψουν το κόστος των προγραμμάτων απαιτούνται χρήματα που θα επιβαρύνουν τα δημοτικά τέλη που πληρώνετε ανά δίμηνο στη ΔΕΗ.

Στη συνέχεια θα κληθείτε να κάνετε συνολικά 4 επιλογές. Σε κάθε επιλογή θα επιλέξετε μεταξύ 3 εναλλακτικών προγραμμάτων καταπολέμησης τα οποία θα διαφέρουν ως προς τα χαρακτηριστικά που μόλις σας περιγράψαμε. Σε όλες τις περιπτώσεις, η τρίτη εναλλακτική δεν σας επιβαρύνει περαιτέρω οικονομικά αλλά σύμφωνα με αυτή δεν θα προκύψουν τα απαραίτητα έσοδα για τη χρηματοδότηση του προγράμματος καταπολέμησης των κουνουπιών.

Παρακαλείστε να σημειώσετε σε κάθε έναν από τους παρακάτω 4 πίνακες την επιλογή που προτιμάτε, λαμβάνοντας υπόψη ότι το κόστος καταπολέμησης των

κουνουπιών θα επιβαρύνει το οικογενειακό σας εισόδημα. Τονίζεται ότι κάθε κάρτα επιλογής είναι ανεξάρτητη από τις προηγούμενες και ότι δεν υπάρχουν σωστές απαντήσεις, καθώς σκοπός της έρευνας είναι να καταγράψουμε τις ατομικές σας προτιμήσεις.

1η κάρτα επιλογής

Επιλογές πολιτικής καταπολέμησης των κουνουπιών	**Πρόγραμμα Α**	**Πρόγραμμα Β**	**Υφιστάμενη κατάσταση**
Μείωση κινδύνου σοβαρών κρουσμάτων ασθενείας εξαιτίας του Ιού του Δυτικού Νείλου	Μέγιστος κίνδυνος 	Μηδενικός κίνδυνος 	Δεν επιλέγω **κανένα** από τα δύο προτεινόμενα συμπληρωματικά προγράμματα καταπολέμησης των κουνουπιών Η καταπολέμηση των κουνουπιών θα συνεχίζει να εφαρμόζεται **όπως εφαρμόζεται μέχρι σήμερα**
Λήψη έξτρα μέτρων προστασίας για τις ασθένειες του Τίγρη	ΟΧΙ 	ΝΑΙ 	
Βελτίωση του δείκτη όχλησης κατά τη διάρκεια της ημέρας	Μικρή βελτίωση 	Μεγάλη βελτίωση 	
Βελτίωση του δείκτη όχλησης κατά τη διάρκεια της νύχτας	Μικρή βελτίωση 	Μεγάλη βελτίωση 	

			
Αύξηση των δημοτικών εισφορών ανά νοικοκυριό (ανά δίμηνο)	15€ 	20€ 	0 € 
Επιλογή	☐	☐	☐

2η κάρτα επιλογής

Επιλογές πολιτικής καταπολέμησης των κουνουπιών	**Πρόγραμμα Α**	**Πρόγραμμα Β**	**Υφιστάμενη κατάσταση**
Μείωση κινδύνου σοβαρών κρουσμάτων ασθενείας εξαιτίας του Ιού του Δυτικού Νείλου	Μεσαίος κίνδυνος 	Μέγιστος κίνδυνος 	Δεν επιλέγω **κανένα** από τα δύο προτεινόμενα συμπληρωματικά προγράμματα καταπολέμησης των κουνουπιών Η καταπολέμηση των κουνουπιών θα συνεχίζει να εφαρμόζεται **όπως εφαρμόζεται μέχρι σήμερα**
Λήψη έξτρα μέτρων προστασίας για τις ασθένειες του Τίγρη	ΝΑΙ 	ΟΧΙ 	
Βελτίωση του δείκτη όχλησης κατά τη διάρκεια της ημέρας	Μεγάλη βελτίωση 	Καμία βελτίωση 	
Βελτίωση του δείκτη όχλησης κατά τη	Καμία βελτίωση	Μικρή βελτίωση	

διάρκεια της νύχτας 			
Αύξηση των δημοτικών εισφορών ανά νοικοκυριό (ανά δίμηνο)	15€ 	20€ 	0 € 
Επιλογή	☐	☐	☐

3η κάρτα επιλογής

Επιλογές πολιτικής καταπολέμησης των κουνουπιών	**Πρόγραμμα Α**	**Πρόγραμμα Β**	**Υφιστάμενη κατάσταση**
Μείωση κινδύνου σοβαρών κρουσμάτων ασθενείας εξαιτίας του Ιού του Δυτικού Νείλου	Μεσαίος κίνδυνος 	Μέγιστος κίνδυνος 	Δεν επιλέγω **κανένα** από τα δύο προτεινόμενα συμπληρωματικά προγράμματα καταπολέμησης των κουνουπιών Η καταπολέμηση των κουνουπιών θα συνεχίζει να εφαρμόζεται **όπως εφαρμόζεται μέχρι σήμερα**
Λήψη έξτρα μέτρων προστασίας για τις ασθένειες του Τίγρη	ΝΑΙ 	ΟΧΙ 	
Βελτίωση του δείκτη όχλησης κατά τη διάρκεια της ημέρας	Καμία βελτίωση 	Μικρή βελτίωση 	
Βελτίωση του δείκτη όχλησης κατά τη	Μικρή βελτίωση	Μεγάλη βελτίωση	

διάρκεια της νύχτας 			
Αύξηση των δημοτικών εισφορών ανά νοικοκυριό (ανά δίμηνο)	10€ 	15€ 	0 € 
Επιλογή	☐	☐	☐

4η κάρτα επιλογής

Επιλογές πολιτικής καταπολέμησης των κουνουπιών	**Πρόγραμμα Α**	**Πρόγραμμα Β**	**Υφιστάμενη κατάσταση**
Μείωση κινδύνου σοβαρών κρουσμάτων ασθενείας εξαιτίας του Ιού του Δυτικού Νείλου	Μέγιστος κίνδυνος 	Μηδενικός κίνδυνος 	Δεν επιλέγω **κανένα** από τα δύο προτεινόμενα συμπληρωματικά προγράμματα καταπολέμησης των κουνουπιών Η καταπολέμηση των κουνουπιών θα συνεχίζει να εφαρμόζεται **όπως εφαρμόζεται μέχρι σήμερα**
Λήψη έξτρα μέτρων προστασίας για τις ασθένειες του Τίγρη	ΝΑΙ 	ΟΧΙ 	
Βελτίωση του δείκτη όχλησης κατά τη διάρκεια της ημέρας	Μικρή βελτίωση 	Μεγάλη βελτίωση 	
Βελτίωση του δείκτη όχλησης κατά τη	Μεγάλη βελτίωση	Καμία βελτίωση	

διάρκεια της νύχτας 			
Αύξηση των δημοτικών εισφορών ανά νοικοκυριό (ανά δίμηνο)	10€ 	15€ 	0 € 
Επιλογή	☐	☐	☐

Γ. Κατανόηση των προτεινόμενων σεναρίων – Οφέλη από τη μείωση της όχλησης

1. **Βρήκατε δύσκολη την επιλογή των σεναρίων κατά την προηγούμενη ενότητα;**

   ☐ ☐

   Ναι Όχι

2. **Αν ναι ποιες ήταν οι βασικές δυσκολίες:**

   α. Δεν κατάλαβα τις ερωτήσεις

   β. Οι εναλλακτικές ήταν υπερβολικά ακριβές

   γ. Πολύ μεγάλο πλήθος πληροφορίας για να διαχειριστώ

   δ. Δύσκολο να επιλέξω καθώς οι περισσότερες μεταβλητές ήταν σημαντικές

ε. Δεν πιστεύω ότι οι καταναλωτές πρέπει να πληρώνουν για ένα αποτελεσματικό πρόγραμμα καταπολέμησης των κουνουπιών

στ. Δε γνωρίζω / Δεν απαντώ

3. Αν επιλέξατε την διατήρηση της υφιστάμενης κατάστασης (3η στήλη) σε όλες τις καρτέλες για ποιο λόγο το κάνατε;

α. Το εισόδημά μου είναι περιορισμένο

β. Δεν θεωρώ σημαντικό το πρόβλημα των κουνουπιών

γ. Πρέπει να επιβαρυνθεί ο Δήμος ή η Περιφέρεια το κόστος αυτό

δ. Δεν πιστεύω ότι ένα νέο πρόγραμμα μπορεί να βοηθήσει πιο αποτελεσματικά στην καταπολέμηση των κουνουπιών

4. Ποιο από τα παρακάτω προγράμματα θεωρείτε καλύτερο αν προσφερθεί χωρίς επιπλέον κόστος;

	Πρόγραμμα Α	**Πρόγραμμα Β**
Μείωση κινδύνου εμφάνισης κρούσματος Δυτικού Νείλου	Μέγιστος κίνδυνος 	Μηδενικός κίνδυνος 
Βελτίωση του δείκτη όχλησης κατά τη διάρκεια της νύχτας 	Μικρή βελτίωση 	Μεγάλη βελτίωση 
Επιλογή	☐	☐

5. Αναφορικά με την όχληση, πως πιστεύετε ότι θα βελτίωνε την καθημερινότητά σας το προτεινόμενο πρόγραμμα; (μπορείτε να επιλέξετε παραπάνω από μία απαντήσεις)

α. Βελτίωση συνθηκών υπαίθριας εργασίας

β. Μικρότερη όχληση κατά τη διασκέδαση/αναψυχή σε εξωτερικούς δημόσιους χώρους

γ. Μικρότερη όχληση σε παιδιά και βρέφη

δ. Καλύτερες συνθήκες ύπνου

ε. Μικρότερη όχληση κατά τον ελεύθερο χρόνο στο σπίτι (εντός του σπιτιού, στην αυλή ή το μπαλκόνι)

στ. Σε τίποτα, δεν θεωρώ ότι υπάρχει κανένα πρόβλημα από τα κουνούπια

Δ. Προσωπικές πληροφορίες

1. Φύλλο του ερωτώμενου: Άνδρας ☐ Γυναίκα ☐

2. Ηλικία του ερωτώμενου (έτος γέννησης):_____

3. Διεύθυνση μόνιμης κατοικίας:_____

4. Η κατοικία σας έχει κήπο; Ναι ☐ Όχι ☐

5. Μορφωτικό επίπεδο του ερωτώμενου:

α. Απόφοιτος Δημοτικού β. Απόφοιτος Γυμνασίου

γ. Απόφοιτος Λυκείου δ. Ανώτερη/Ανώτατη Εκπαίδευση

ε. Μεταπτυχιακός/Διδακτορικός τίτλος

6. Επάγγελμα του ερωτώμενου:

α. Ιδιωτικός Υπάλληλος β. Δημόσιος Υπάλληλος

γ. Ελεύθερος Επαγγελματίας δ. Συνταξιούχος

ε. Άνεργος στ. Οικοκυρικά

η. Άλλο (διευκρινίστε): _____

7. Αριθμός μελών νοικοκυριού:_____

8. Αριθμός μελών άνω των 15 ετών:_____

9. Ετήσιο οικογενειακό εισόδημα του ερωτώμενου:

α. Έως 5.000€

β. 5.000€ - 10.000€

γ. 10.000€ - 15.000€

δ. 15.000€ - 20.000€

ε. 20.000€ - 25.000€

στ. 25.000€ - 30.000€

η. Πάνω από 30.000€

8.10 The Complete Questionnaire to Greek households distributed through the website of www.meteo.gr (in Greek)

LIFE CONOPS

"Ανάπτυξη και επίδειξη διαχειριστικών σχεδίων έναντι των ενισχυόμενων από την κλιματική αλλαγή χωροκατακτητικών κουνουπιών στην Νότια Ευρώπη" (LIFE12ENV/GR/0046)

ΜΠΕΝΑΚΕΙΟ ΦΥΤΟΠΑΘΟΛΟΓΙΚΟ ΙΝΣΤΙΤΟΥΤΟ

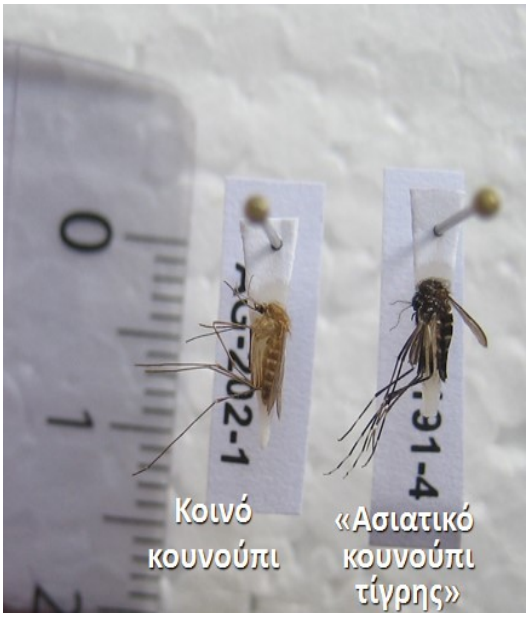
ΙΝΣΤΙΤΟΥΤΟ ΑΣΤΙΚΟΥ ΠΕΡΙΒΑΛΛΟΝΤΟΣ & ΑΝΘΡΩΠΙΝΟΥ

<u>Διαδικτυακό Ερωτηματολόγιο για την αποτίμηση των επιπτώσεων του Ασιατικού κουνουπιού τίγρης στην Ελλάδα</u>

Το παρόν ερωτηματολόγιο πραγματοποιείται στο πλαίσιο του έργου LIFE CONOPS το οποίο μελετά τις επιπτώσεις των χωροκατακτητικών κουνουπιών όπως του Ασιατικού κουνουπιού τίγρης (*Aedes albopictus*) στην Ελλάδα και την Ιταλία. Αναλυτικότερα, στοχεύει στην ανάπτυξη ολοκληρωμένων σχεδίων διαχείρισης των χωροκατακτητικών κουνουπιών, προκειμένου να εξασφαλιστεί ο έλεγχος της εξάπλωσης και της εγκατάστασής τους σε ολόκληρη την Ευρώπη.

Το έργο "LIFE CONOPS" (LIFE12 ENV/GR/000466) συγχρηματοδοτείται κατά 50% από το Ευρωπαϊκό πρόγραμμα LIFE+ Environment Policy and Governance. Περισσότερες πληροφορίες μπορείτε να βρείτε στην ιστοσελίδα του έργου, www.conops.gr.

Γενικές πληροφορίες για το Ασιατικό κουνούπι τίγρης



Το Ασιατικό κουνούπι τίγρης είναι ένα κανονικό σε μέγεθος κουνούπι με μήκος σώματος παρόμοιο με εκείνο του κοινού κουνουπιού (5-6 mm). Βασικό χαρακτηριστικό του είναι ο ασπρόμαυρος χρωματισμός του σώματός του καθώς και το ότι τα θηλυκά είναι επιθετικά και τσιμπούν συνήθως κατά τη διάρκεια της ημέρας με το μέγιστο της δραστηριότητάς τους να παρατηρείται νωρίς το πρωί (06:00 με 08:00) και αργά το απόγευμα (16:00 με 18:00).

Η υγειονομική σημασία του Ασιατικού κουνουπιού τίγρης

Από υγειονομική άποψη το Ασιατικό κουνούπι τίγρης έχει πολύ μεγάλη σημασία καθώς μπορεί να μεταδώσει πολυάριθμες σοβαρές για τον άνθρωπο ασθένειες με σημαντικότερες τους ιούς του Δάγκειου πυρετού, του Ζίκα και του Chikingunya. Αντίθετα δεν φαίνεται να μεταδίδει άλλες ασθένειες που σχετίζονται με κουνούπια όπως η ελονοσία και ο ιός του Δυτικού Νείλου.

Ανεξάρτητα από την ικανότητα μετάδοσης ασθενειών, η υγειονομική του σημασία έγκειται και στην έντονη όχληση που προκαλεί με τα τσιμπήματά του κυρίως σε

αστικές περιοχές όπου καθίσταται δύσκολη η αντιμετώπιση λόγω των πολυάριθμων εστιών ανάπτυξης. Η όχληση που προκαλεί είναι έντονη και πολλές φορές η αντίδραση ευαισθησίας στο δέρμα των θυμάτων είναι εμφανής προκαλώντας κοκκινίλες, φαγούρα ή και εξανθήματα. Στην ιστοσελίδα του έργου μπορείτε να βρείτε περισσότερες πληροφορίες που αφορούν στα κουνούπια, www.conops.gr.

Στο πλαίσιο του έργου LIFE CONOPS «Ανάπτυξη και επίδειξη διαχειριστικών σχεδίων έναντι των ενισχυόμενων από την κλιματική αλλαγή χωροκατακτητικών κουνουπιών στη Ν. Ευρώπη» (LIFE12 ENV/GR/000466), το οποίο συγχρηματοδοτείται κατά 50% από το Ευρωπαϊκό πρόγραμμα LIFE+ Environment Policy and Governance.

Ερωτηματολόγιο

Ερώτηση 1η

Γνωρίζατε για το κουνούπι τίγρης πριν την ανάγνωση του εισαγωγικού μέρους του παρόντος ερωτηματολογίου;

ΝΑΙ ☐ ΟΧΙ ☐

Ερώτηση 2η

Γνωρίζετε εάν στην περιοχή σας εντοπίζεται το Ασιατικό κουνούπι τίγρης;

ΝΑΙ ☐ ΟΧΙ ☐

Ερώτηση 3η

Πώς θα χαρακτηρίζατε την όχληση από τα κουνούπια στην περιοχή σας;

i) κατά τις βραδινές ώρες;

Ανυπόφορη ☐ Μεγάλη ☐ Μέτρια ☐ Μικρή ☐ Ανύπαρκτη ☐

ii) κατά τις πρώτες πρωινές ώρες και αργά το απόγευμα;

Ανυπόφορη ☐ Μεγάλη ☐ Μέτρια ☐ Μικρή ☐ Ανύπαρκτη ☐

Ερώτηση 4η

Θεωρείτε πως στην περιοχή που κατοικείτε έχει ενταθεί το πρόβλημα των κουνουπιών σε σχέση με την περσινή χρονιά;

ΝΑΙ ☐

ΟΧΙ ☐

Εάν ΝΑΙ, για ποιο λόγο πιστεύετε ότι εντάθηκε το πρόβλημα;

.....(ανοιχτή ερώτηση)

Ερώτηση 5η

Ποιους μήνες αντιμετωπίζετε πρόβλημα με τα κουνούπια, ώστε να κάνετε χρήση ατομικών μέσων προστασίας (αντικουνουπικά σπρέυ, φιδάκια, εντομο-απωθητικά, αντικουνουπικές σίτες);

Μήνας έναρξης του προβλήματος:.....

Μήνας λήξης του προβλήματος:.....

Ερώτηση 6η

Στο παραπάνω χρονικό διάστημα, πόσα χρήματα ξοδεύετε κατά μέσο όρο μηνιαίως ως νοικοκυριό για την αντιμετώπιση του προβλήματος των κουνουπιών;

.....(ανοιχτή ερώτηση)

Ερώτηση 7η

Ποιος είναι ο κύριος λόγος για τον οποίο λαμβάνετε τα συγκεκριμένα μέτρα προστασίας;

Η μείωση της καθημερινής όχλησης από τα κουνούπια ☐

Η μείωση του κινδύνου εκδήλωσης κάποιας ασθένειας σχετική με τα κουνούπια ☐

Ερώτηση 8η

Κατά πόσο συμφωνείτε με τις παρακάτω προτάσεις (1= συμφωνώ απόλυτα, 5= διαφωνώ):

☐ Θεωρώ το πρόβλημα των κουνουπιών σημαντικό αλλά πιστεύω πως πρέπει να δοθεί οικονομική προτεραιότητα σε άλλους κλάδους

☐ Θεωρώ το πρόβλημα των κουνουπιών σημαντικό αλλά δε γνωρίζω τις ακριβείς συνέπειες της διαχείρισής τους στο υπόλοιπο οικοσύστημα

☐ Θεωρώ πως πρέπει να ληφθούν περαιτέρω μέτρα διαχείρισής τους παρά τις όποιες πιθανές επιπτώσεις στο υπόλοιπο οικοσύστημα

☐ Θεωρώ πως η ορθή εφαρμογή περαιτέρω μέτρων διαχείρισής τους δε θα έχει πιθανές επιπτώσεις στο υπόλοιπο οικοσύστημα

☐ Δε θεωρώ σημαντικό το πρόβλημα των κουνουπιών

Ερώτηση 9η

Κατά πόσο θεωρείτε ότι είναι επαρκή τα δημόσια μέτρα διαχείρισης **σε σχέση με το στόχο της αντιμετώπισης του προβλήματος των κουνουπιών;**

(Παρακαλώ βαθμολογήστε από 1-5, όπου **1 = ελάχιστα επαρκή**, **5= απολύτως επαρκή**)

☐ 1

☐ 2

☐ 3

☐ 4

☐ 5

Ερώτηση 10η

Ως προς τι θεωρείτε ότι μπορούν να γίνουν αποτελεσματικότερα τα δημόσια προγράμματα καταπολέμησης κουνουπιών σε σχέση με τους στόχους που εξυπηρετούν;

(Παρακαλώ βαθμολογήστε στα κουτάκια από το 1= καθόλου σημαντικό έως 5= το πιο σημαντικό)

- ❑ Α. Μείωση ρίσκου μετάδοσης νοσημάτων από ενδημικά είδη κουνουπιών ειδών (π.χ ελονοσία, ιός δυτικού Νείλου, κλπ)
- ❑ Β. Μείωση ρίσκου μετάδοσης νοσημάτων από νέα είδη κουνουπιών (π.χ. zika, chikungunya, δάγκειος πυρετός)
- ❑ Γ. Μείωση όχλησης κατά τις βραδινές ώρες
- ❑ Δ. Μείωση όχλησης κατά την ημέρα
- ❑ Ε. Μείωση επιπρόσθετου κόστους στα νοικοκυριά

Ερώτηση 11η

Έχει νοσήσει ποτέ μέλος του νοικοκυριού σας από μεταδιδόμενη από κουνούπια ασθένεια (π.χ. Ελονοσία, Ιός Δυτικού Νείλου);

ΝΑΙ ☐ ΟΧΙ ☐

Αν ναι από ποια ασθένεια έχει νοσήσει;.....

Θα είχατε την πρόθεση να ξανασυμμετάσχετε σε παρόμοια τηλεφωνική έρευνα στο επόμενο διάστημα; Αν ναι, θα μπορούσατε να μας δώσετε τον αριθμό επικοινωνίας σας;.....

Προσωπικές πληροφορίες:

Περιοχή Κατοικίας (Διεύθυνση, Δήμος, Νομός):

Αριθμός Μελών Νοικοκυριού:

Ηλικία:

Στοιχεία Επικοινωνίας (τηλέφωνο ή email):

Σας ευχαριστούμε πολύ για τη συμμετοχή σας

Τα αποτελέσματα του ερωτηματολογίου θα αναρτηθούν στο επόμενο χρονικό διάστημα στην ιστοσελίδα του προγράμματος Life Conops (www.conops.gr).

8.11 Questionnaire on the appraisal of socioeconomic impacts of management plans by stakeholders and policy makers

1. There is (or you think there is) any problem of mosquitoes in your specific region and how would you rate it?

- ☐ There is no problem
- ☐ There is a problem but it is minor
- ☐ The problem is only in certain regions (eg. In rural, urban, natural ecosystems.)
- ☐ There is severe problem in both urban and rural areas

2. Do you know if in your area, in recent years, the "tiger mosquito" has settled, or other new types of mosquitoes (probably invasive) which did not exist before (over a decade)?

- ☐ Is installed
- ☐ Not installed
- ☐ Do not know

3. Do you know if there are recorded outbreaks of diseases transmitted by mosquitoes in your region (eg. Malaria, West Nile virus, Dengue virus, Chikungunya, Zika virus)? The cases were imported or indigenous (ie. The transmission took place in our country)?

- ☐ Outbreaks have been recorded
- ☐ No cases have been recorded
- ☐ Do not know

If yes, which, of these diseases were native and / or imported (eg. Imported cases of malaria and West Nile
Virus),.....

4. How have you formed the image you described about the problem of mosquitoes in your area? (Multiple responses accepted)

- ☐ Briefing on reports or actions scientific bodies or governmental institutions.
- ☐ Information from reports or presentations to media.
- ☐ Personal considerations

- ☐ Complaints of citizens in the region
- ☐ Outbreaks have been recorded (native - imported)

5. Do you know if the municipality, Region or Regional Unit, or the office with which you are involved, is engaged in addressing the problem of mosquitoes in your area?

• Involved / actively

• Not Involved

• Do not know

6. You know the kind of actions your service involved? (Multiple responses accepted)

Mosquito Control

- ☐ conduct spraying with the same instruments,
- ☐ project tender for implementation by contractors,
- ☐ participation in other actions (eg. Channel cleaning, reduce outbreaks, etc.)
- ☐ Monitor and control the course of fighting work performed by a contractor (an independent body)

Informing the public

- ☐ organizing information meetings / lectures,
- ☐ TV spots,
- ☐ Entries press, publication and distribution of brochures
- ☐ Actions in schools, or other groups.

Health care - Medical Actions

- ☐ actively search cases,
- ☐ passive search cases,
- ☐ Display monitoring network traffic or diseases transmitted by mosquitoes,
- ☐ patient care,

- ☐ care to avoid spreading the relative environment, by blood transfusions, etc.).
- ☐ Other actions ....

7. Which of these 3 is regarded as most important (please rate the boxes from 1 = most important to 3 = less important)

• mosquito control actions

• Information measures for the problem of mosquitoes

• Health Care - Medical Actions

8. Of the three categories of actions what you see as the most important sub-actions in any class action? (Please rate the boxes from 1 = most important to 3 = less important)

A. Mosquito control actions

- ☐ conduct spraying with the same instruments,
- ☐ project tender for implementation by contractors,
- ☐ participation in other actions (eg. Channel cleaning, reduce outbreaks, etc.)

II. Information measures for the problem of mosquitoes

- ☐ organizing information meetings / lectures, actions in schools, KAPI, or other groups
- ☐ TV spots,
- ☐ Entries press, publication and distribution of brochures

III. Health Care - Medical Actions

- ☐ active cases search, passive search cases,
- ☐ Display monitoring network traffic or diseases transmitted by mosquitoes,
- ☐ care patients, care to prevent the spread relative to the environment, by blood transfusions, etc.

9. You as a person / agency / institution / agency are involved in the programs or actions to address the problem of mosquitoes in your area of competence? If so, how and to what extent?

• YES

• NO

If so, how and to what extent: ....

10. Do you know the amount of funding spent on programs of those activities in your area. Do you have data or estimates about the amount per action (or even if funding is only for sprays or other actions)?

Amount of funding /
year.....

amounts per
Action:.....
.....
.....
.....
.....

11. Are the expected results from the programs or actions achieved, in order to address the problem of mosquitoes in your area of competence?

(Please rate on a scale from 1 = complete success to 5 = almost no successful)

☐ 1

☐ 2

☐ 3

☐ 4

☐ 5

12. Do you know or believe that there are problems in the implementation of programs that have an impact on their success? (Multiple responses accepted)

☐ Bureaucratic procedures.

☐ Ensure funding and permanent character.

☐ Operational problems

- ☐ Absence or inadequate supervision and evaluation of programs
- ☐ Reduced public response
- ☐ Inability to access private areas
- ☐ Other problems ....

13. Do you consider that the amount spent is sufficient? You think it is necessary increase / (or decrease) of that amount?

- ☐ Sufficient
- ☐ Increase
- ☐ Decrease

14. Do you think it is necessary to have a permanent provision and funding to deal with mosquito control or should they take place only when these problems occur (eg. Cases, nuisance above tolerable levels, outbreaks etc.)? Note that in cases not timely applied directly address the problems can be very difficult and / or impossible.

- ☐ YES
- ☐ NO

15. How do you think they could secure additional financial resources or means to improve programs or actions? (Possibly multiple responses accepted)

- ☐ Reallocation of State Budget
- ☐ Redistribution of Resources by Region or the municipality.
- ☐ Transfer funds from other Municipalities / Regions actions etc.
- ☐ Imposition of special fees to citizens
- ☐ Obligation of individuals to take some action / sprays in private spaces.

16. How would you prioritize the necessity of programs in relation to the objectives that serve? (Please rate the boxes from 1 = most important to 5 = least important)

- ☐ Reducing wrecks of disease risk
- ☐ Reduction of disease risk from new species

- ☐ Reducing nuisance in the evening
- ☐ Reducing nuisance in the morning
- ☐ Implementation Cost

17. Please rate from 1 to 5 (1 = max to 5 = minimum) the extent to which you believe that those involved by municipalities (or depending on the region or Regional Unit) or the service you belong to have the necessary scientific training / expertise / experience to diagnose the problem, prioritizing needs, designing programs and activities, training notices, monitoring and evaluation of programs in your area?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ 5

18. Do you believe that a) it would be useful / necessary to get by municipalities (or depending on the region or Regional Unit) or the Service you belong to the necessary scientific background and expertise in order to achieve better results? or b) it is preferable to assigning specialized external scientific institutions (public or private).

- ☐ It would be useful
- ☐ It would be useful
- ☐ It is preferable to assigning specialized external scientific bodies

19. Do you consider that the design of programs and actions, training notices, supervision and evaluation of the programs should be central to the whole country or stay at local level - and to what (eg. Regional Level, Regional Unity municipality, etc.).

- ☐ Main Level

Local Level (specify) .....