ACTIONS FOR THE CONSERVATION OF COASTAL DUNES WITH JUNIPERUS spp. IN CRETE AND THE SOUTH AEGEAN (GREECE)

LIFE07NAT/GR/000296

Action E.4
Deliverable E.4.2

REPORT ON THE SUCCESSES AND FAILURES OF PREVIOUS EXPERIENCES IN EUROPE

Responsible beneficiary: MAICh

Prepared by: Dr. Elisabeth Conrad

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"Actions for the conservation of coastal dunes with *Juniperus* spp. in Crete and the South Aegean (Greece)"

- JUNICOAST -

Action E.4: Networking with other similar LIFE projects

Deliverable E.4.2: Report on the successes & failures of previous experiences in Europe

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Table of content

ΠΕΡΙΛΗΨΗ

Εισαγωγή

Σκοπός της παρούσας έκθεσης είναι να συλλέξει πληροφορίες σχετικά με τις θετικές ή αρνητικές εμπειρίες από τη διαχείριση των παράκτιων αμμοθινών στην Ευρώπη και να συμβάλλει στη βελτίωση των μελλοντικών δραστηριοτήτων στον τομέα αυτό. Προορίζεται επίσης να παρέχει γνώσεις για την αποτελεσματική δικτύωση με άλλους ειδικούς που εμπλέκονται σε παρόμοιες πρωτοβουλίες.

Για τη σύνταξη της έκθεσης χρησιμοποιήθηκαν τέσσερις κύριες μεθοδολογίες:

(i) Ανασκόπηση αναφορών, εκθέσεων και άλλων εγγράφων που επιλέχθηκαν λόγω της συσχέτισής τους με το αντικείμενο της παρούσας έκθεσης

(ii) Ανασκόπηση των έργων LIFE που σχετίζονται με τη διαχείριση αμμοθινών και είναι καταχωρημένα στην ηλεκτρονική βάση δεδομένων του LIFE

(iii) Έρευνα μέσω e-mail, υπό μορφή ερωτηματολογίου που απευθύνθηκε σε συμμετέχοντες σε έργα LIFE σχετικά με τη διαχείριση και αποκατάσταση των παράκτιων αμμοθινών καθώς και σε ειδικούς για τις παράκτιες αμμοθίνες

(iv) Ανασκόπηση της πρόσφατης βιβλιογραφίας για τις παράκτιες αμμοθίνες.

Α. Αξιολόγηση επιλεγμένων αναφορών, εκθέσεων και εγγράφων

Από την έρευνα προέκυψε ότι υπήρξε σημαντική βελτίωση στη γνώση σχετικά με τις αμμοθίνες στην Ευρώπη, ιδιαίτερα μετά τη δημοσίευση του καταλόγου των ευρωπαϊκών παράκτιων αμμοθινών το 1991. Η πρόοδος καλύπτει νέα διαθέσιμα στοιχεία για περιοχές που δεν είχαν μελετηθεί στο παρελθόν, υπάρχει πιο βαθιά γνώση για τα συστήματα των αμμοθινών, καθώς και βελτίωση της κατανόησης των θεμάτων διαχείρισης. Η βιβλιογραφία εμπλουτίστηκε σημαντικά με νέες δημοσιεύσεις και άλλες εκδόσεις ιδιαίτερα μετά την επικαιροποίηση της απογραφής του 1991. Επίσης τα τελευταία χρόνια πραγματοποιήθηκαν αρκετές Ευρωπαϊκές εκδηλώσεις οι οποίες επικεντρώθηκαν, εν όλω ή εν μέρει, στις παράκτιες αμμοθίνες.

Μια θεμελιώδης τάση η οποία αναγνωρίσθηκε στη βιβλιογραφία είναι η εγκατάλειψη της θεώρησης των αμμοθινών ως στατικά συστήματα και η υιοθέτηση και κατανόηση της φυσικής δυναμικής τους. Το «ζήτημα της διάβρωσης» εξακολουθεί να είναι και σήμερα σχετικό, καθόσον βασικό αντικείμενο της διαχείρισης παραμένει η αποκατάσταση της ισορροπίας των αμμοθινικών συστημάτων και οι παράκτιες διεργασίες. Ομοίως, η διαχείριση των αμμοθινικών

συστημάτων αποτελεί ευκαιρία όσον αφορά τη συνεργασία μεταξύ των περιφερειών. Άλλες σχετικές απειλές που εντοπίζονται στη βιβλιογραφία είναι οι αναπτυξιακές πιέσεις, η συσσώρευση θρεπτικών ουσιών και ο ευτροφισμός, ο κατακερματισμός των οικοτόπων, η πίεση από τη βόσκηση, οι αναδασώσεις που σχετίζονται με τη διαχείριση χωροκατακτητικών ειδών και την επίτευξη ισορροπίας μεταξύ προστασίας και αναψυχής.

Το Ευρωπαϊκό Δίκτυο Αμμοθινών (European Dune Network) και το Δίκτυο Αμμοθινών (Sand Dune and Shingle Network) έχουν στόχο να διευκολύνουν την επικοινωνία και την ανταλλαγή απόψεων μεταξύ ειδικών που ασχολούνται με την αειφορική χρήση και διαχείριση των παράκτιων αμμοθινών. Τα δύο αυτά δίκτυα δεν έχουν αναπτυχθεί στην ίδια έκταση αλλά το δεύτερο φαίνεται να είναι πιό δραστήριο.

Β. Έργα LIFE

Δύο πρόσφατες ανασκοπήσεις διαπίστωσαν ότι το πρόγραμμα LIFE έχει μια ουσιαστική συμβολή στη διατήρηση των αμμοθινών στην Ευρώπη, με δράσεις που αφορούν την αύξηση της ευαισθητοποίησης, τη διαχείριση επισκεπτών, την προστασία της φύσης, την αποκατάσταση οικοτόπων, την παρακολούθηση, τη διαχείριση κινδύνων, κλπ. Το πρόγραμμα LIFE έχει παίξει επίσης σημαντικό ρόλο υποστηρίζοντας την στρατηγική της Ευρώπης για την "Ολοκληρωμένη διαχείριση των παράκτιων περιοχών". Η παρούσα ανάλυση έλαβε επίσης υπόψη 152 προγράμματα από τη βάση δεδομένων έργων LIFE, ως αποτέλεσμα της αναζήτησης με τη χρήση του όρου «αμμοθίνες» ώς λέξη-κλειδί. Έργα για τα οποία δεν υπήρχαν διαθέσιμα αποτελέσματα αποκλείστηκαν. Από τα υπόλοιπα, 12 προγράμματα εστίαζαν σε μεγάλο βαθμό στις αμμοθίνες, ενώ 57 έργα ασχολούνταν εν μέρει με αμμοθινικούς οικοτόπους ή είδη.

Τα θετικά αποτελέσματα από τα 12 προαναφερθέντα έργα μεταξύ άλλων περιελάμβαναν την αποκατάσταση των οικοτόπων, τη βελτίωση της κατάστασης διατήρησης των οικοτόπων και των ειδών προτεραιότητας, την ενίσχυση της γνώσης σχετικά με τις παράκτιες αμμοθίνες, την αξία επίδειξης πιλοτικών έργων, την παραγωγή εκπαιδευτικού υλικού για τη διαχείριση των αμμοθινών, καθώς και την αύξηση της ευαισθητοποίησης του κοινού. Οι περιορισμοί που αναγνωρίζονται από τα έργα αυτά περιλαμβάνουν τεχνικά προβλήματα (πχ. λάθη στην ακρίβεια των δεδομένων) και εμπόδια που προκύπτουν από το νομικό πλαίσιο (πχ. περιορισμοί για την υλοποίηση των δράσεων των έργου, λόγω της υφιστάμενης νομοθεσίας).

Τα 57 προγράμματα με μερική εστίαση στις αμμοθίνες καταγράφουν επίσης πολλά θετικά αποτελέσματα. Μεταξύ άλλων αναφέρονται η αποτελεσματική αποκατάσταση οικοτόπων, η αναθεώρηση και βελτίωση των διαχειριστικών πρακτικών, η ενίσχυση της ευαισθητοποίησης του κοινού, η αύξηση της επιστημονικής γνώσης, η προστασία των περιοχών, η επέκταση των προστατευόμενων περιοχών και η κατασκευή υποδομών για τη διαχείριση των

επισκεπτών. Περιορισμοί ή δυσκολίες που επισημάνθηκαν ως εμπόδια για την επίτευξη των στόχων των προγραμμάτων αναφέρονται οι συγκρούσεις των ενδιαφερομένων μερών (π.χ. σύγκρουση με τους ιδιοκτήτες γης ή με τις τοπικές κοινωνίες), προβλήματα διαχείρισης του έργου (π.χ. διαχείριση του χρόνου), τεχνικά προβλήματα (π.χ. ανεπαρκής εμπειρία στον σχεδιασμό), καθώς και περιορισμοί που επιβάλλονται από την ισχύουσα πολιτική και τη νομοθεσία.

Γ. Έρευνα με ερωτηματολόγια

Για την συμπλήρωση των αποτελεσμάτων που συζητήθηκαν παραπάνω, στάλθηκαν ερωτηματολόγια σε συμμετέχοντες σε προγράμματα LIFE καθώς και σε ειδικούς στον τομέα της διαχείρισης των αμμοθινών.

Στην πρώτη περίπτωση, υπήρξε χαμηλό ποσοστό απαντήσεων το οποίο αποδίδεται σε μεγάλο βαθμό, στην έλλειψη ενημερωμένων πληροφοριών επικοινωνίας που περιλαμβάνονται στη βάση δεδομένων του LIFE, με αποτέλεσμα να μην είναι δυνατή η επαφή με πολλούς συμμετέχοντες που συμπεριλαμβάνονται στη βάση. Οι έξι συμμετέχοντες, οι οποίοι απάντησαν προσδιόρισαν ώς βασικές απειλές για τις παράκτιες αμμοθίνες την αστική ανάπτυξη, τη σταθεροποίηση των αμμοθινών, την εναπόθεση θρεπτικών συστατικών, την τουριστική ανάπτυξη, καθώς και την έλλειψη οικολογικής ευαισθητοποίησης και ενημέρωσης. Οι επιτυχίες των έργων που επισημάνθηκαν από τους ερωτηθέντες ήταν παρόμοιες με αυτές που συζητήθηκαν παραπάνω, ενώ οι περιορισμοί περιλαμβάνουν την αδυναμία των σχεδίων για την αντιμετώπιση σημαντικών θεμάτων (π.χ. την αποκατάσταση της δυναμικής των αμμοθινών), και την αποτυχία για στην υλοποίηση αποτελεσματικών δράσεων. Όλοι οι συμμετέχοντες σημείωσαν ότι υπήρξε συνέχεια στα έργα στα οποία συμμετείχαν, μέσω της επιστημονικής παρακολούθησης.

Στην περίπτωση των ειδικών, αναγνωρίσθηκαν παρόμοιες απειλές, αλλά επισημάνθηκαν και πρόσθετες οι οποίες συμπεριλαμβάνουν τις δραστηριότητες καθαρισμού των παραλιών οι οποίες αποσταθεροποιούν τις εμπρόσθιες αμμοθίνες, την κατασκήνωση και την κίνηση οχημάτων εκτός δρόμου καθώς και την κατασκευή τεχνικών έργων για τη σταθεροποίηση των ακτών. Οι έξι ειδικοί οι οποίοι ανταποκρίθηκαν στην έρευνα αισθάνονται ότι μέχρι σήμερα οι απειλές για τις παράκτιες αμμοθίνες δεν έχουν αντιμετωπιστεί επιτυχώς. Τα κυριότερα προβλήματα που επισημαίνονται είναι η υπερβολική γραφειοκρατία, η έλλειψη της σωστής εκτίμησης και αξιοποίησης των παράκτιων πόρων, η τάση αυτών που λαμβάνουν τις αποφάσεις να υποχωρούν στις πιέσεις που δέχονται, και η έλλειψη αποτελεσματικού ελέγχου των ξενικών ειδών. Παρόλα αυτά επισημαίνονται σημαντικές επιτυχίες που συμπεριλαμβάνουν την αύξηση της προστασίας των αμμοθινικών συστημάτων, τη θετική συμβολή της οδηγίας 92/43 της ΕΕ για τους οικοτόπους, καθώς και την αυξημένη ευαισθητοποίηση για τη σημασία των αμμοθινών. Παράλληλα προτείνονται κάποιες βασικές συστάσεις όπως η συντονισμένη ανάλυση των δεδομένων που έχουν συγκεντρωθεί μέσω

προγραμμάτων σχετικών με τα αμμοθινικά συστήματα και η περαιτέρω ανάπτυξη των ικανοτήτων στον τομέα αυτό.

Δ. Ακαδημαϊκή έρευνα

Για την κατανόηση των επιστημονικών εξελίξεων σχετικά με τις παράκτιες αμμοθίνες και τις συνεχιζόμενες απειλές, πραγματοποιήθηκε μια σύντομη ανασκόπηση της πρόσφατης βιβλιογραφίας.

Ένας βασικός τομέας της έρευνας που προσδιορίζεται από τη βιβλιογραφία είναι η ανάπτυξη και βελτίωση των τεχνικών καταγραφής, παρακολούθησης και κατανόησης της δυναμικής των αμμοθινών. Οι τεχνικές της τηλεπισκόπησης είναι μια σημαντική συμβολή στο θέμα αυτό. Υπάρχει επίσης σημαντική έρευνα που επικεντρώνεται στη βελτίωση των γνώσεων της οικολογίας των αμμοθινών, ενώ αρκετές μελέτες επισημαίνουν την πολυπλοκότητα και τη σημασία της κατανόησης του ρόλου της διαταραχής και της αστάθειας των συστημάτων αυτών. Έχει επίσης ερευνηθεί μια σειρά επίμονων απειλών συμπεριλαμβανομένων των επιπτώσεων των χωροκατακτητικών ξενικών ειδών, καθώς και οι μηχανισμοί μέσω των οποίων τα είδη αυτά εγκαθίστανται στις αμμοθίνες και ανταγωνίζονται τα αυτόχθονα είδη. Επίσης ένας αναδυόμενος τομέας έρευνας αφορά τις πιθανές επιπτώσεις της κλιματικής αλλαγής στη δυναμική των αμμοθινών. Μία σειρά από συγγραφείς εκφράζουν ανησυχίες σχετικά με τις κλιματικές και υδρολογικές αλλαγές, και τις επακόλουθες επιπτώσεις στη μορφολογία και την οικολογία των αμμοθινών.

Συμπεράσματα

Η παρούσα αξιολόγηση έδειξε ότι τα τελευταία χρόνια υπήρξαν αρκετά θετικά αποτελέσματα από την ευρωπαϊκή εμπειρία στη διαχείριση των αμμοθινών. Σχετικά με τις μελλοντικές δραστηριότητες προκύπτουν κάποια βασικά συμπεράσματα τα οποία περιλαμβάνουν (i) την ανάγκη για καλύτερη ενοποίηση των πληροφοριών σχετικά με τις εμπειρίες της διαχείρισης των αμμοθινών στην Ευρώπη, (ii) την ανάγκη βελτίωσης της δικτύωσης-συνεργασίας των ειδικών που ασχολούνται με τα αμμοθινικά συστήματα, (iii) την ανάγκη αντιμετώπισης των προκλήσεων και των αδυναμιών (πχ. αδυναμίες στα πλαίσια των διαδικασιών λήψης αποφάσεων, καθώς και αδυναμίες στην αντιμετώπιση των απειλών που σχετίζονται με τις κοινωνικο-οικονομικο-πολιτικές συνθήκες), (iv) την ανάγκη περαιτέρω ανάπτυξης των συμμετοχικών και κοινωνικο-οικονομικών προσεγγίσεων στη διαχείριση των αμμοθινών, και (v) την ανάγκη αντιμετώπισης σύγχρονων απειλών όπως η κλιματικής αλλαγή.

1. Introduction

1.1 This report has been prepared as an output for Action E4 within the LIFE+ Nature JUNICOAST project (*Actions for the conservation of coastal dunes with Juniperus spp.in Crete and the Southern Aegean [Greece])*. The principal aim of this action is to collate information and experiences on coastal habitat restoration, conservation and management in Europe, in order to enable and stimulate the international exchange of ideas and experiences between consortia that have been working in the past or present on similar subject areas. This report has the specific objective of collating information on positive and negative aspects of coastal dune management experiences in Europe, with a view to providing insights to guide future activities in this field. It is also intended to provide insights for effective networking with other professionals involved in similar initiatives.

1.2 This report has been compiled based on four main methodologies:

(i) A review of reports, reviews and other documents selected for their specific relevance to the subject of this analysis;

(ii) A review of LIFE projects related to dune management, based on the online LIFE projects database;

(iii) An online survey, delivered to participants in LIFE projects (related to coastal dune restoration and management) and to coastal dune specialists via email; and

(iv) A review of selected recent academic literature on coastal dunes.

1.3 Whilst the terms of reference for this assignment refer to 'successes' and 'failures', the latter term is considered to be of limited utility in a review of this nature. The retrospectives conducted in this analysis are not intended to provide an in-depth evaluation of individual projects, but rather to gauge general trends, and to highlight areas of progress and areas where progress is still lacking. For this reason, it may be more appropriate to talk of limitations, challenges, constraints or problems encountered in the course of relevant projects and initiatives, rather than outright 'failures'; these terms are therefore adopted in the remainder of this report.

2. Review of selected reports, reviews & documents

2.1 Overview

2.1.1 Ten publications were selected by the JUNICOAST consortium on the basis of their relevance to this action, and were reviewed accordingly (with key conclusions discussed below). A full list of these ten publications is provided in Annex 1.

2.2 State of knowledge of European dunes

2.2.1 Following the first European dune conference held in Leiden (Netherlands) in 1987, the newly established European Union for Dune Conservation (EUDC) was tasked with producing an inventory of coastal dunes throughout Europe, subsequently published in 1991. Limited information was available at the time, and several additional studies have been carried out since the compilation of this inventory. There have also been numerous positive developments in European dune conservation since. For this reason, Doody (2005) provides an indicative update of areas for which our knowledge base has significantly improved, since publication of the 1991 inventory. These include the following examples:

- Improved documentation of sand dune distribution in Iceland; key management issues in this country include the need for a continuous programme for sand stabilisation, and the impact of river dams on sediment delivery at the coast.

- New data available from extended surveys of dunes in Great Britain, conducted to facilitate the selection of Natura 2000 sites, to identify *Ecological Zones*, and as a basis for monitoring future change. Results highlighted the great diversity of sand dune vegetation in this region, and pointed to four main management issues, namely: (i) the importance of understanding the role of instability in dune conservation, (ii) the need for management of recreational use, (iii) the need for the development of methods suitable for managing successional change, and (iv) the importance of naturalness.

- New data available from extended surveys of Spanish coastal dunes and wetlands.

- Improved documentation of coastal dunes in Turkey; this occurred concurrently with increasing tourism-driven pressures on these habitats within the country.

- Additional data available from surveys of sand dunes in Finland, Denmark, Ireland and the Atlantic coast of France.

- The availability of consolidated information on the sand dunes of Europe in two publications: *The World's Coasts* (Bird, 2003) [1] and *Dry Coastal Ecosystems* (van der Maarel, 1993).

- The organization of conferences and specialist meetings focused, in whole or in part, on European sand dunes.

2.3 Management approaches and challenges

2.3.1 Doody (2005) highlights a change in management approaches to dunes since the early 1990s, specifically a shift away from seeing erosion as a problem, to a broader understanding of the dynamic nature of dunes, and their dependence on fluctuating sediment budgets. The author also notes growing European awareness of the value of dune systems to society, as natural sea defences, wildlife refuges and recreational areas. He further observes, however, that there is substantial scope for better consolidation of knowledge concerning European sand dunes.

2.3.2 In a separate presentation, Doody (2008) provides a review of management challenges for European coastal dunes, based on an update of the 1991 inventory. He quotes the total sand dune area of Europe as being 600,000 hectares, although noting that this is likely an underestimate. A figure mapping the distribution of sand dunes in Europe is reproduced here as Figure 2.1. Key management issues identified by Doody (2008) include:

- Achieving a balance between erosion and stabilisation;
- Managing grazing pressure, including identifying appropriate levels of grazing;
- Understanding the extent to which stabilisation and scrub encroachment will continue to diminish open grassland, dune slacks and heath habitats;
- Reversing afforestation trends;
- Managing recreational uses of dunes;
- Addressing the problem of eutrophication; and
- Dealing with the threats posed by invasive species.

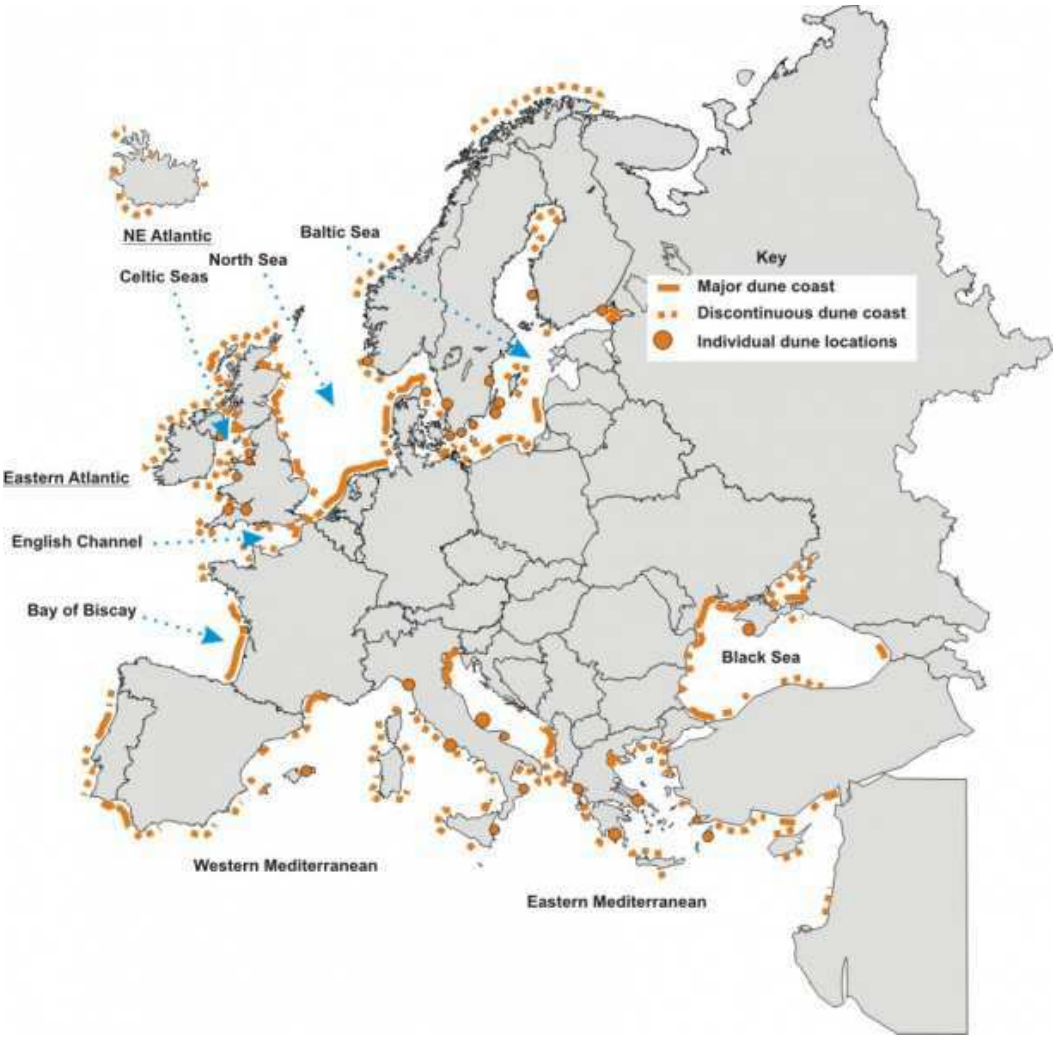
2.3.3 Similarly, Houston (2005) highlights the problem of damage (both direct and cumulative) caused by the following:

- Development;
- Fragmentation;
- Over-stabilization;
- Afforestation;
- Edge effects of development;

[1] The same author has since also edited an *Encyclopedia of the World's Coastal Landforms* (2010).

- Water loss;
- Nutrient deposition;
- Lack of ecological understanding; and
- Lack of awareness and respect.

Figure 2.1:
Distribution of coastal dunes in Europe
(Source: http://www.coastalwiki.org/coastalwiki/Image:Sand_dune_Distribution.jpg)



2.3.4 Doody (2008) points to the importance of 'the erosion question' as a pertinent dune management issue, reflecting on whether intervention is necessary in order to reduce sand movement. The author notes, for example, that mobile sand is essential for the formation of new dunes, and that erosional features (such as blowouts) may evolve into important habitat areas (such as dune slacks). In light of this, a recommendation is presented, to increase coastal resilience by restoring

the sediment balance and providing space for coastal processes (rather than seeking stability as a solution in all cases). In the latter case, phenomena such as 'sand dune squeeze' are particularly relevant. Doody furthermore highlights the importance of considering scale in management decisions.

2.3.5 The Eurosion initiative for sustainable coastal erosion management has produced a guide (dated 2004) to coastal erosion management practices in Europe, based on lessons learnt from past experiences. The document identifies four main groups of adverse impacts arising from dune erosion, namely (i) coastal flooding, (ii) the destruction of assets located on retreating cliffs, beaches and dunes, (iii) undermining of sea defence, and (iv) loss of lands of economical and ecological value. It also notes that coastal erosion results from both natural and anthropogenic influences[2], with these having different spatio-temporal patterns, and manifesting themselves through mechanisms that are not yet fully understood. The issue of uncertainty is thus very relevant to coastal erosion management. The report further notes that anthropogenic erosion has surpassed natural erosion in Europe, and that it is largely a result of cumulative and indirect impacts of small and medium sized projects. These impacts are, however, not being given adequate consideration in planning, including in the process of Environmental Impact Assessment (EIA). Furthermore, there is to date no 'miracle' solution to the problems of coastal erosion, with these best tackled through a combination of hard and soft engineering techniques.

2.3.6 The Eurosion report further notes that knowledge on the forcing agents of coastal erosion, and their interaction, tends to increase over time, but that this knowledge is fragmented and based on empirical observations in different areas of Europe. This conclusion appears to be reinforced by this analysis, as discussed in other parts of this report. Past measures to manage erosion have tended to be designed from a local perspective, ignoring the influence of non-local forcing agents, and as a result based inadequately on an understanding of wider-scale sediment dynamics. The Eurosion report also notes that management based on the concept of 'sediment cells' requires strong cooperation between regions; this challenge of harmonising management approaches has been addressed in at least two of the LIFE projects discussed in Section 3.

2.3.7 The same report makes recommendations for the management of coastal erosion in Europe, recommending (i) the assignment of clear and measurable objectives to coastal erosion management solutions, (ii) the use of multi-functional technical designs (fulfilling social, economic and coastal protection goals), and (iii) more explicit consideration of the balance of costs and benefits related to coastal protection.

[2] Natural factors listed include waves, winds, tides, near-shore currents, storms, sea level rise, slope processes and vertical land movements. Human induced factors include coastal artificialisation (including hard coastal defence), land reclamation, river water regulation works, dredging, vegetation clearing, gas mining or water extraction, and ship-induced waves.

2.4 Networking

2.4.1 A key focus of this JUNICOAST action relates to networking. Rooney (2005) discusses first steps taken towards the development of a European Coastal Dune Management Network during a 2004 conference in Aberdeen, and with the support of the Coastal and Marine Union (EUCC). The network was intended to be 'bottom-up' in nature, aiming to involve major stakeholders including conservationists, recreation managers, scientists, and engineers, amongst others. The network was further developed during the 2005 Dunes and Estuaries conference held in Belgium. As per information provided on the EUCC website, formal support for the establishment of a European Dune Network was subsequently given by the EUCC Council in April 2010, with the network intended to focus on conservation of dune sites contributing to the Natura 2000 network. The agreed aims of the network are:

- Promoting the sustainable use and management of coastal dunes;
- Supporting policies and actions that conserve the intrinsic natural values of coastal dunes;
- Developing a vibrant European network of communities concerned with coastal dune use and management;
- Supporting the advancement of knowledge and understanding of coastal dunes; and
- Providing an international platform dedicated to coastal dunes.

(EUCC, 2012)

2.4.2 The European Dune Network page on the EUCC website notes that the exchange of knowledge within the sand dune community has been supported by several significant LIFE projects in France, the United Kingdom, Belgium and Denmark, together with other projects in the Baltic Sea, and further driven by interest in networking between projects in the Mediterranean. However, the present-day coverage/activity of this network appears to be somewhat limited, at least on the basis of information provided on the EUCC webpages. The site still lists only four *initial* national contact points (from Portugal, Germany, the Netherlands and Italy), and there are no indications of activities/events held through this network. It is also of note that two of the links provided on the page (to the Sand Dune and Shingle Network based at Liverpool Hope University) are broken. If the European Dune Network is still active, then there appears to be substantial scope for it being broadened and given much greater visibility, particularly in order to foster new 'recruitment'.

2.4.3 The above-mentioned Sand Dune and Shingle Network appears to be very active, with the most recent event listed on its webpage being a Dune Scrub and Woodland Conference held in September 2012. The fact that the Network is still active was also attested to by one of the respondents to the survey discussed in Section 4. The Network publishes three newsletters annually (although only one

2012 newsletter is available online, with this published in March), providing news and updates on a variety of dune-related initiatives across Europe, including management activities, LIFE and other projects, relevant EU initiatives, publications and events, as well as information on regional, national and local experiences. The newsletters also provide a specific link to the European Dune Network (discussed above); it is worth noting, however, that the last available newsletter notes "*a need to push forward with the European Dune Network as a vehicle to highlight the continuing threats to European dunes and to promote improvements in practice and policy"*.

2.5 The contribution of LIFE projects

2.5.1 Houston (2005) reviews the contribution made by the LIFE programme to the conservation of sand dunes in the Atlantic Biogeographical Region, the major European region in terms of scale and number of dune systems (see Figure 2.1). He notes that the LIFE programme has helped translate emergent ideas concerning dune management into practice and demonstration, as well as linking dune management to wider conservation priorities of Natura 2000. Both claims appear to be validated by the review of LIFE projects presented in Section 3 of this report. Houston's review is conducted with reference to a range of identified dune 'land use' systems, including the following:

- The continuation of low-intensity agricultural activities including grazing, cultivation and rabbit-cropping;
- Use of dune areas as recreational sites (including for beach-based recreation);
- Use of dune areas as nature reserves, with access and management determined on the basis of species/habitat requirements;
- Use of dune areas for sea defence;
- Use of dune areas for other land uses, including forestry, water abstraction, sand extraction, military use, golf courses, and other leisure activities.

2.5.2 LIFE actions highlighted by Houston (2005) include:

- Awareness-raising activities with local communities;
- Introduction of visitor management systems;
- Stabilisation efforts (where necessary because of infrastructure and development) and development of less-intensive techniques were possible;
- Re-building of damaged shifting dunes;
- Encouraging changes in attitudes amongst established sectors (e.g. forestry) to enable a balance with nature conservation;
- Extending nature conservation messages to new partners (e.g. military, those involved in establishment/maintenance of golf courses);
- Purchase of sites at risk, and development of policies for land acquisition;
- Restoration of dune areas (following removal of infrastructure);
- Establishment of management and monitoring systems at Natura 2000 site level;

- Investigations into challenges of monitoring habitat quality;
- Predictions of habitat changes as a result of climatic change and associated phenomena;
- Assessment of insidious threats (e.g. nutrient deposition);
- Production of media materials (e.g. brochures);
- Encouraging the development of European networks; and
- Working with other EU funding sources to develop long-term management programmes.

(Houston, 2005)

2.5.3 Houston (2005) also reviews a selection of LIFE projects from the Atlantic Biogeographical Region. Specific contributions of these projects include: (i) the development and implementation of techniques for dune restoration (including re-profiling of dune faces, planting of dune grasses, sowing of species, fencing); (ii) the development of dialogue with, and new practices within, the forestry sector, (iii) the development of improved techniques for habitat and species management; (iv) the establishment of links with private land owners, for purposes of conservation; (v) the development of monitoring protocols for dune condition, habitat and species; (vi) initiatives for awareness raising, information dissemination and education, and (vii) facilitating networking activities.

2.5.4 The European Union has also published its own review of the contribution of the LIFE programme to coastal zone management in Europe (in 2012). This notes that the LIFE programme has been one of the main EU financial instruments used to support the adoption and implementation of Integrated Coastal Zone Management (ICZM) strategies in Europe, and that a total of 35 coastal zone management projects have been funded through the ICZM Demonstration Programme. A number of these projects are discussed in Section 3 below. The key approaches highlighted as being crucial to ICZM are:

- Integration;
- Ecosystem-based approaches;
- Participatory approaches;
- Knowledge-based approaches;
- Socio-economic approaches;
- Technical approaches.

The extent to which these approaches have been adopted in the reviewed LIFE projects is discussed further in Section 6.

3. LIFE projects

3.1 Overview

3.1.1 A search of the LIFE projects database (hosted at http://ec.europa.eu/environment/life/project/Projects/index.cfm), using the keyword *'dune'*, returned 152 results. The full list of projects is provided in Annex 2, with this list spanning projects funded between 1999 and 2011. An overview of the timeline and geographical spread of these projects is provided in Table 3.1 below. The background, objectives, results and target habitats/species of each of these 152 projects were reviewed, also with a view to (i) identifying the extent to which they focus on dunes, and (ii) identifying project successes and failures. The search did not attempt to exclude projects that did not focus on *coastal* dunes, as there was a danger that an attempt to do so would result in the exclusion of projects of relevance. It should therefore be noted that the projects discussed hereunder address a variety of dune typologies, including coastal dunes, shifting sands, grey dunes and inland dunes.

Table 3.1:
LIFE projects database search results for project descriptions including keyword *'dune'*.

	Year of funding																				
Country	**92**	**93**	**94**	**95**	**96**	**97**	**98**	**99**	**00**	**01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**Total**
Algeria[3]	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	**1**
Austria	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	**1**
Belgium	-	-	1	1	1	-	-	2	-	-	1	2	1	2	5	1	2	4	-	2	**25**
Denmark	-	-	1	-	1	1	-	-	-	-	1	-	-	-	-	-	-	-	-	1	**5**
Estonia	-	-	-	-	-	-	-	-	1	-	1	-	1	-	-	-	-	-	1	-	**4**
Finland	-	-	-	-	2	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	**4**
France	2	-	-	1	1	-	2	1	-	-	-	-	1	-	1	1	-	-	-	-	**10**
Germany	-	-	-	1	1	-	2	-	-	-	2	-	-	2	-	-	-	-	1	-	**9**
Greece	-	-	-	-	-	1	1	-	-	-	3	-	-	-	-	1	-	1	-	-	**7**
Hungary	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	**2**
Ireland	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**4**
Italy	-	3	4	1	-	2	3	3	3	-	2	1	-	2	1	1	1	3	2	2	**34**
Latvia	-	-	-	-	-	-	-	-	1	-	2	1	-	-	1	-	-	-	-	-	**5**
Lithuania	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	**2**
Netherlands	-	-	-	-	-	-	-	-	-	-	1	1	1	1	2	1		2	1	1	**11**
Poland	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	**2**
Portugal	-	-	-	2	1	-	2	-	-	-	-	-	1	-	-	-	-	-	-	-	**6**
Slovakia	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	1	-	**3**

[3] LIFE Third Country project

	Year of funding																				
Spain	-	-	-	-	1	-	2	3	1	-	-	2	3	-	-	-	-	-	-	-	**12**
UK	-	-	-	2	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	**5**
Total	**3**	**4**	**7**	**9**	**9**	**4**	**13**	**12**	**6**	**0**	**13**	**7**	**8**	**10**	**11**	**5**	**4**	**12**	**8**	**7**	**152**

3.1.2 15 projects did not focus directly, or to a significant degree, on dunal habitats/species, and appear to have been included in the search results because of incidental occurrences of the word *dune* in the project information included within the LIFE projects database. In one case, for example, *dune* appeared only within the partner description, with reference to previous projects conducted, whilst in other cases, the word *dune* was used only in broad descriptions of the study area. These 15 projects focused on a range of thematic areas including water treatment, marine conservation, wetland management, conservation in coastal lagoons, and light pollution, amongst others. These projects were excluded from the subsequent analysis.

3.1.3 68 projects appear to focus on dunes, at least to some extent, but the information provided on the LIFE projects database did not include any indication of results obtained. Given that the remit of this report is a review of successes and failures, these 68 projects are therefore excluded from the analysis, as such an assessment cannot be conducted without reference to documented results. In some cases, results may not be available because projects are ongoing/recent, and such information is therefore not yet available or public – this may reasonably be assumed to be the case for projects funded between 2009-2011, but is far less likely to explain the lack of information available for projects within the other two year groups (Table 3.2). This lack of information concerning results obtained does appear to represent a constraint in terms of successful networking and exchange of experiences across Europe (see Section 6).

Table 3.2:
LIFE projects for which no results are available – distribution across year groups.

Year group	Number of projects
1992-1999	21
2000-2008	20
2009-2011	27

3.1.4 12 projects focus extensively or exclusively on dunal habitats and species; an additional 57 projects focus on dunal habitats, at least in part. These 69 projects are discussed further below. It should be noted, however, that the discussion below is based solely on material provided through the LIFE projects database, with results and indications of successes/failures likely provided by project

beneficiaries themselves. Whilst the validity of these insights is certainly not in question, the objectivity of such a 'self-analysis' may be different from a similar analysis, either conducted by all project participants (rather than only the main beneficiary) or through an external audit. This point should be borne in mind with reference to the discussion below.

3.2 Projects with an extensive focus on dunes

3.2.1 The 12 projects which focus extensively/exclusively on dune habitats are described in some detail in Table 3.3. All projects indicate several successes, with these including, both site-specific and more generic outputs, as follows:

Case specific outputs

- Dunal habitat recovery & restoration;
- Improved conservation status of priority sites & species;
- Improved ecological integrity of dunal habitats, including through the promotion of natural dynamics;
- Enhancement of the knowledge base related to dune dynamics and ecology;
- Development and implementation of improved management practices within case study sites;
- Successful collaboration across relevant stakeholders; and
- Increase in coverage of protected areas.

Generic outputs

- The demonstration value of LIFE pilot projects for other sites/initiatives;
- Significant increases in public awareness/information within and beyond case study areas;
- The generation of management guidance material and decision-support tools for dunal habitat restoration/management; and
- Policy/legal changes as a result of LIFE project actions.

3.2.2 Seven projects (58%) do not indicate any constraints or instances in which project objectives were not met; of these, two projects specify that all objectives were fully satisfied. Constraints listed by the remaining five projects are indicated in Table 3.3. In two cases (Hulsig Hede and DUNE TOSCA), the constraints encountered appear to relate, at least in part, to technical limitations – in the first case, estimates of vegetation coverage based on aerial photography turned out to misrepresent the true extent, whilst in the second case, the removal of an alien species (*Yucca gloriosa*) does not appear to have been done successfully, notwithstanding the project actions. In the case of Hulsig Hede, the project was funded in 1996 and implemented shortly thereafter, and there has undoubtedly been much progress in the development of accuracy in remote sensing technologies in this field since - see Section 5 below. The constraints relating to

Table 3.3:
LIFE projects with an extensive focus on dunal habitats.

Project title	Country	Year of finance	Threats addressed	Project actions	Key successes	Constraints
Cons. Costa W	Portugal	2004	Trampling Disruption of dune dynamics Poor conservation status of target species	Construction of stone walls/fencing Use of biodegradable 'blankets' for dune protection Seeding of dune habitats Planting of specimens Filling of ravines with tree branches Awareness raising initiatives	Restoration of dune habitat Halting/reversal of regressive trends Increased distribution/population of target species Significant increase in awareness & information	Recovery of dune ecosystem took place in area substantially smaller than foreseen at the start of the project (approx. 1/3 that originally envisaged).
Dunas Albufera	Spain	2000	Urban pressure	Demolition of coastal infrastructure Dune restoration Construction of trail for non-motorised vehicles Awareness raising initiatives	Habitat recovery Improved conservation status of site Promotion of natural processes as a result of site restoration Increased population of 2 endangered fish species Significant increase in awareness & information High demonstration value of project for sustainable tourism	All objectives achieved.
Dunas Laida	Spain	2004	Tourism pressure Dumping of dredged silt on supra-tidal beach area Climate change & increased frequency of sea-storms	Establishment of dune belts Recolonization of dune system Control of public use through establishment of perimeter enclosure Awareness raising initiatives Scientific monitoring	Regeneration of coastal dune ecosystem Promotion of natural processes as a result of site restoration Reduction in impact of people on dunes Increased knowledge of dune dynamics Publication of management guidelines Economic benefits	None indicated.

Project title	Country	Year of finance	Threats addressed	Project actions	Key successes	Constraints
Dune Habitats	Denmark	2002	Inappropriate land-use Over stabilization Large-scale invasion of non-native species Ammonium deposition Inability of dunes to function as dynamic natural system	Purchase of land Scientific monitoring Clearing of invasive/non-native vegetation Grazing, burning & cutting Closure of drainage trenches Awareness raising initiatives	Improvement in conservation status of priority habitats Production of Best Practice guides Significant increase in awareness & information	Project found that efforts to use grazing as a management tool in marginal areas are faced with financial constraints resulting from the Common Agricultural Policy (CAP), with farmers unwilling to enter into grazing agreements without accompanying subsidies.
DUNETOSCA	Italy	2005	Large-scale invasion of non-native species Disruption of dune dynamics	Removal of alien species Planting of autochthonous species Closure of paths Installation of platforms and fences	Discovery of 2 new habitats Improved status of priority habitats Successful recolonization of dunes by dune species	Difficulties removing the invasive *Yucca gloriosa*; resprouting of this species during the final year of the project.
Enebro Valencia	Spain	2004	Urban pressure Visitor pressure	Removal of obsolete infrastructure Reconstruction of dune hills and abrasion platforms Recovery of network of malladas Planting of marine juniper Removal of alien species Awareness raising initiatives	Habitat and species recovery Improvements in germination rate of marine juniper Development of predictive model for habitat management	None indicated.
FEYDRA	Belgium	2002	Urban pressure Tourism pressure Decline in grazing	Damming & clearing of stream Removal of woodland Dismantling of sewage plant Scientific monitoring Establishment of communication with public/semi-public authorities Awareness raising initiatives Networking	Restoration of open dune vegetation Effective large-scale management of water level Increased knowledge of dunes Significant increase in awareness & information	None indicated.

Project title	Country	Year of finance	Threats addressed	Project actions	Key successes	Constraints
Hulsig Hede	Denmark	1996	Large-scale invasion of non-native species	Pine clearance	Improved conservation status of priority habitats Increased knowledge of dune dynamics	Clearing work turned out to be more expensive than foreseen, because of (i) underestimate of overgrowth based on aerial photography, and (ii) weather and terrain conditions rendering fieldwork more expensive.
Implementing alternative strategies in Irish beach & dune management	UK	1996		Demonstrations in informed, multisectoral, community-based sustainable management of beach/dune systems, combining utilization and conservation	Development of dissemination programme designed to inform and influence coastal policy at European level Ongoing collaboration across partners	None indicated.
Pannonische Sanddunen	Austria	1998	Intensive agriculture/forestry Sand quarrying Proliferation of shrubbery Insufficient erosion/deposition	Land acquisition Clearance of hedges and bushes Conversion of arable land into sand grassland Grazing, mowing, vegetation removal Awareness raising initiatives	Establishment of seed collections/experimental plantations of rare sand dune species Creation/increase in coverage of protected areas Improvements to forestry law	Problems encountered in obtaining permits for tree removal – constraint addressed through the project.
Silberscharte	Germany	1996	Habitat degradation/loss	Land acquisition Removal of fences/huts Clearance of hedges and bushes Mowing of grass Pruning/felling of trees Implementation of crop cycling Soil ploughing/addition of sand Awareness raising initiatives Scientific monitoring	Increase in available habitats for target species Improvement of soil/habitat conditions	None indicated.

Project title	Country	Year of finance	Threats addressed	Project actions	Key successes	Constraints
Vattajan	Finland	2005	Military use of dune habitats	Clearing of wooded pastures/meadows Clearing stumps/young pines Blocking of ditches Construction of dam Raising of embankment Relocation of firing stations & infrastructure Awareness raising initiatives	Management plan Restoration plans for dunes Adjustment of military/recreational activities on site Decrease in military use of priority sand dune habitats Significant increase in awareness & information	All objectives reached.

removal of alien species, do, however, appear to be pertinent to this day. This point is also discussed further in Section 5.

3.2.3 Two other projects (Dune Habitats and Pannonische Sanddünen) encountered constraints emerging from the policy/legal framework. In one case, the cooperation of farmers for grazing agreements was difficult to secure because of the Common Agricultural Policy (CAP) framework and related expectations related to subsidies, whilst in the second case, project beneficiaries faced bureaucratic difficulties in felling trees for purposes of habitat management/restoration because of forestry laws in place at the time. Both of these constraints may be less pertinent today; in the first case, CAP reforms implemented since are likely to have changed the policy landscape, whilst in the second case, relevant forestry laws were revised, at least partly as a result of the initiatives and involvement of the LIFE project beneficiaries.

3.2.4 The project Cons. Costa W encountered difficulties in carrying out restoration activities, but details are not provided on the LIFE projects database; it is noted, however, that the area successfully restored was only a third the size of that originally envisaged.

3.3 Projects with a partial focus on dunes

3.3.1 The objectives and results of the 57 projects which focused on dunal ecosystems (in part) were also reviewed. This review is qualified by the fact that several of the project descriptions did not distinguish clearly between actions targeted at dunal habitats and actions addressing other related (e.g. wetland) or unrelated (e.g. infrastructural) elements. Similarly, successes and failures are often discussed in general project terms, and the relevance to dunal habitats thus needs to be inferred from available documentation.

3.3.2 Several of these projects do not specifically identify a threat to dunal habitats that the project seeks to respond to. Of those that do, the majority (8 projects) refer to tourism and related visitor pressures. Other threats (cited by 1-3 projects in each case) include:

- The expansion of agricultural activities, including land reclamation;
- Urban pressure;
- Pressure from industrialization;
- Invasive alien species;
- Lack of grazing/mowing and/or decline of other management practices;
- Disturbance of indigenous species; and
- Habitat degradation.

3.3.3 Project successes and difficulties are indicated in Tables 3.4 and 3.5 below. The list includes only achievements/challenges specifically mentioned in the available

documentation within the LIFE projects database. Thus, for example, whilst 21 projects specifically refer to enhanced public awareness as a point of success, this does not exclude that this was also an effective output of other projects (other than these 21), which did not choose to list this as a key result. The same proviso applies to other 'successes' listed, including the establishment of collaboration mechanisms, the implementation of participatory approaches and the development of an improved knowledge base.

Table 3.4:
Project 'successes', as cited in LIFE project descriptions.

Project 'successes'	Cited in (no. of project descriptions)
Effective habitat restoration	32
Revised/improved management practices	24
Enhanced public awareness	21
Enhancement of scientific knowledge base	15
Protection of sites/extension of protected areas	14
Benefits of project actions for faunal species	12
Construction of visitor facilities	11
Demonstration value of pilot projects	7
Development of guidance materials/protocols	6
Capacity building	5
Successful collaboration	5
Participatory planning	3
Dune building/reinforcement	2
Enhanced tourism value	2
Harmonization of planning tools	2
Exchanges of knowledge and experience	1

3.3.4 Most commonly cited successes are (i) restoration of habitat, and (ii) revised/improved management approaches and practices. With reference to habitat restoration, several projects appear to have implemented actions designed to improve habitat integrity, and to restore habitats to a better state of conservation and to a condition of improved viability. Amongst the project actions commonly listed and related to this goal are efforts to remove infrastructural elements that have disrupted dune dynamics (e.g. roads, huts), initiatives to clear vegetation that has spread and invaded dunal habitats (e.g.

woodland/shrubs), attempts to remove invasive alien species, and initiatives to re-establish dune vegetation, through seeding/planting. Revised/improved management approaches discussed in these projects are related, but vary in scale, from the establishment of long-term management plans and medium-term operational plans, to site-specific management initiatives (e.g. changes in agricultural practices, zonation/re-siting of activities, changes to grazing regimes, etc.).

3.3.5 Several projects report on enhanced public awareness as a key project output, often referring to a variety of actions implemented in this regard, including the development of brochures, posters and publications, the organization of exhibitions and public events, and a variety of other outreach/consultation/dissemination actions. It is worth pointing out that several projects appear to report on 'increased public awareness' as an intuitive, rather than evidence-based, result. Whilst project managers are undoubtedly well positioned to gauge whether a project has led to any change in public sentiment or in public levels of information, it would also be valuable if this project dimension were to be evaluated in a systematic and objective manner, based on clearly defined criteria. It would likewise be informative if such evaluations were to consider, not only whether public knowledge of, and appreciation for, dunal habitats has increased, but also whether projects have resulted in any tangible change in attitudes and/or behaviour. Furthermore, important insights could be gleaned from an analysis of whether knowledge/attitude/behaviour changes are similar across different sub-groups, or whether there are differences, for example related to age or level of education.

3.3.6 Other project 'successes' include (i) improved knowledge of dunal systems and (ii) enhanced protection of sites. In the case of the former, knowledge aspects enhanced were generally related to dune ecology and/or to population dynamics of dunal species. Several projects indeed carried out surveys specifically designed to address knowledge gaps. In some cases, these surveys were intended to serve a complementary function linked to point (ii) above, i.e. that of contributing to the designation of dunal sites as protected conservation areas, and leading to their eventual management. A number of projects in fact appear to have been designed specifically with the Natura 2000 network in mind. In some cases, the project appears to have contributed to the designation of a dunal sites as a protected conservation area, whilst in others, it has contributed to an increase in the spatial extent of the protected area.

3.3.7 A number of additional project achievements are discussed below:

- Positive effects on faunal species – a number of projects reported that the success of habitat restoration/improvement efforts conducted throughout the project time-span had already been reflected in increased populations of target species, including avifaunal species, amphibians and reptiles.

- Visitor facilities – given the importance of managing visitor pressures within several dunal sites (see discussion above), a number of projects have invested in the construction of visitor facilities which are compatible with conservation objectives, with these commonly including boardwalks and observation facilities.

- Demonstration value – several pilot projects were noted to have demonstration value, showing that it is possible to reconcile nature conservation with other land-use objectives, and illustrating how this can be done, as well as establishing a precedent for future projects.

- Development of guidance materials/protocols and decision-support tools – apart from case study-specific outputs, a number of projects generated guidance material of wider applicability for dune management.

- Capacity building was noted to be a key result in a small number of projects, with training of technical staff and also training of those whose activities may influence the conservation status of dunal sites.

- Two projects referred to the benefits of improved harmonisation of planning systems for different dunal sites across different political units as a key element of success.

- A further two projects referred to the enhanced value of dunal sites for tourism, as a result of LIFE project activities.

3.3.8 16 projects identified constraints/difficulties that impeded successful achievement of all project objectives. These are indicated in Table 3.5 below, and incorporate:

- Stakeholder conflicts;
- Policy limitations;
- Project management problems;
- Inadequate technical experience;
- Unforeseen developments; and
- The socio-political context of LIFE projects.

Table 3.5:
Project difficulties, as cited in LIFE project descriptions.

Project 'difficulties'	Cited in (no. of project descriptions)
Lack of cooperation between relevant authorities	1
Inadequacy/inappropriateness of policy/legal framework	1
Project organization difficulties	4

Project 'difficulties'	Cited in (no. of project descriptions)
Failure to deliver on project objectives/actions	5
Conflict with stakeholders	3
Lack of technical experience	1
Lack of project continuity	1

3.3.9 Stakeholder conflicts were identified in a number of projects. These included (i) problems achieving cooperation between local authorities relevant to the project, and also between local and national authorities, (ii) conflicts between project beneficiaries and owners of land areas relevant to the project, and (iii) conflicts between project beneficiaries and local communities. In the latter case, one project reported that the local community did not feel it had been adequately involved, nor that it had been allowed to benefit from the LIFE project. In the case of point (ii), one project reported that its actions had been blocked by landowners. Another project reports that it was unsuccessful in its attempts to acquire land, but does not specify whether this was due to stakeholder issues or to other matters.

3.3.10 Project management problems included internal organizational problems, problems with time management and a failure to adequately deliver all planned elements of the project. In some cases, this appeared to be due to unforeseen events. In one project, the beneficiary reports that activities were disrupted due to an earthquake. In another project, the lead partner noted that its efforts were diverted to another initiative, with consequent negative impacts on the LIFE project. Socio-political events also appear to affect the success of LIFE projects; in one example, tensions related to a mining accident appear to have complicated the implementation of project actions.

3.3.11 A third category of constraints relates to technical/capacity limitations. One project reports that the team had inadequate experience with participatory planning initiatives, with consequent impacts on the project. In another example, the project reports that its efforts to raise awareness were inadequate.

3.3.12 Additional constraints include (i) the limitations imposed by existing policy and legal instruments, and (ii) the lack of project continuity. In the first case, existing policy instruments may present challenges for effective habitat management, and projects do not always appear to be successful in overcoming these. In one case, an attempt to have an area designated as protected appears to have failed, at least within the time span of the project. The point concerning project continuity refers to both continuity over the duration of the project, and continuity beyond the time frame of LIFE. Several projects appear to make some provision for the latter, but details of successes/failures beyond the LIFE timespan are generally unavailable.

4. Surveys

4.1 LIFE project coordinators/participants

4.1.1 In order to supplement the results discussed in Section 3 above, a brief online survey was designed, with the intention that this would be disseminated to all project beneficiaries listed in connection with the above-mentioned 152 projects. The email addresses of lead beneficiaries were obtained from the LIFE projects database.

4.1.2 A full copy of the survey is provided in Annex 3. Respondents were asked to indicate (i) the LIFE project that they participated in, (ii) the capacity in which they were involved (e.g. coordinator, partner), (iii) the time-period of the project, (iv) the spatial scale of the project (e.g. local, regional), and (v) the project study area. Key questions within the remainder of the survey asked respondents for their views on the following points:

- The most significant threats to coastal dunes in Europe;
- The extent to which these threats were successfully addressed through the LIFE project;
- The key successes of the LIFE project;
- The limitations/constraints encountered during the project;
- The extent to which there was follow-up after conclusion of the LIFE project; and
- Participation in coastal dune networks.

4.1.3 Although the survey was sent out to all respondents for whom email data was available through the LIFE database (125 in total), the response rate was very poor (6 responses). This was at least in part due to the fact that many of the email addresses listed in the LIFE database were evidently no longer in use. Some 50 of the emails sent out were in fact returned by the respondents' mail systems. This presents a significant constraint to the use of the LIFE projects database as a basis for networking, a point which is discussed further in Section 6. Five of the respondents were project coordinators, with the time span of projects ranging from 2004 to 2013.

4.1.4 The most significant threats to European coastal dunes identified by respondents were urban development (indicated by 4 respondents), dune stabilisation (4 respondents), nutrient deposition (4), touristic and recreational development (3), decline in quality/quantity of water resources (3), lack of ecological understanding (3), lack of awareness (3), infrastructural development (2), fragmentation of the sediment-dune system (2), and afforestation (1). Other threats indicated by respondents were:

- The invasion of alien species (2);
- Simplification of the floristic composition of dune communities (1);

- Coastal erosion (1); and
- The disruption of dunal dynamics (1).

4.1.5 The most frequently addressed threat in projects was dune stabilisation (tackled in 5 of the 6 projects). The extent to which other threats were addressed in such projects is indicated below:

- Touristic and recreational development (3 projects);
- Lack of ecological understanding (3);
- Lack of awareness (3);
- Afforestation (2);
- Nutrient deposition (2);
- Decline in quality/quantity of water resources (1);
- Infrastructural development (1);
- Agricultural development (1).

None of the respondents were involved in projects tackling urban development or the fragmentation of the sediment-dune system. Other threats addressed included industrial development, the invasion of exotic plants, and the issue of rabbit grazing.

4.1.6 Three respondents felt that the threats had been well resolved within their projects, whilst one noted that this could only be determined on the basis of future monitoring results. The remaining two respondents qualified their views of project success. One noted that threats were resolved for a number of years but not indefinitely, and that certain problems persisted (e.g. lack of deposition, rabbit grazing). The second respondent observed that whilst project results appear to indicate success, the most significant threat of nutrient deposition could not be tackled within the framework of the project, because it forms part of a much larger complex of problems.

4.1.7 Project successes highlighted by respondents included increased awareness and improved collaboration with a range of stakeholders (listed by 3 respondents), and successful habitat restoration (1 respondent). Constraints related to wider dunal dynamics that could not be addressed by the project (e.g. large-scale coastal erosion, lack of sediment deposition), and to project 'failures' – one example cited was the failure of a LIFE project to consider regulating the licensing of bathing establishments and better managing tourist fluxes in order to deal with the problem of visitor pressure.

4.1.8 All respondents indicated that there has been follow up to their projects following the end of the formal project period, with references to a range of scientific monitoring programmes.

4.1.9 Only two of the six respondents presently participate in networks relating to coastal dune management. The two networks indicated are the Sand Dune and

Shingle Network (discussed above) and *Pôle Relais Lagunes Méditerranéennes*. Five of the six respondents indicated that they would be interested in being involved in networks related to coastal dune management.

4.2 Specialists in coastal dune management

4.2.1 A second related survey was designed for dissemination to 'experts' in coastal dune management. A list of potential respondents was compiled on the basis of professional networks, and six respondents submitted a reply to the online survey (copy in Annex 4). The content of the survey was similar to that provided for LIFE project participants.

4.2.2 The major threats highlighted by all six respondents were (i) urban development, (ii) touristic and recreational development, (iii) infrastructural development, and (iv) lack of awareness. Lack of ecological understanding was also considered to be a significant threat (noted by five respondents), as was fragmentation of the sediment-dune system (4). Other threats indicated included beach 'cleaning' activities which destabilize foredunes and dunes, camping and offroading activities, the implementation of hard engineering works to 'stabilise' the coast, a decline in sediment quantities transported by rivers, alien invasive species, and 'coastal squeeze'.

4.2.3 When asked about the extent to which these threats have been successfully resolved through projects, plans, policies and other European initiatives, respondents were generally not too optimistic. Five of the six respondents indicated areas were threats had not been successfully resolved, with points noted including:

- Excess bureaucracy and its negative impact on conservation measures;
- The lack of proper valorisation and appreciation of dunal resources;
- A tendency for decision-makers to give way to pressure by developers, particularly on the coast, and the lack of any evidence that coastal development is being successfully controlled/managed;
- The lack of effective control of alien invasive species; and
- The lack of effective control of litter and the likelihood that this problem will worsen.

4.2.4 The main successes highlighted by respondents were (i) the increased protection of several dunal systems through the establishment of conservation areas and ecological corridors, (ii) the influence of the EU Habitats Directive in slowing down the speed of occupation and fragmentation, and (iii) increased awareness of the importance of dune systems.

4.2.5 Respondents were also asked to indicate persistent problems related to dune management, which will need to be addressed in future years. Key response themes are indicated below:

- Activities that impact on dunes negatively (e.g. offroading, trampling, pollution), which are still inadequately controlled;
- Coastal development, which although acknowledged to be a problem, has not been tackled effectively;
- Pervasive gaps in scientific knowledge;
- Interruption of links between marine-terrestrial ecosystems, including changes in sediment flow to beach and dune systems;
- The implementation of beach nourishment projects using unsuitable sediments, which interfere with natural dune dynamics; and
- Lack of scientific knowledge at policy/planning levels.

4.2.6 Key recommendations proposed by respondents included (i) coordinated analysis of data concerning dunal systems gathered across projects and over several years, (ii) implementation of EU Directives for coastal zone management and protection, (iii) building capacities for effective implementation of management actions, through provision of funding and personnel, and (iv) development of effective networks for management purposes.

4.2.7 Only one respondent presently participates in a coastal dune network; all respondents would, however, be interested in networking opportunities.

5. Academic research

5.1 Overview

5.1.1 The scope of this review of academic research was to obtain an indication of relevant areas in which our knowledge has increased, as well as to contribute toward an understanding of persistent challenges in dune management. The review was also intended to indicate present areas of research focus related to dune systems. An initial search was conducted (using the SCOPUS database) for research papers with the words *coastal dune* in the title, abstract or keywords. 4505 results were initially returned, which were subsequently filtered, to include only research papers from European countries (total of 1648). This also served to provide an indication of the geographical spread of coastal dune research in Europe (Table 5.1), enabling an assessment of the extent to which our knowledge is based on representative empirical observations from across the European region. Abstracts of a random selection of these 1648 articles were reviewed, and a more in-depth analysis of papers published in 2012 and 2013 was carried out. A number of papers were excluded because their scope did not relate to coastal dune management, planning and/or restoration.

Table 5.1:
Geographical spread of coastal dune research in Europe
(as per listings on SCOPUS database – 20/01/13).

Country	Research papers
United Kingdom	340
Netherlands	288
Germany	193
Italy	175
Spain	174
France	167
Portugal	112
Belgium	93
Denmark	63
Poland	45
Sweden	38
Turkey	33
Lithuania	28
Switzerland	24
Ireland	23

Country	Research papers
Russian Federation	19
Greece	16
Norway	15
Estonia	13
Latvia	11
Austria	9
Finland	7
Czech Republic	5
Bulgaria	4
Romania	3
Hungary	2
Armenia	1
Croatia	1
Iceland	1
Malta	1
Slovakia	1
Slovenia	1

5.2 Key research areas

5.2.1 A number of key trends/conclusions emerged from this academic literature review. These are summarized in Table 5.2 below, and discussed in more detail in the subsequent paragraphs, with examples of relevant studies cited in each case. The list of indicated areas is not intended to be exhaustive, but rather, to provide a snapshot view of a number of key areas of research effort.

Table 5.2:
Key academic research areas (2012-13).

Research areas
Techniques for the measurement and monitoring of coastal dune dynamics
Developing an improved understanding of physical dune dynamics
Developing an improved understanding of dunal ecological characteristics/interactions
Exploring the potential impacts of climate change on dune dynamics

Research areas
The effective management of invasive alien species on dunes
Addressing the loss of dunal biodiversity
The role of dunal systems in coastal protection
The effect of hazards and risk on dune systems
Resolving recreation/conservation conflicts in dunal areas
Addressing land-use conflicts and pressures in dunal areas

5.2.2 Several recent studies have focused on the development of new and improved methods for understanding coastal dune dynamics. The inherently variable nature of these environments has long presented a constraint for their management, particularly in the absence of a clear understanding of the extent to which observed seasonal and long-term variation was due to natural and/or anthropogenic contributing factors. Amongst examples of recent innovations are (i) studies that seek to measure and monitor dunal change, (ii) studies that seek to improve the resolution of coastal dune data, and (iii) studies that assess measurement/monitoring techniques and constraints. Examples within these categories include studies that use multi-temporal LIDAR to assess dunal change (e.g. Richter *et al.* 2013), studies that seek to measure effects of erosion/accretion at higher spatial and temporal resolution than existing datasets, using GPS surveys in Real Time Kinematic (RTK) mode (e.g. Garrido *et al.*, 2013), and the development of methods to estimate error in shoreline change studies (e.g. Del Rio *et al.*, 2013). Remote sensing techniques feature prominently in several such research endeavours, both for understanding of broad-level land cover change, as also for thematic assessments. In an example of the latter, Hantston *et al.* (2012), use object-based classification (using multispectral aerial photographs and indices derived from LIDAR) to classify invasive woody species in dunes. Research has also focused on the suitability of different techniques for dune monitoring. Tatum *et al.* (2012), for example, assess the suitability of radar for monitoring dune environments, considering the influence of factors such as moisture in the dune core, the presence of conducive evaporates drawn upwards from the dune base through capillarity, surface salinity on coastal dunes, the presence of vegetation, and lithology.

5.2.3 Linked to the point above, recent published research also reveals improved understanding of several aspects relating to the physical dynamics of coastal dunes. Smyth *et al.* (2012), for example, address the problem of inadequate quantification of 3D wind flows around blowouts, through the development of ultrasonic 3D anemometry and 3D computational fluid dynamic modelling, providing a detailed picture of the heterogeneity of wind flow over this type of terrain. Schönfeldt (2012) provides insights on aeolian sand transport rates, on the basis of two field transport sensors, which were field tested in the same study. A number of studies seek to develop modelling approaches to foster a better

understanding of physical dynamics; Vosdoukas *et al.* (2012), for example, apply a dune erosion model (XBeach) to predict morphological response to storm events along a meso-tidal beach, whilst Roig-Munar *et al.* (2012) use a Digital Shoreline Analysis System to assess erosion trends, correlating observations with visitor use of different beach-dune systems.

5.2.4 There appears to have been significant progress made in understanding the mechanisms through which invasive species become established within coastal dune environments, with important implications for management projects that seek to address this pervasive threat - (a number of such projects have been discussed above). In one study, Novoa *et al.* (2012) discuss the case of *Carpobrotus edulis*, assessing the relevance of soil factors, endozoochory, competition and allelopathic effects in facilitating early establishment of this alien. Their results point to an important role for scarification of seeds following passage through rabbits' intestines, as well as to the long-lasting significance of litter of *C. edulis* on the soil surface, which through allelopathic releases suppresses the growth of other native species. The authors highlight the fact that these results can, at least in part, explain the failure of past projects intended to control this invasive species, and indicate the continued need for further research in this area. In another study, Schirmel *et al.* (2012) assess the influence of an invasive moss (*Campylopus introflexus*) on ecosystem functioning in acidic coastal dunes, observing effects of moss invasion on habitat structure and ground-dwelling arthropod diversity. Several studies point to physiological advantages of alien species under situations of ecological stress. In one case, the invasive exotic legume *Acacia longifolia* is found to pose a threat to the native *Ulex europaeus*, as it is better adapted to handle situations of high salinity (Morais *et al.*, 2012).

5.2.5 Numerous studies point to the complexity of dunal ecosystems, in particular due to their inherent variability and to the as yet inadequately understood role of disturbance and instability. Evidence points towards important small-scale internal gradients in disturbance and stress within dune systems (Brunbjerg *et al.*, 2012). This is evident from a number of studies that show differential species responses to physical dune dynamics; Ciccarelli *et al.* (2012), for example, show that the abundance of *Ammophila arenarius*, *Elymus farctus* and *Otanthus maritimus* ssp. *maritimus* on dunes in central Italy varies depending on erosive/prograding processes, indicating unstable equilibria. At the same time, the ecological importance of coastal dune habitats is reiterated across the literature, with several authors expressing concern about the integrity of this habitat type across Europe. Indeed, Bacchetta *et al.* (2012) identify coastal sand dunes as *the* most endangered habitat type from amongst European Union habitat categories. Particular dune sub-systems also harbour species of high vulnerability; one example is the endangered *Parnassia palustris*, typically found in dune slacks formed by recent sand displacements in dune landscapes (Bonte *et al.*, 2012).

5.2.6 The potential impact of climate change on dune dynamics appears to have stimulated substantial research interest. Several reviewed studies consider this a

matter of serious concern for future coastal dune conservation. Curreli *et al.* (2013) assess the impact of changing hydrological regimes on dune slack vegetation, noting that predicted declines in water levels by 2080 are likely to have a major (negative) impact on the vegetation of these priority conservation habitats. Similarly, Fontan *et al.* (2012) consider the long-term implications of climate change on dune systems, specifically the negative effects of a decrease in trade winds and changes in wave intensity on sediment deposition. Witte *et al.* (2012) consider the implications of changes in precipitation levels for dunal systems, noting that little is known about the effects of dry spells on species composition, and with results from their study indicating that more drought may be expected to increase the proportion of mosses and bare ground cover. Other authors link climate change concerns with invasive species considerations; Morais and Freitas (2012) for example, assess the acclimation potential of *Acacia longifolia* to water stress, finding that this is of significance given predictions of extended droughts in future, as a result of climate change.

5.2.7 A number of studies focus on vulnerability and risk concerns. Rodrigues *et al.* (2012) develop a method to detect overwash-prone areas in a study area in Portugal, in order to develop a vulnerability map. Debaine and Robin (2012) similarly develop a GIS-based model of coastal dune protection services, using geoindicators to highlight aeolian deflation, marine coastal erosion and marine submersion. Other studies focus on habitat remediation following hazard events. Menkis *et al.* (2012) assess the role of root treatment systems for enhancing the establishment of *Pinus sylvestris* seedlings on coastal dunes in Lithuania, when these are planted following forest fires. In a separate study, wildfires were found to have a negative effect on lichens and mycorrhizal species on coastal dunes (Kutorga *et al.*, 2012). Coastal protection systems have also been researched under this 'theme', with relevant studies addressing aspects of hard and soft engineered solutions. In one case, Mendonca *et al.* (2012) consider the impact of artificial reef on nearshore currents, and assess the suitability of such structures as supplementary protection solutions for sand dune systems.

5.2.7 Conflicts between dune conservation interests and recreational uses also appear to be a focus of research. Ariza *et al.* (2012) use different economic valuation methods in a case study in Spain to assess the relative weighting given to different social-ecological resources. Kindermann *et al.* (2013) explore conflicts between recreation and conservation by focusing on the different recreational management regimes adopted for different dunal systems in Germany, Ireland and Scotland, also comparing the acceptability of such regimes in these different social contexts. Other management issues considered in research include urbanization and changes in grazing regimes, amongst others. One factor noted as negatively affecting the integrity of grey dunes is nitrogen loading, with resultant implications for grass and shrub encroachment. Kooijman *et al.* (2012) document changes in nitrogen load trends in a study area in the Netherlands, highlighting problems with high nitrogen levels and with soil organic matter, and noting that these issues present constraints to the achievement of management goals for these

habitats. Other authors note the necessity of allowing the natural dynamism of dunes, as excess stabilisation is resulting in a loss of biodiversity (Arens *et al.,* 2012).

6. Conclusions

6.1 Key conclusions emerging from the above analysis include the following:

1. The availability of information concerning past experiences with dune conservation is somewhat limited, notwithstanding the valuable contribution of the LIFE projects database. The fact that information concerning results is unavailable for several projects listed within this database presents a constraint. It is strongly recommended that, where results are available (particularly in the case of projects conducted some years ago), these be uploaded for public use, to facilitate information exchange. There also appears to be scope for a more extensive 'clearing-house' mechanism for exchange of knowledge and experiences related to dune management.

2. There likewise appears to be substantial scope for improved networking of dune professionals in Europe. Whilst existing successful networks need not be duplicated, more outreach may be needed to give these networks more visibility, and to develop better links between the various networks that presently exist. In this regard, it is important that such networks include up-to-date contact information for all participants. As described above, the LIFE projects database has limited utility as a potential networking tool precisely because contact information for several participants is outdated.

3. Whilst substantial progress in dune conservation and management has been registered in many fields (notably including in habitat restoration and in the development of methods/techniques for habitat management), a number of weaknesses remain. Some of the more substantial of these relate to planning and governance systems. As noted above, processes such as Environmental Impact Assessment need to play a greater role in successfully predicting and mitigating against negative impacts on dune systems; likewise, structures for informed decision-making need to be strengthened, particularly in cases where impacts result from the cumulation of several small projects, rather than from a single large-scale development. More research for the development of appropriate decision-making tools/methods may therefore be needed. It is certain that given that several dune management challenges are inextricably tied to wider socio-economic-political trends, governance aspects need to be further addressed in future projects.

4. The six ICZM approaches discussed in Section 2 above appear to feature, to varying degrees, in the reviewed projects. *Integration* and *ecosystem-based approaches* characterize several of the LIFE projects discussed above, with many of these seeking to foster a wider-scale, and in some cases multi-functional approach to dune management. Similarly *knowledge-based approaches* feature prominently in both project experiences and in academic research, as do *technical approaches*. Further work may, however, be needed for the development of more sophisticated *participatory* and *socio-economic approaches* in the context of dune

management, as several projects report facing constraints relating to these aspects.

5. Future dune conservation initiatives will likely need to address a number of existing and emerging challenges, including, but not limited to (i) the impact of climate change on dunal systems, (ii) the challenges of managing dunal systems based on a 'sediment cell' perspective, (iii) the successful integration of recreational and conservation interests, and (iv) the effective management of a range of threats (notably including urbanization, dune stabilization, nutrient deposition, and invasive alien species.

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Sand Dune and Shingle Network (13th Newsletter, December 2011)

Sand Dune and Shingle Network (14th Newsletter, April 2012)

UK Dune and Network (2nd newsletter of the UK Dune and Shingle Network)

Annex 2:
Reviewed LIFE projects

Project title	Project no.
A conservation strategy for the sand dunes of the Secton Coast, North West England	LIFE95NAT/UK/000818
ACCOLAGOONS - Actions for the conservation of coastal habitats and significant avifauna species in NATURA 2000 network sites of Epanomi and Aggelochori Laggons, Greece	LIFE09NAT/GR/000343
ActiveKPN- Protection of natural resources of Kampinos Forest - Natura 2000 Site, through the renaturalisation of bought-up land	LIFE10NAT/PL/000655
ADAZI - Restoration of Biological Diversity in Military Training Area and Natura 2000 site 'Adazi'	LIFE06NAT/LV/000110
Amsterdam Dune project - Amsterdam Dunes - source for nature, dune habitat restoration project	LIFE11NAT/IT/000776
Archipelago - Restoration of grasslands and pastures in Archipelago National Park and Biosphere Reserve	LIFE96NAT/FIN/003027
Baix Ter - Arrangement and management of the Baix Ter Coastal lagoons and marshes	LIFE99NAT/E/006386
BALTCOAST - Rehabilitation of the Baltic coastal lagoon habitat complex	LIFE05NAT/D/000152
Bargerveen - From degraded to active raised bogs pSCI Bargerveen	LIFE04NAT/NL/000206
Biodiversity and dune protection	LIFE92ENV/F/000024
Biodiversity management in Natura 2000 areas of the Yyteri Peninsula	LIFE96NAT/FIN/003028
Bourget - Lake of Bourget	LIFE99NAT/F/006321
Campaign for the dunes' preservation in Vila Nova de Gaia	LIFE95ENV/P/00254
Candidate SACs - Development of management plans and emergency actions directed at candidate SACs	LIFE95NAT/IRL/000822
Capo Feto - Reclamation and environmental remediation of the Capo Feto biotope	LIFE99NAT/IT/006270
Caretta - Reduction of mortality of *Caretta caretta* in the Greek seas	LIFE02NAT/GR/008500
Caretta caretta/Kiparissia - Application of management plan for Caretta caretta in southern Kyparissia Bay	LIFE98NAT/GR/005262
CILENTO IN RETE - Management of the network of pSCIs and SPAs in the Cilento National Park	LIFE06NAT/IT/000053

Circeo - Completion of the main programme for the reestablishment of the coastal dune in Parco Nazionale Circeo	LIFE95NAT/IT/000739
Co-op bogs and dunes - dissemination of ecological knowledge and practical experience for sound planning and management	LIFE03NAT/CP/NL/000006
Cons. Costa W - Species and habitats conservation in Portuguese Western Coast	LIFE04NAT/P/000212
Conservation of habitats of Community importance in Ireland under the Birds and Habitats Directive	LIFE92NAT/IRL/013500
Conservation programme for the geographical area of the Delta Po park (first phase)	LIFE93NAT/IT/010500
Conservation programme for the geographical area of the Delta Po park (first phase)	LIFE93NAT/IT/010501
Conservation programme for the geographical area of the Delta Po Park (first phase)	LIFE93NAT/IT/010502
Conservation programme for the Po Delta park geographical area (second phase)	LIFE94NAT/IT/000538
Conservation programme for the Po Delta park geographical area (second phase)	LIFE94NAT/IT/001079
Conservation programme for the Po Delta park geographical area (second phase)	LIFE94NAT/IT/005902
Costas Cadiz - Conservation of coastal habitats of the Province of Cadiz	LIFE03NAT/E/000054
Cross-border wet ec. - Cross-border recovery and conservation of wet ecosystems	LIFE99NAT/B/006296
Cuxhavener Kustenheiden - Large Herbivores for Maintenance and Conservation of Coastal Heaths	LIFE05NAT/D/000051
Delta del Ebro - Improvement of habitat management in the SPA of the Ebro Delta (Catalonia, Spain)	LIFE96NAT/E/003133
Delta Po - Safeguard of the habitat and nesting places in Delta of the Po	LIFE98NAT/IT/005130
Dommeldal - Transboundary habitat restoration in the valley of the Dommel	LIFE05NAT/B/000091
Donana - Land acquisition of strategic areas in Donana district	LIFE99NAT/E/006325
Dunas Albufera - Model of restoration of dunes habitats in L'Albufera de Valencia	LIFE00NAT/E/007339
Dunas Laida - Dune regeneration on Laida beach (Urdaibai)	LIFE04NAT/ES/000031
Dune - DUNE - Conserving European Coastal Dune Relict Habitats	LIFE02NAT/ST/IT/000043
Dune Habitats - Restoration of Dune Habitats along the Danish West Coast	LIFE02NAT/DK/008584
DUNETOSCA - Conservation of ecosystems in northern Tuscany	LIFE05NAT/IT/000037

Dutch Coastal Dunes - Restoration of dune habitats along the Dutch coast	LIFE05NAT/NL/000124
Dutch dune revival - Realisation of Natura 2000 targets for calcareous white, grey dunes and dune slacks in three Dutch dune sites	LIFE09NAT/NL/000418
ECOLIGHT - Integrated management of lighting in the Albufera Nature Reserve (Valencia)	LIFE03ENV/E/000118
ECONAT - Development of Pilot Ecological Netowrk through Nature Frame Areas in Southern Lithuania	LIFE09NAT/LT/000581
EE Priority Forests - Protection of priority forest habitat types in Estonia	LIFE02NAT/EE/008555
Eichenwalder bei Wesel - Acidophilous oak woods with bogs and heaths	LIFE10NAT/DE/000009
EmysTer - Recovery of the habitat of amphibians and Emys orbicularis in the Baix Ter	LIFE04NAT/ES/000059
Enebro Valencia - Recovery of the littoral sand dunes with Juniper spp in Valencia	LIFE04NAT/ES/000044
ESGIRA-MARIA - Integrated Management Structure of Ria de Aveiro: ESGIRA -MARIA	LIFE99ENV/P/006295
Extension of the 2nd Phase of the protection of habitats of Community Importance under Council	LIFE94NAT/IRL/00407
Famara - Restoration of the islets and the cliffs of Famara (Lanzarote Island)	LIFE99NAT/E/006392
FEYDRA - FEYDRA: Fossil Estuary of the Yzer Dunes Restoration Action	LIFE02NAT/B/008591
Flemmish polders - Salt meadows in the Flemmish polders	LIFE99NAT/B/006295
Foret de Haguenau - Restoration and Preservation of the Haguenaue Forest habitats	LIFE98NAT/F/005243
Gargano - Urgent actions for the Natura 2000 sites protection in the Gargano NP	LIFE98NAT/IT/005121
Haademeeste - Restoration and management of the Haademeeste wetland complex	LIFE00NAT/EE/007082
HABI.COAST - Protection of coastal habitats in pSCI Torre Guaceto	LIFE05NAT/IT/000050
HELA - Cross-border restoration of heathland on continental dunes	LIFE06NAT/B/000085
Hulsig Hede - Protection of grey dunes and other habitats on Hulsig Hede/Hulsig Heath	LIFE96NAT/DK/003000
Hungarian Little Plain - Restoration and conservation of priority-listed Pannonic sand land habitats in military owned area of the Hungarian little plain	LIFE08NAT/H/000289
HUTURJAN - Conservation of priority natural values in 'Turjanvidek' Natura 2000 site southern unit	LIFE10NAT/HU/000020
ICCI - Integral Coastal Conservation Initiative	LIFE95NAT/B/003032

Ilots marins de Bretagne - maritime archipelagos and islets of Brittany	LIFE98NAT/F/005250
Implementing alternative strategies in Irish beach and dune management: community involvement	LIFE96ENV/UK/000404
Integrated management of the bay of Brest and its catchment area	LIFE 96ENV/F/000386
Integrated Management Programme for Ria de Aveiro - MARIA	LIF96ENV/P/000601
JUNICOAST - Actions for the conservation of coastal dunes with Juniperus spp. in Crete and the South Aegean	LIFE07NAT/GR/000296
Kemeri - Conservation of wetlands in Kemeri National Park	LIFE02NAT/LV/008496
KopuNatura - Management of Natura 200 habitats of the Kopu Peninsula	LIFE04NAT/EE/000073
LAG'Nature - Creating an experimental and demonstrative network of lagoon and dune Natura 2000 sites on the Mediterranean coastline of Languedoc-Roussillon	LIFE07NAT/F/000193
Lake Pape - Lake Pape - conservation, preservation and evolution	LIFE03NAT/LV/000081
Leopoldia - Ripristino degli habitat dunali nel paesaggio serricolo del golfo di Gela per la salvaguardia	LIFE11NAT/IT/000232
Liereman - Habitat restoration in Landschap De Liereman	LIFE04NAT/BE/000010
LIFE Abeek - Habitat restoration in the Abeek Valley	LIFE08NAT/B/000035
LIFE AUFIDUS - Habitats restoration actions in the SCI Ofanto Valley - Lake Capacciotti	LIFE11NAT/IT/000175
LIFE Averbode - Habitat restoration in Averbode Bos en Heide	LIFE06NAT/B/000081
LIFE Grote Nete - Restoration of the lowland river system 'Grote Nete'	LIFE05NAT/B/000090
Life Hageland - HABITATHERSTEL IN HET HAGELAND, concentratie van biodiversiteit op een meervoudige gradient	LIFE11NAT/BE/001067
Life Itter en Oeter - habitat restoration in the valleys of the eastern region of Limburg: Bosbeek and Itterbeek	LIFE09NAT/BE/000416
LIFE Kleine Nete - Large scale habitat restoration in the valley of the Kleine Nete	LIFE09NAT/BE/000411
LIFE LAESOE - restoration of birdlife and natural habitats at Laesoe	LIFE11NAT/DK/000893
LIFE Marais - conservation of the most remarkable habitats and species of the Poitevin Marshes	LIFE04NAT/FR/000087
LIFE Turnhouts Vennengebied - Large-scale Habitat Restoration in 'Turnhouts Vennengebied'	LIFE06NAT/B/000084
Life Visbeek - Habitat restoration in the Visbeekvalley	LIFE08NAT/B/000034

LITCOAST - Natura 2000 site conservation and management on the Lithuanian coast	LIFE05NAT/LT/000095
LITTORALE VENETO - Concerted action for biodiversity on the Veneto Coast	LIFE03NAT/IT/000141
Living with the sea - Living with the sea: Managing Natura 2000 sites on dynamic coastlines	LIFE99NAT/UK/006081
LR-21 - Livonian Green Coastal Region - 21	LIFE 00ENV/LV/000956
LV coastal habitats - Protection and management of coastal habitats in Latvia	LIFE02NAT/LV/008498
MAESTRALE - Actions for the recovery and the conservation of dune and back dune habitats in the Molise Region	LIFE10NAT/IT/000262
Maintbiodiv - Preservation of the coast biodiversity on the Gavres-Quiberon site	LIFE06NAT/F/000146
MC-SALT - Environmental Management Restoration of Mediterranean Salt Works and Coastal Lagoons	LIFE10NAT/IT/000256
Mesola - Conservation of habitats and species of the SIC Bosco della Mesola	LIFE 00NAT/IT/007147
MILITAIRE GEBIEDEN - Integrated restoration of natural habitats on military areas in Natura 2000	LIFE03NAT/B/000024
Monte Russu - JUNIPER DUNES: Rearrangement and conservation SCI Monte Russu	LIFE99NAT/IT/006189
Montecristo 2010 - Montecristo 2010: eradication of invasive plant and animal aliens and conservation of species/habitats	LIFE08NAT/IT/000353
Most-Keiheuvel - Natuurherstel Most-Keiheuvel: natuurherstel op de gradient van veen naar stuifzand	LIFE11NAT/BE/001061
N2K Wales - Development of a programme for the management and restoration of Natura 2000 in Wales	LIFE11NAT/UK/000385
Natura 2000 in the Po Delta - Conservation of habitats and species in the Natura 2000 sites in the Po Delta	LIFE09NAT/IT/000110
Natura 2000 sites in Wales - Integrating monitoring with management planning: a demonstration of good practice on Natura 2000 sites in Wales	LIFE95NAT/UK/000821
Nature conservation within the Ekenas-Hango-Pojo archipelago area	LIFE99NAT/FIN/006255
Nestos - Habitat Management and Raptor Conservation in Nestos Delta and Gorge	LIFE02NAT/GR/008489
Nossentiner - Preservation and securing of the reproduction of endangered species by protecting and managing biospheres of common interest in the nature park Nossentiner/Schwinzer Heide	LIFE95NAT/D/000029
Oenanthe conioides (Elbe) - Restoration of a freshwater section of the estuary of the River Elbe especially for *Oenanthe conioides*	LIFE02NAT/D/008457

Orbetello - Urgent actions for conservation of pSCI Orbetello Lagoon	LIFE00NAT/IT/007208
PANNONICSK - Restoration of endemic pannonic salt marshes and sand dunes in Southern Slovakia	LIFE 10NAT/SK/000083
Pannonische Sanddunen - Pannonian sanddunes	LIFE98NAT/A/005418
Parco della Maremma - Maremma Park: management of wetlands and sand dunes	LIFE98NAT/IT/005117
Piscinas/Arcuentu - Dune di Piscinas -Monte Arcuentu	LIFE97NAT/IT/004140
Protecting dunes from erosion	LIFE92/ENV/F/000021
Protection and restoration of habitat of corncrake (Crex crex) in Belgium	LIFE94NAT/B/001516
Protection and restoration of habitat of corncrake (Crex crex) in Belgium	LIFE95NAT/B/004796
Protection of habitats of Community importance under Council Directives 79/409/EEC and 92/43/EEC	LIFE93NAT/IRL/012200
PROVIDUNE - Conservation and recovery of dune priority habitats among the sites of Cagliari, Caserta, Matera provinces	LIFE07NAT/IT/000519
Punta de la Mora - Sustainable Management of Punta de la Mora in Tarragona	LIFE98NAT/E/005311
Pustynia Biedowska - Active conservation of priority sand habitats complex (6120, 2330) in the Natura 2000 site Bledowska Desert	LIFE09NAT/PL/000259
Pylos Lagoon - Implementation of management plan for Pylos Lagoon and Evrotas Delta	LIFE97NAT/GR/004247
RAHID - Restoration of Atlantic Heaths and Inland Dunes in Denmark	LIFE09NAT/DK/000370
Re-establishing lichen and coastal heaths in the Anholt desert, Denmark	LIFE94NAT/DK/000492
Re.S.C.We. - Restoration of Sentina coastal wetlands	LIFE09NAT/IT/000608
Recovery, Conservation and Management of Species and Natural Habitats in the Coastal Area of central Portugal	LIFE95ENV/P/00119
Rehabilitation and sustainable managemnet of four French dunes	LIFE95ENV/F/00676
Rehabilitation, valorisation, development of Zemmouri ecosystem, including the coastal zone	LIFE99TCY/DZ/136
Restoration and conservation of the habitat of the Circeo National Park	LIFE94NAT/IT/001079
Revitalising Noordduinen - Revitalising the Noordduinen: from concrete surfaces to grey dune habitats	LIFE09NAT/NL/000417
Sand dynamics in inland dunes - Revival of dynamics by activation of sanddrift in in inland dunes	LIFE07NAT/NL/000571

SELSY - Sea-Land System: concerted Actions for the Coastal Zone Management	LIFE 00ENV/IT/000090
Setubal/Sado - NATURA 2000 network of the Setubal Peninsula/Sado	LIFE98NAT/P/005235
SIC del Tirreno - Protection of sea and coastline habitats in SCIs along the Southern Tyrrhenian Sea in Italy	LIFE99NAT/IT/006275
Silberscharte - Protection and Development of the Population of Jurinea cyanoides (Silberscharte) in the typical plan association on continental dunes (Sandgrasheiden) near Volkach	LIFE96NAT/D/003042
SPA Ilperveld - Restoration of biotope for Botaurus stellaris, Anas penelope and Limosa limosa in the SPA Ilperveld	LIFE02NAT/NL/008486
Strofylia-Kotychi - Conservation management in Strofylia-Kotychi	LIFE02NAT/GR/008491
Stropersbos - Habitat restoration of alluvial foreststst and heath in the 'Stropers' area	LIFE06NAT/B/000082
Trockenrasen Deutschland R-Pf-Restoraiton and conservation of xeric grasslands in Germany (Rheinland-Pfalz)	LIFE02NAT/D/008461
UITKERKSEPOLDER - Uitkerkse Polder: a suplus value for nature and people	LIFE03NAT/B/000023
Unterer Inn - Lower Inn with riparian woodland	LIFE98NAT/D/005372
URBANCOWS - Restoration and Public Access of Urban Coastal Meadow Complex in Parnu Town	LIFE10NAT/EE/000107
Valdovino - Restoration and protection of the coastal laguna of Valdovino	LIFE98NAT/E/005362
Valle del Ticino - Restoration of alluvial woods and oak woods along the Ticino River	LIFE97NAT/IT/004134
Vattajan dyyni LIFE - Restoration of dune and coastal habiats in the Vattaja Military Area	LIFE05/NAT/FIN/000104
Vendicari - Conservation and improvement of habitats in the SPA of Vendicari	LIFE02NAT/IT/008533
Vest Stadil Fjord - The restoration of the area of Vest Stadil Fjord	LIFE97NAT/DK/004199
Vlaams Veldgebied - Restoration of Intermediate Atlantic heathland habitats in Flanders	LIFE07NAT/B/000024
Wattenmeer - Protection of Birds in the Wadden Sea by Means of Visitor Guidance	LIFE98NAT/D/005105
WET - Wastewater & Effluent Treatment	LIFE06ENV/NL/000167
Wetland succession - Wetlands: challenges and innovation in succession management	LIFE06NAT/NL/000074
WETREST - Restoration of Westlands at Zahorie Lowland	LIFE05NAT/SK/000112
Wuthering heaths - Restoration of inland dunes and psammophyte heathland in the North-western Veluwe	LIFE10NAT/NL/000023

ZAHORIE SANDS - Restoration and management of sand dunes habitats in Zahorie military training area	LIFE06NAT/SK/000115
ZENO - Zwindunes Ecological Nature Optimalisation	LIFE06NAT/B/000087
ZONE UMIDE SIPONTINE - Conservation actions of habitats in the coastal wetlands of SCI Wetlands of Capitanata	LIFE09NAT/IT/000150
ZTAR - Zwin Tidal Area Restoration	LIFE09NAT/BE/000413

Annex 3:
Survey distributed to LIFE project coordinators/participants

Coastal dune management in Europe

Project information

1. Title/s of LIFE project/s related to coastal dune management in which you participated (provide details for as many projects as applicable):

Capacity in which you were involved (e.g. coordinator, partner):

Time-period of project/s (e.g. 2000-2003):

Spatial scale of project/s (tick as many as apply):

- [ ] Local
- [ ] Regional
- [ ] National
- [ ] European

Project study area/s:

Project website/s:

Coastal dune management: experiences and trends

2. What do you consider to be the most significant threats to coastal dunes in

Europe? Please check as many as apply, and add any other threats you consider to be significant.

- [ ] Urban development
- [ ] Touristic and recreational development
- [ ] Infrastructural development
- [ ] Agricultural development
- [ ] Afforestation
- [ ] Dune stabilization
- [ ] Fragmentation of the sediment–dune system
- [ ] Decline in quality/quantity of water resources
- [ ] Nutrient deposition
- [ ] Lack of ecological understanding
- [ ] Lack of awareness

Other:

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3. Which, if any, of these threats were addressed in the project/s listed above? Tick as many as apply.

- [ ] Urban development
- [ ] Touristic and recreational development
- [ ] Infrastructural development
- [ ] Agricultural development
- [ ] Afforestation
- [ ] Dune stabilization
- [ ] Fragmentation of the sediment–dune system
- [ ] Decline in quality/quantity of water resources
- [ ] Nutrient deposition
- [ ] Lack of ecological understanding
- [ ] Lack of awareness

Other:

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4. In your opinion, how successfully were these threats resolved within the project study area/s, either through the above-mentioned project, or through other initiatives?

5. Please list the 3 (THREE) threats that you consider to be most significant at European scale at present:

1.
2.
3.

6. Please list the 3 (THREE) threats that you consider to be most significant within the study area/s of your project/s at present:

1.
2.
3.

7. What do you consider to be the key successes of your project/s and its/their main contributions to better coastal dune management?

8. What, if any, do you consider to be the limitations of your project/s? What results would you like to have achieved but were unable to?

9. Has there been any follow-up to the project/s following the end of the formal project period (e.g. monitoring, evaluations, ongoing initiatives)? Please provide details.

- ○ Yes
- ○ No

Details:

Networking

10. Do you presently participate in any networks relating to coastal dune management?

- ○ Yes
- ○ No

Please provide details of any relevant networks below:

If you do not presently participate in networks, would you be interested in being involved in such networks related to coastal dune management?

- ○ Yes
- ○ No

Submit

0%

Annex 4:

Survey distributed to dune conservation/management specialists

Coastal dune management in Europe

Coastal dune management: experiences and trends

1. What do you consider to be the most significant threats to coastal dunes in Europe? Please check as many as apply, and add any other threats you consider to be significant.

- [ ] Urban development
- [ ] Touristic and recreational development
- [ ] Infrastructural development
- [ ] Agricultural development
- [ ] Afforestation
- [ ] Dune stabilization
- [ ] Fragmentation of the sediment-dune system
- [ ] Decline in quality/quantity of water resources
- [ ] Nutrient deposition
- [ ] Lack of ecological understanding
- [ ] Lack of awareness

Other:

2. Please list the 3 (THREE) threats that you consider to be most significant at European scale at present:

1.
2.
3.

3. In your opinion, how successfully have these threats been resolved in recent years within Europe, through projects, plans, policies and other initiatives?

4. Is your expertise relating to coastal dunes based on experience of any particular study area/s within Europe?

- Yes
- No

If yes, please list the study area below, and describe any changes you have observed within this study area over recent years.

5. What do you consider to be the key elements of progress in European coastal dune management over recent years?

6. What, in your opinion, are the persistent challenges in this field (in Europe), which still need to be addressed?

7. Do you have any recommendations for research/management actions relating to European coastal dunes?

Networking

8. Do you presently participate in any networks relating to coastal dune management?

- ○ Yes
- ○ No

Please provide details of any relevant networks below:

If you do not presently participate in networks, would you be interested in being involved in such networks related to coastal dune management?

- ○ Yes
- ○ No

Submit

0%