Darwin Initiative – Final Report

Darwin project information

Project Reference	15/023
Project Title	Conservation of endangered coastal biodiversity hotspots of Central Chile
Host country(ies)	Chile
UK Contract Holder Institution	University of Oxford
UK Partner Institution(s)	University of Oxford
Host Country Partner Institution(s)	University of Talca; CODEFF;CONAMA;CONAF
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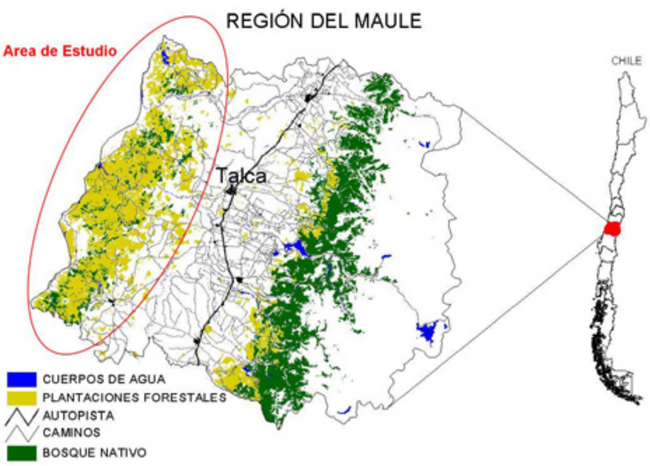
Project Leader Name	Dr Stephen Harris
Project Website	http://www.darwinmaule.cl/
Report Author(s) and date	Dr Stephen Harris Dr José María San Martín Acevedo 18th December 2009

1 Project Background

The project is aimed at developing a Conservation and Sustainable Management Strategy (CSMS) for the Maule region's coastal forests in the Chilean Biodiversity Hotspot (Fig. 1), and building the technical and educational capacity and policy framework for the CSMS's implementation. The main technical output of the project has been a CMCS for the region. The main achievements have been the recognition that CSMS recommendations will be incorporated into the forest management plans of private companies and government organisations. The recommendations required a combination of high quality fieldwork and ecological data analysis, together with detailed analysis of pollen flow patterns.

Figure 1. Maule showing the study area and the extreme fragmentation of the native forest.



2 Project support to the Convention on Biological Diversity (CBD)

The project was focused on *in situ* conservation of coastal Maulino ecosystems, which despite their international biodiversity significance, are underrepresented in existing policy frameworks, conservation strategies and protected area networks. The project produced a CSMS together with supporting training programmes. 90% of the region's forest is privately owned; therefore implementation of project results relied on the participation of large forestry companies and small land owners. The three forest companies involved in the project are FSC or CERTFOR-PEFC certified and committed to integrating and implementing the conservation strategy in their environmental management systems. These certifications have proven very important in getting these companies to agree that the recommendations of this project should be incorporated into their management plans. Similar acceptance of the recommendations has been made by the relevant local government departments. Small forest owners have been encouraged to adopt the conservation and management strategies through a multi-stakeholder consultation process. In addition, project partners provided extension and education materials and technical assistance to all forest owners.

3 Project Partnerships

At the start of the project, the Chilean partners were a little sceptical over the vegetation methodology that the Oxford team were promoting. This method was a radical change from the methodology usually used but offered the opportunity to collect large quantities of data quickly over large geographical areas. However, as the methodology was implemented, the Chilean partners took the approach as their own, and disseminated it through the ecological and botanical communities in Chile. All aspects of the project regarding fieldwork, RBS and herbarium analysis and the development of the management strategy were driven by the Chilean partners. The major role of the UK partner was in the provision of guidance, training and the implementation of the genetic analyses in *Gomortega*. The lead organisation was effectively a minor partner in most of the practical side of the project. Day-to-day decisions regarding particular aspects of the project were made by the relevant partner. Larger decisions were made by all partners.

The partnership has developed and become much stronger during the project period. There is now real interest in continuing to develop the approaches used in the project and extend them both into other parts of the Mediterranean region of Chile and to other parts of Chile. The Chilean partners have taken a strong lead in this activity. An MOU between the UK and all the Chilean partners was established. However, this took far longer to sign formally than project members envisaged because of wrangling over phrasing by the administrations of the lead and partner organisations. The major challenges were not with the partnership but with the dramatic change in strength of the pound against the dollar. It was decided at the beginning of the partnership to ensure that the Chilean partners received all of the funding that they had been promised in the MOU. Hence, it was necessary for the lead organisation to save money in order to keep within budget. This was achieved by reducing the number of visits made to Chile, undertaking a training course in Oxford, rather than Talca, and taking advantage of cost-savings on laboratory consumables.

4 Project Achievements

4.1 Impact: achievement of positive impact on biodiversity, sustainable use or equitable sharing of biodiversity benefits

The scientific data collected by the project has been synthesised into a scientifically based CSMS (Arnold et al. 2010) and is now linked to linked to existing planning frameworks in force in the Maule Region (Maule Regional Strategy 2008-2020, Maule Biodiversity Strategy, 2002). These results have been developed into a fully costed, 20-year strategic plan for the management of conservation actions. The strategic plan has three work programs that address three major challenges for forest conservation in the region:

(1) Conservation areas and localities with species of high conservation value, occurring in very small populations, where genetic threats are imminent;

(2) Conservation areas and localities with species of high conservation value, occurring in populations that have not yet reached critical survival thresholds;

(3) Improvement of knowledge about the biology, ecology and conservation of species, and the distribution of this knowledge among relevant stakeholders.

Implementation of conservation actions in priority areas has been agreed. Private forest enterprises have agreed to incorporate new conservation elements and protection into environmental management plans at locations with bioquality indices and new AAVAs for areas with high bioquality indices will be created. At the public level, CONAF will incorporate high bioquality grid cells into existing control and forest extension programmes.

Enhancement of the herbarium and the creation of on-line databases make information on the Maule forests widely accessible. Furthermore, RBS approaches have become a focus of interest among the wider ecological and botanical community in Chile.

4.2 Outcomes: achievement of the project purpose and outcomes

A rigorous CSMS, based on strong scientific data, is now available for the coastal forests of the Maule region. Importantly, this CSMS has been endorsed by one of the most important economic drivers in the regions, the forestry sector. Catastrophic habitat change, through land conversion, remains one of the most important factors influencing *in situ* conservation in the region. The CSMS is an important document for arguing the case for conservation of the coastal forests and provides a rigorous and practical framework in which this can be done. To this end, the project achieved its aim; initial scepticism has given way to full engagement with the programme across a range of stakeholder sectors.

4.3 Outputs (and activities)

The CSMS has been completed and is currently in press. We originally stated that it would be published by the end of the project. However, the final workshop for the project was held in November and we considered that it was important that all of the major stakeholders in the project were informed about the CSMS contents. Furthermore, it was important that these stakeholders had an opportunity to comment upon, and discuss, the conclusions before the CSMS was published. All other outputs proposed in the original logical framework have been achieved. In addition, the Talca herbarium was fully databased and the relevant staff trained in the use and maintenance of the database system.

4.4 Project standard measures and publications

See Annexes 4 and 5.

4.5 Technical and Scientific achievements and co-operation

Bioquality analysis of coastal forests and woodlands in the Maule region

This part of the project was primarily conducted in Chile. The majority of the work was done by J. San Martín, C. Sepúlveda, P. Penailillo and P. Garrido, with training inputs provided by D. Filer and W. Hawthorne in Oxford. These data are currently being prepared for publication in peer-reviewed journals.

Analyses of bioquality have confirmed the global importance of the Coastal subregion of Maule Region for the conservation of Chliean plant biodiversity. 20% of the plant species found in the study area represent species of very high or high conservation interest (black and gold star species) and 60% of all sites investigated had bioquality indices that were considered high or very high (150 to 296)

The concept of bioquality shows its strength compared with simple measures of species level biodiversity or descriptive approaches to the analysis of vegetation communities. While the number of species and vegetation communities found in coastal Maule fall far short of some countries, the high degree of endemism (44%) and threats to the existence of vegetation in coastal Maule are reflected in relatively high bioquality indices.

The bioquality concept is a tool for prioritizing conservation efforts to areas where conservation values, in relative terms, are highest. It can also help focus monitoring programs, and encourage and justify the incorporation of new areas in to both private and state protected area systems.

The analysis of paternity of queule (*Gomortega keule*, Gomortagaceae) study showed that, contrary to what one might think, fragmented populations are connected through gene flow, even in the absence of migration by seeds or seedlings. The importance of fragments, even if they consist of only one tree, for the maintenance of connectivity between subpopulations should not be underestimated. The different types of land use prevalent in the project area have different effects (barriers or facilitators) on the connectivity between queule populations, and probably other species with similar reproductive systems. Queule pollinators move out of areas of native forest and effect long distance pollinations. It is likely that patterns of generalist insect-pollination in other species are similar to those found in queule, for example, the critically threatened pitao (*Pitavia punctata*, Rutaceae)and michay rojo (*Berberidopsis corallina*, Berberidopsisaceae).

The incorporation of management measures for species of very high or high conservation value in the management plans of productive areas (farm-forestry) may be important in the conservation of species and maintaining the long-term viability of their populations. The effects of these measures would be mainly: (1) conservation of genotypes not found in protected areas; (2) facilitation of gene flow between fragments (being inside and outside protected areas); (3) maintaining a quantity of reproductively interconnected to levels needed for minimally viable population genetic and demographic terms; (4) mediation pollinators and seed dispersers.

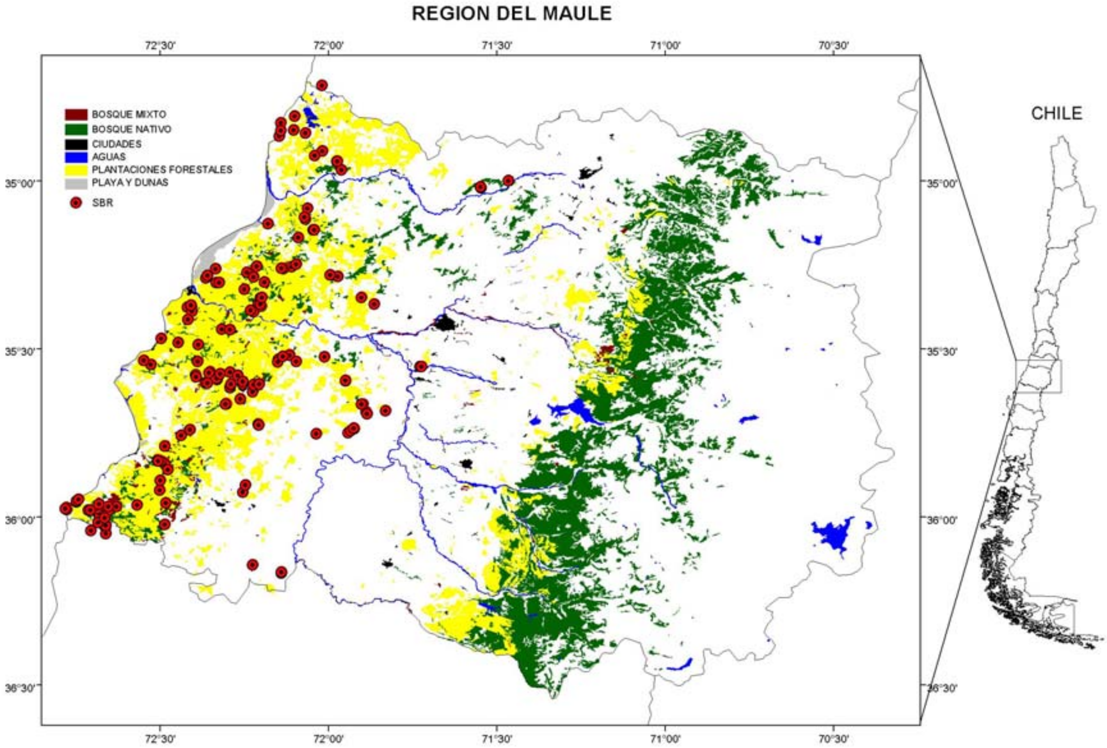
The biological corridor concept should be extended to a more functional than just a physical connection between fragments apart geographically. The connectivity between fragmented forests can be given on a mosaic of different land uses not necessarily all be native forest also.

Methods for studying biodiversity often do not take into account the relative value to the conservation of different species investigated. Thus, at first sight, it is impossible to distinguish between very abundant species and widely distributed species that occur only infrequently in a few localities. Furthermore, some species are very sensitive to disturbance, whilst others have much greater resilience. Clearly, the conservation value of some species may be very different to the conservation value of others. One way to give relative weights to different species is a bioquality index. This index scores species according to their global rarity, degree of taxonomic relationship, ecology, local abundance and its social and economic importance as a single value. The quantification of several locations allows comparison in terms of their relative importance for conservation of biodiversity (bioquality) and the generation of guidelines for prioritizing conservation actions, even on a global scale between different countries or regions. The method adopted here was developed by Hawthorne & Abu-Juam (1995) for tropical forests, has been used in different countries (Cameroon, Ivory Coast, Sierra Leone, Malaysia, Honduras, Mexico, Trinidad & Tobago). It consists of three main elements:

1. Rapid Botanical Surveys (SBR) of the existing floristic diversity in a region.
2. Categorisation of species according to different coloured stars that indicate different conservation values
3. Calculation of the genetic heat bioquality index for each locality.

The botanical survey in the coastal region of Maule comprised 158 plots (Fig. 2), and the data analysed with the support of the database BRAHMS. Species were categorised as one of four star colours (black, gold, blue, green), based on global rarity, degree of taxonomic relationship, ecology, local abundance and potential threats. Green star species are very common, and have least conservation concern. Blue, gold and black stars represent increasingly rarer species that are less abundant and more threatened. After classification, the weight of each type of star is determined as the inverse average number of square degrees occupied in the taxon's area of geographical distribution. Subsequently, a bioquality index is calculated for each locality sampled based on all the taxa recorded from the locality.

Figure 2: Location of sample plots used in the RBS analysis of the coast regions of Maule



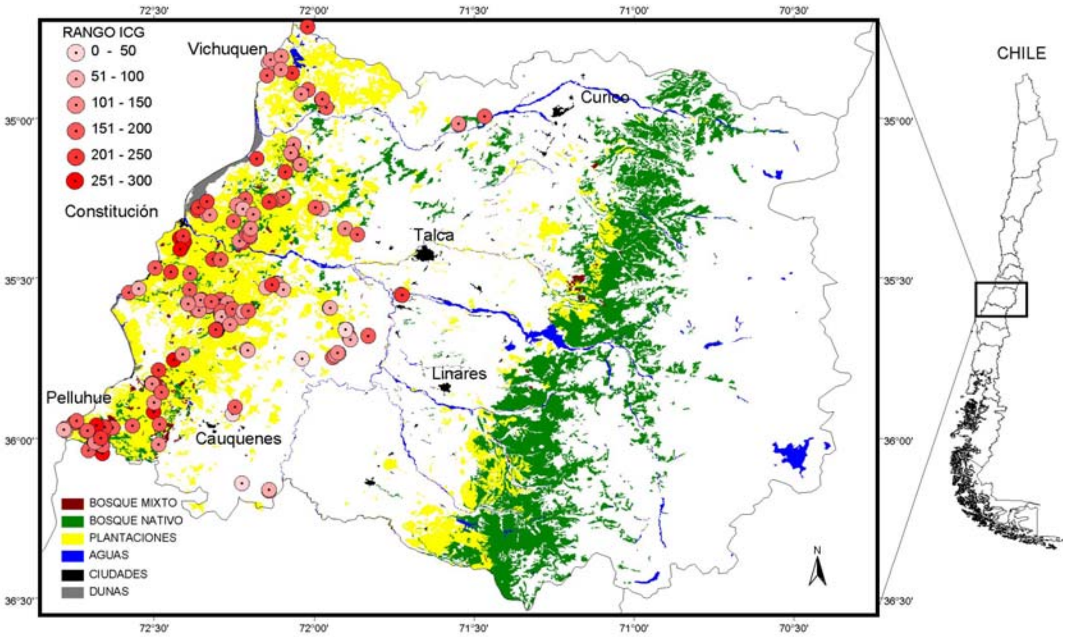
475 taxa were identified, of which 18 had Black Stars (Table 1), 73 had Gold Stars, 135 had Blue Stars and 249 had Green Stars.

Table 1. List of Black Star taxa indetified in the coastal region of Maule.

Taxon	Family
Adesmia elegans	Fabaceae
Alstroemeria angustifolia	Alstroemeriaceae
Berberidopsis corallina	Berberidopsisaceae
Calceolaria dentata	Calceolariaceae
Ercilla syncarpellata	Phytolaccaceae
Escallonia florida	Escalloniaceae
Gomortega keule	Gomortegaceae
Haplopappus setulosus	Asteraceae
Jovellana violacea	Calceolariaceae
Myrceugenia pinifolia	Myrtaceae
Nassella pfisteri	Poaceae
Nothofagus alessandrii	Nothofagaceae
Nothofagus leonii	Nothofagaceae
Pitavia punctata	Rutaceae
Scutellaria valdiviana	Lamiaceae
Senecio chilensis	Asteraceae
Senecio nigrescens	Asteraceae
Tarasa reichei	Malvaceae

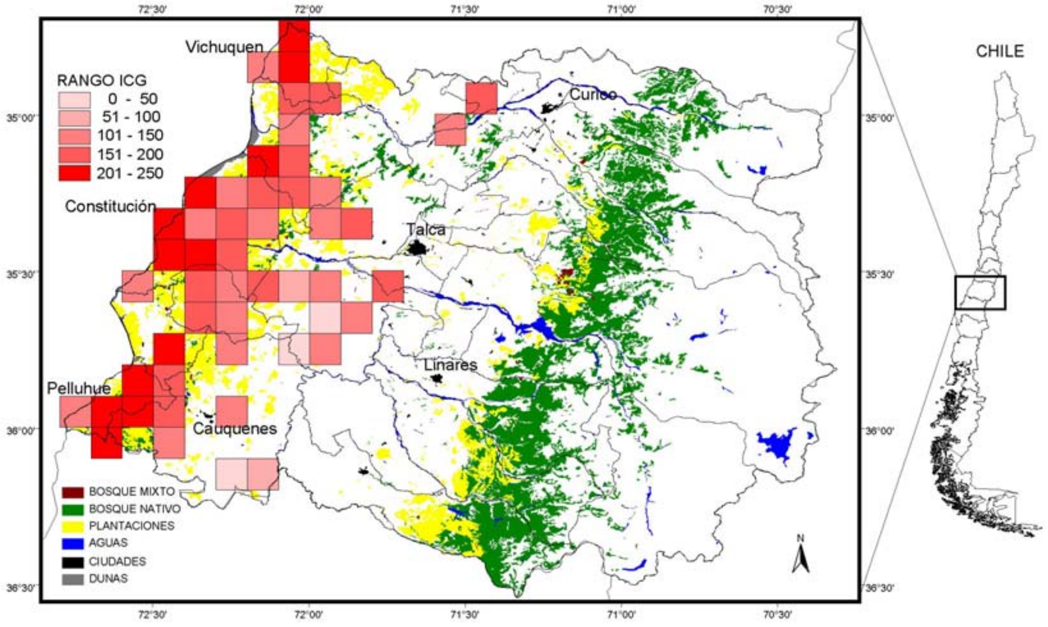
Bioquality indices were calculated for each of the 158 sampled localilities (Fig. 3). The highest bioquality value was obtained for the town of Cañas Díaz located in Constitution. In contrast, the lowest bioquality came from the town of Patagua Ford located in Cauquenes.

Figure 3. Bioquality indices for the 158 localities sampled.



The broader pattern of these data were mapped onto a 10 km x 10 km grid (Fig. 4).

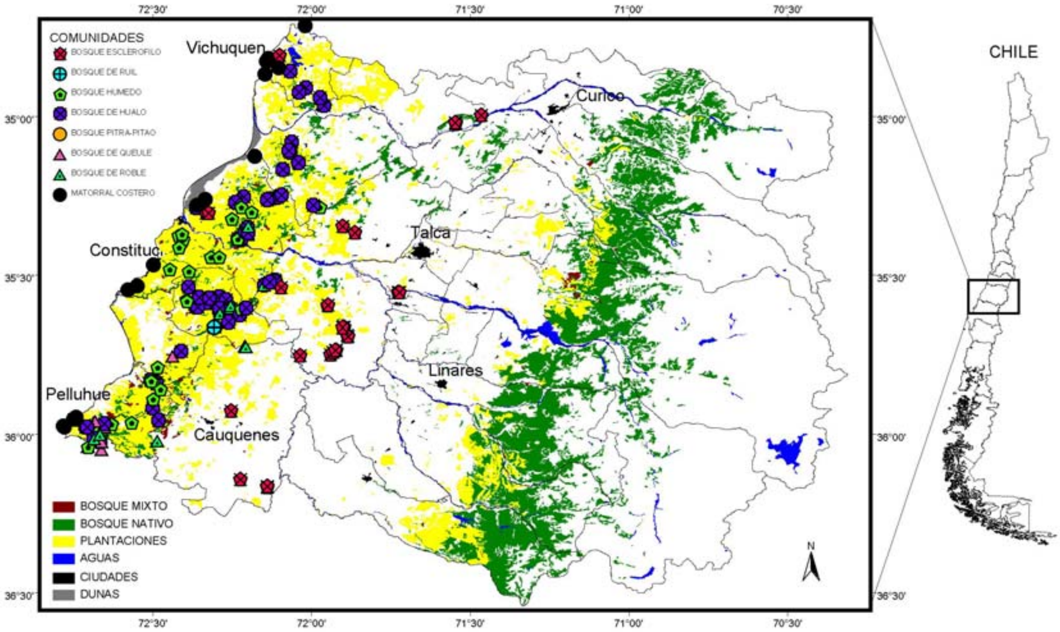
Figure 4. Bioquality scores calculated for a 10 x 10 km grid square laid over the study region.



Eight vegetation types were identified in the study region (Fig. 5).

Based on the bioquality scores, 26 grid squares with scores greater than 150 were identified (Fig. 6). These grid squares include all areas containing high conservation value (Black Star) and most areas with species of high and medium conservation value (Gold and Blue Stars). These grid squares also include areas that currently lack either public or private conservation policies (Table 2).

Figure 5: Distribution of major vegetation types identified in the coastal region of Maule.

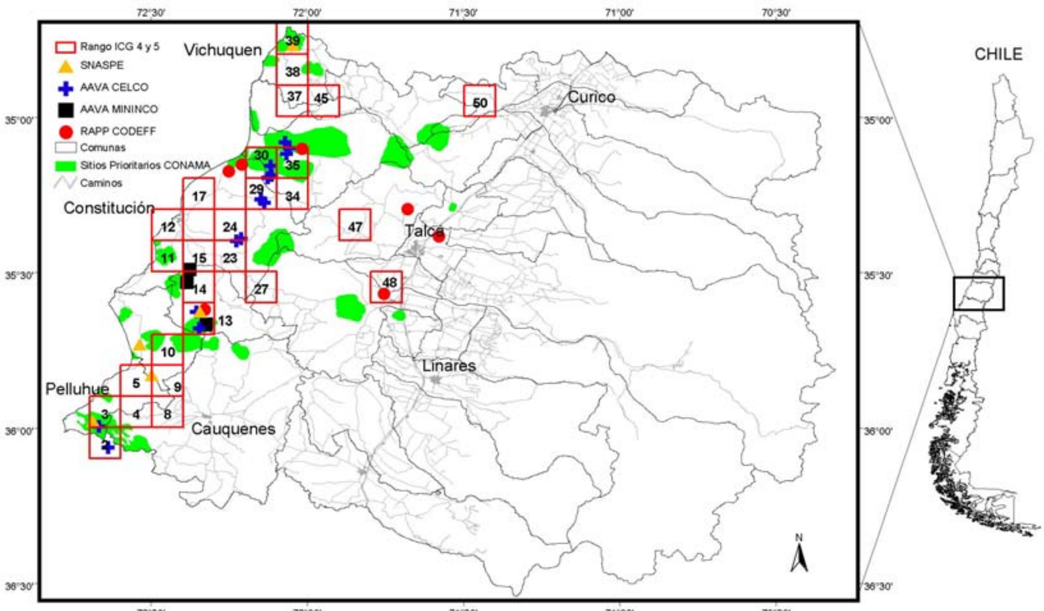


Implementation of conservation actions in priority areas identified have been agreed as follows:

Private stakeholders (forest enterprises) – Priority Action will be to incorporate new conservation elements and protection into environmental management plans at locations where bioquality indices are greater than 150. Secondary action will be to incorporate new AAVAs for areas with bioquality indices greater than 150.

Public stakeholder –CONAF will incorporate high bioquality grid cells into existing control and forest extension programmes.

Figure 6. Prioritization of grids according to bioquality and private-public conservation designation.



PVA of model species (*Gomortaga keule*) and development of conservation models

This part of the project was primarily conducted in Oxford. The majority of the work was done by T. Lander for her D.Phil. Fieldwork was conducted in Chile. The methodology used was based on microsatellites isolated and described in Lander *et al*. (2007, Lander, T.A., Boshier D.H. & Harris S.A. Isolation and characterization of eight polymorphic microsatellite loci for the endangered, endemic Chilean tree *Gomortega keule* (Gomortegaceae). *Molecular Ecology Notes*, 7: 1332-1334).

The Maule landscape is a complex mosaic of economic landuses and native vegetation, ideal for the study of matrix effects in landscape fragmentation and its broader implications for the development of conservation models. A set of microsatellite markers was developed for *Gomortega keule* and paternity analysis and gene flow patterns studied in 26 study populations. The main findings from this investigation are:

1. *Gomortega keule* is predominantly visited by syrphid flies in March-April, and that syrphids carry a greater proportion of *G. keule* pollen than the other insects collected. No significant difference was found in insect species composition in the native forest and agricultural study areas. Low intensity agricultural systems appear to provide habitat in which syrphids forage and *G. keule* is able to produce fruit successfully; suggesting that a landscape made up of a mosaic of different landuse types is not necessarily inimical to the continued reproduction of *G. keule*. Given the known sensitivity of syrphids to landscape composition and diversity, these results are likely to be dependent upon landuse type and intensity of management. These results have been published in Lander *et al*. (2009; Lander, T.A., Harris, S.A. & Boshier, D.H. Flower and fruit production and insect pollination of the endangered Chilean tree, *Gomortega keule* in native forest, exotic pine plantation and agricultural environments. *Revista Chilena de Historia Natural* 82: 403-12).
2. Reproduction in *Gomortega keule* is characterized by apparent limitation of effective pollination, extensive selfing and vegetative reproduction, and only very rare seedling establishment. This suite of characteristics suggests that the species is suited to persistence *in situ*, with individual genets surviving potentially indefinitely as clone groups, occasional seedling establishment maintaining the populations on a long time scale, and self-compatibility providing reproductive assurance in small populations. Extensive forest clearance in the species' range has created a landscape where native forest exists as scattered patches containing small populations of native species. While *G. keule*'s ability to coppice and reproduce vegetatively has undoubtedly contributed to its survival despite logging, deforestation and habitat fragmentation, the ability to establish new populations could be valuable in the current anthropogenically-modified landscape. The species' apparent reliance on individual longevity, asexual reproduction and very rare seedling establishment may well compromise its ability to survive in the face of extensive landscape change and clearance of native forest and may mean that this species no longer has a viable strategy for long-term population persistence. (These results have been submitted for publication and are currently in review).
3. It is often assumed that fragmented populations are genetically isolated and will therefore suffer genetic consequences of that isolation (*e.g.*, inbreeding depression, genetic drift and loss of adaptive potential). Gene flow between spatially separated populations would reduce or eliminate the genetic consequences of spatial separation, so that habitat fragmentation could no longer be equated with genetic isolation. Four questions were addressed: (i) how far does pollen travel between seed trees and pollen donors?; (ii) is there genetic structure within and between populations of the study species, and if so, is pollen travelling far enough to avoid inbreeding due to spatial proximity of relatives?; (iii) do small sites and single trees contribute to pollen dispersal and genetic connectivity across the landscape?; and (iv) does isolation by distance alone explain the pollen flow patterns observed? The results suggest that the insect pollinators of *G. keule* travel outside of the native forest, between patches and over distances of up to 6 km. Pollen grains were found to move from small sites and single trees into large sites, as well as in the other direction. The quantity of pollen transfer between sites, and the number of pollen donors detected per seed tree, was extremely variable. Genetic structure was detected both within and between sites, however, because pollen is moving beyond the distance at which trees are most likely to be related, there is limited biparental inbreeding. Even at the lowest level of pollen transfer found these sites were not genetically isolated, although other consequences of landscape change may still threaten the survival of this endangered species. Substantial research exists to show that fragmentation often does not result in genetic isolation, and that other potential effects of fragmentation, such as population reduction, reduced individual survival, environment-related stress, or loss of micro-sites for germination and establishment could be more important impacts of habitat fragmentation. (These results have been submitted for publication and are currently in review).

Table 2. Priority conservation areas (bioquality values greater than or equal to 150).

Grid cell	Bioquality measure	Comune	Plot locality	Priority site				Vegetation type
				CONAMA	SNASPE	AAVAs	RAPP	
12	246	Constitución	(1) Pullaullao (1) Callejones (1) El Rosal	(1) Quebrada Honda				(3) Bosque Húmedo
30	235	Curepto	(1) Huenchullami	(1) Bosques Nativos de Curepto Huenchullami		(CELCO) Ruiles de Calzoncillos	(1) Malpaso	(1) Matorral Costero
39	234	Vichuquen	(1) Boyeruca	(1) Complejo Llico-Lorca-Vichuquen	Laguna Torca			(1) Matorral Costero
3	233	Pelluhue y Cauquenes	(1) Salto de Agua (3) Tregualemu (2) Canelillo (1) Cayurranquil	(1) Tregualemu y Cayurranquil (1) Rio Chovellen	Los Queules	(CELCO) Queules y Pitaos Ralbun C		(4) Bosque de Queule, (2) Bosque Humedo, (1) Bosque Pitra-Pitao, (1) Bosque Hualo
11	226	Constitución	(1) Las Cañas Díaz (1) Pellines (1) San Pedro	(1) Las Cañas (1) San Pedro				(2) Bosque Húmedo, (1) Matorral Costero
4	226	Pelluhue y Cauquenes	(1) El Trozo (1) El Manzano	(1) Tregualemu y Cayurranquil				(1) Bosque Humedo, (1) Bosque de Hualo
2	226	Pelluhue y Cauquenes	(5) Copiulemu (1) Ramadilla (2) Quile	(1) Tregualemu y Cayurranquil		(CELCO) Queules y Pitaos Ralbun C		(2) Bosque de Roble, (2) Bosque Húmedo, (2) Bosque de Queule, (2) Bosque de Hualo
15	216	Constitución	(1) San Pedro (1) Pantanillos			(Mininco) Las Cañas		(2) Bosque Húmedo
38	213	Vichuquen	(1) Vichuquen	(1) Trilco (1) Pajonales Tilicura				(1) Bosque de Hualo

Grid cell	Bioquality measure	Comune	Plot locality	Priority site				Vegetation type
				CONAMA	SNASPE	AAVAs	RAPP	
17	213	Constitución	(1) Bellavista (3) Junquillar					(3) Matorral Costero, (1)Bosque Hualo
5	206	Chanco y Pelluhue	(6) El Corte RN Los Ruiles		Los Ruiles			(2) Bosque de Hualo, (3) Bosque Humedo, (1) Bosque de Ruil
10	203	Chanco	(1) La Bodega (2) El Carmín	(1) Paso Malo Crucero (1) Cardonal-Linda Vista				(1) Bosque Húmedo (1) Bosque de Queule (1) Bosque de Hualo
34	200	Curepto y Constitución	(1) Coipue	(1) Bosques Nativos de Curepto Huenchullami				(1) Bosque de Hualo
29	184	Constitución	(2) Agua Buena (1) Coipue			(CELCO) Ruiles de Agua Buena		(1) Bosque de Hualo
48	177	Maule y San Javier	(2) Santa Rosa de Lavadero				(1) Santa Rosa de Lavadero	(2) Bosque Esclerófilo
13	176	Empedrado	(2) Camino a Chanco (4) La Montaña	(1) Cardonal-Linda Vista	Los Ruiles (El Fin)	(CELCO) El Porvenir, (Mininco)	(1) Santa Elena, El Fin	(2) Bosque de Hualo, (3) Bosque de Ruil (2) Bosque de Roble
24	175	Constitución	(1) Los Puentes (4) La Costilla, 1) Los Huesos (2) Quivolgo 4			(CELCO) Ruiles de Quivolgo		(1) Bosque Humedo, (2) Bosque de Roble, (5) Bosque de Hualo
23	174	Constitución	(1) Pantanillos			(CELCO) Ruiles de Quivolgo		(1) Bosque Húmedo
35	169	Curepto	(1) Huelon (1) Catorce	(1) Bosques Nativos de Curepto		(CELCO) Ruiles de Huelon	(1) Cuchi	(3) Bosque de Hualo (1)

Grid cell	Bioquality measure	Comune	Plot locality	Priority site				Vegetation type
				CONAMA	SNASPE	AAVAs	RAPP	
			Vueltas (1) Lo Ramírez (1) Angostura	Huenchullami				Bosque Humedo
9	168	Chanco, Pelluhue y Cauquenes	(3) Robles del Maule		Los Ruiles			(1) Bosque Humedo, (1) Bosque Hualo, (1) Bosque de Roble
27	166	Constitución y San Javier	(3) Lo González (3) Nirivilo					(1) Bosque de Roble, (5) Bosque de Hualo,
37	162	Vichuquen	(2) Uraco					(1) Bosque de Hualo
45	162	Vichuquen	(2) Licanten (1) Junquillar					(1) Bosque de Hualo y (1)Húmedo
50	162	Rauco	(1) Viña Raíces					(1) Bosque Esclerófilo
47	152	Pencachue	(1) Tejeria (1) Cuesta Chepica					(2) Bosque Esclerófilo
14	151	Empedrado	(1) San Pedro (5) Galumavida (2) Camino a Chanco	(1) Galumavida		(Mininco) San Pedro		(4) Bosque de Hualo, (2) Bosque de Roble, (2) Bosque Húmedo

AAVA, Areas de alto valor ambiental; RAPP, Red de Areas Protegidas Privadas; SNASPE, Sistema Nacional de Areas Protegidas del Estado.

4. Five aspects of landuse type and composition influence pollen flow in *Gomortega keule* (these results have been submitted for publication and are currently in review):
   (i) Landuse type. Of the four landuse distance variables (agriculture, native forest, plantation, clearfell), clearfell was the landuse variable most strongly negatively correlated with pollination probability. Agriculture was the landuse distance variable least negatively correlated with pollination probability. It must be noted that the agriculture found in the study area is low intensity, high diversity, small farms. Native forest was less negatively correlated with pollination than plantations at distances greater than 1 km, which may show that at distances greater than 1 km native forest is a more appealing medium for pollinator movement than plantation. The most common pattern observed in the models developed, from least to most negatively correlated with pollination probability, was agriculture, native forest, plantation, clearfell. Meadows, when present, were consistently positively correlated with pollination probability, but the rarity of this landuse type makes the data difficult to assess.
   (ii) Landuse fragmentation. Increasing average size of clearfell fragments decreased the probability of pollination (*i.e.*, the smaller clearfells were, and the more interspersed with other landuse types they were, the higher the probability of pollination). The same pattern was true for plantations as for clearfells, but only at distances greater than 1 km. In the southwest region, near Quiles Alto, where meadows were abundant the number of meadow fragments and increasing size of meadow fragments positively correlated with pollination probability.
   (iii) Distance. This study found an exponential decrease in pollination probability with linear distance; pollination probability approximately halves for each 2 km of separation above zero, irrespective of other ecological factors that may influence pollination.
   (iv) Spatial distribution of trees. *Gomortega* individuals are grouped inside native forest patches in the north and south and sparse in the centre of the study area, where much of the native forest has been cleared. *Gomortega* individuals tend to be absent from plantation or clearfell areas, although some individuals were found at the Bajo Pino 1, Bajo Pino 2 and Bajo Pino Nuevo sites in the plantations in the north of the study area. *Gomortega* individuals were absent from areas below 350 m, although this probably reflects patterns of forest clearance rather than species autoecology. This arrangement of individuals in the landscape limits the possibilities for pollen movement at the most fundamental level, simply through the absence of individuals in certain areas of the landscape, irrespective of other ecological or abiotic factors that might also influence pollen movement. The rarity of the species at both the regional and global scale, combined with the patchy distribution, pollination limitation and isolation by distance effects mean that spatial distribution of individuals is likely to be an important predictor of pollination probability throughout the species' distribution. The map of documented pollen movement shows a clear 'stepping stone effect' through the centre of the study area where the fewest *G. keule* trees remain, with single 'isolated' trees and small copses that have been left following forest clearance both receiving pollen from and donating pollen to distant sites, maintaining genetic connectivity and reducing the probability of genetic isolation.
   (v) Tree size. The size of individual *Gomortega keule* trees was positively correlated with pollination probability. Apparently smaller trees emphasize pollen production in their reproductive strategy, whilst larger trees invest in seed production. For the documented pollinations, the mean seed tree diameter at breast height (dbh) is 35.15 cm, the mean pollen donor tree dbh is 30.29 cm, and the mean dbh of all trees in the study is 25.12 cm.

Monitoring programme for critical areas

The implementation of this component is based on the results that are derived from RBS and PVA analyses. The PVA analysis of *Gomortega keule* reveals:

1. The ability of *Gomortega keule* to coppice and reproduce vegetatively can probably be relied upon to contribute to its survival *in situ* despite logging, deforestation and habitat fragmentation.

2. *Gomortega keule* populations separated by more than 6 km from each other are more likely to be genetically isolated than sites closer together, and sites separated by 1 km or less are likely to have pollen transfer between them. Pollination probability approximately halves for each 2 km of separation above zero.
3. Stepping-stone sites between areas of high population concentration do contribute to genetic connectivity across the landscape.
4. Very small sites and single trees make a genetic contribution, thus no population has too few individuals to be useful in providing genetic connectivity or 'stepping-stones' between larger sites.
5. Populations in agricultural areas are as likely to contribute to genetic connectivity as populations in native forest areas.
6. Larger trees, possibly individuals over 25 cm dbh, are more likely to contribute to seed production.
7. Clearfells are most strongly negatively correlated with pollination probability and low intensity, high diversity agriculture is least negatively correlated with pollination probability. The most common pattern observed in the models developed, from least to most negatively correlated with pollination probability, was agriculture, native forest, plantation and clearfell.
8. At distances greater than 1 km native forest may be a more appealing medium for pollinator movement than plantation.
9. The smaller the clearfell and the more interspersed they are with other landuse types the higher the probability of pollination. The same pattern is true for plantations as for clearfells, but only at distances greater than 1 km.

These results have been combined with the RBS to produce a *Propuesta de una estrategia de conservación para los bosques nativos de la sub-región Costera del Maule. Aportes a la política regional de biodiversidad en la región del Maule*. The lead on writing the CSMS was taken by F. Arnold.

4.6 Capacity building

A new set of ecological methodologies (RBS) have been introduced to researchers in Chile for the assessment of biodiversity. After some initial scepticism, these methods have been welcomed by researchers in the Maule region, who are now busy extending there use into other parts of Chile, especially the adjacent regions. The importance of this new approach is shown by the adoption of these methods in a DI application to extend the current project. This has mainly been achieved through training in the appropriate techniques, especially in the design of field teams and the efficient analysis of subsequent data.

Other capacity building has been through the complete digitisation of the herbarium of the University of Talca and making this available on-line (http://dps.plants.ox.ac.uk/bol/TALCA/Home/Index), and the addition of 5000+ specimens to the herbarium through this project. Digitisation of the Talca herbarium was not initially considered. However, it soon became clear that to make maximum use of the data being generated by RBS, access to a collection of well-identified specimens would become essential. This database has been complemented by the creation of an image database using the Virtual Field Herbarium platform (http://herbaria.plants.ox.ac.uk/vfh/). Chilean members of the project have been trained in the use of both BRAHMS and VFH, two standard biodiversity data management systems.

Feedback from Chilean partners was instrumental in increasing the functions of BRAHMS to analyse biodiversity data, and improving the interface of the database.

4.7 Sustainability and Legacy

The project achievements that are most likely to endure are:

1. The practical, scientific conservation guidance for the Maule's coastal forests offered by the CSMS. Implementation of the CSMS, monitoring and adaptive management, should ensure conservation of these forests, and protect their biological value for future generations. CONAF and private forestry companies have already agreed to start implementing recommendations of the CSMS.

2. The digital maps of forest bioquality, essential elements of the CSMS, will provide guidance for future conservation and development programmes. There is already interest among stakeholders in the region to produce maps at a finer resolution that the 10 km x 10 km grids used by the project.
3. The RBS methodology is a revolutionary approach to looking at vegetation classification and the setting of conservation priorities in the Maule region. This is likely to become an important element in the training of future ecologists and forest managers in Maule (and other parts of Chile).
4. The herbarium, and its contents, has been given an explicit role in the in situ conservation of the coastal forests.
5. The PVA of *Gomortega* has revealed the fundamental importance of the anthropogenic landscape for the conservation of forest fragments in the coastal forests. It has revealed the types of information that detailed analyses of landscape genetics can bring to species (and habitat) conservation.

Project staff and resources have become part of the relevant organizations. In the case of staff, some have moved on to other roles in Chilean biodiversity conservation using the experience and knowledge gained in the project.

The lead and Chilean partners are likely to keep in touch; discussions are already underway to undertake additional research work on the coastal forests.

5 Lessons learned, dissemination and communication

A key lesson learnt from this project was the importance of trainers and trainees being able to spend sufficient time together. Intensive training over a relatively short period is to be preferred over less intense courses. However, it is important that the trainee and trainer remain in contact with each other so that particular problems can be solved as they arise. Techniques training was greatly enhanced by having trainees in the field or removed from their normal working place so distractions could be kept to a minimum. Training courses that deal with data analysis are much better based around trainees own data rather than standard data sets. This realisation meant that it was necessary to hold analysis-training courses once all of the field data had been processed. This meant that they occurred much later than originally planned. Training is a two-way process; it was also important that these course were dynamic and allowed problems perceived by the trainee to be fed-back to the trainer, and that these concerns were alleviated. A great strength of working in Chile on biodiversity-related research is that there is a great understanding of the plants, and that decent Floras have been written, compared to many other parts of the world. It was also a great advantage to have the involvement of first-rate field botanists on the project. During the course of the project, internet communication was very important and reduced the need for UK partners to travel extensively to Chile for routine meetings.

Members of the Darwin project team have become permanent members to serve on the Comité Operativo de Biodiversidad (CORB), established by CONAMA, for the Maule region. This potentially provides a direct route for project results to influence local government biodiversity policy and conservation management.

Dissemination will continue after the project. The RBS methodology has generated great interest from many regions of Chile, and there is interest in how it might be applied to other types of Chilean vegetation. Furthermore, we have had commitments from the private forestry companies that they will implement the recommendations of the project in their forest management plans. To date the major dissemination has been to forestry companies, government agencies, conservation NGOs and the academic community. Work needs to be done to make sure that the project results are fed down to a more local level outside of forested areas. A plan for this has been presented in the CSMS, and project results will continue to be disseminated in Maule.

5.1 Darwin identity

The Darwin project was a distinct project within both Chile and the UK. All publications, conference posters and conference talks used the Darwin logo. Furthermore, the Darwin logo and the Darwin Initiative were important elements of the media coverage of the project in Chile. The Darwin Initiative is familiar in the Chilean higher education and NGO sector but is less familiar outside of these spheres.

6 Monitoring and evaluation

There were no major changes in the project design, although it was necessary to request a six-month extension to the project to accommodate necessary training, in the light of the comments made in response to question 5 above.

No baseline data were specifically collected before the start of the project, although basic accounts of the plants of the region were available. However, considerable effort had been spent during the project conception stage of the proposal to obtain the opinions of many stakeholder representatives as to what was needed to improve *in situ* conservation of the plants of the region. The log framework provided a focus for the research programme and ensured that project activities were directed towards the particular objectives of the project. With hindsight it would have been useful to have defined the outputs more specifically than was done. This would have made some of the choices that had to be made during the course of the project easier to effect.

There was no independent internal or external review of the project during its lifetime.

6.1 Actions taken in response to annual report reviews

All of the issues raised in the reviews of project annual reports have been addressed. These comments were often useful in providing focus to the project, following discussion among all project partners.

7 Finance and administration

7.1 Project expenditure

Item	Budget (£)	Actual (£)	Variation	Explanation
Salaries				
Oxford				Increase due to costs of employment, plus higher than budgeted salary increases during the project.
Chile				Differences in exchange rates between the pound and the dollar, plus the need to ensure that salaries in Chile were not cut increased the costs here.
Rent, rates, etc.				These costs were reduced since there was an increase in the proportion of the total Darwin grant spent Chile, where overheads were lower than in Oxford.
Office costs				Electronic communication and dissemination of material reduced these costs.
Travel & subsistence				The number of RBS sites was increased from the original plan, plus there were increases in the costs of fuel.
Printing				Costs of printing materials and easier electronic dissemination of material reduced these costs.
Conferences				-
Capital items				
Lab/field consumables				Costs of DNA sequence analysis fell dramatically during the course of the project, hence the savings.
Total				

7.2 Additional funds or in-kind contributions secured

None

7.3 Value of DI funding

DI funding enabled the host country and UK partners to undertake a coordinated research programme on *in situ* conservation of native forests in the coastal region Maule, Chile. Without DI funding small parts of the programme might have been attempted but it is unlikely that the rigour of the whole programme would have been possible. DI funding allowed a programme that brought together ecological and genetic data into a scientifically-based, rigorous management plan to flourish.

Annex 1 Report of progress and achievements against final project logframe for the life of the project

Project summary	Measurable Indicators	Progress and Achievements April 2007 - March 2008	Actions required/planned for next period
Goal: To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but constrained in resources to achieve: • The conservation of biological diversity, • The sustainable use of its components, and • The fair and equitable sharing of the benefits arising out of the utilisation of genetic resources		A fully costed set of conservation strategy, *Propuesta de una estrategia de conservación para los bosques nativos de la sub-región Costera del Maule. Aportes a la política regional de biodiversidad en la región del Maule*, is in press.	(do not fill not applicable)
Purpose Develop a public-private biodiversity conservation strategy for coastal forest ecosystems in the Maule Region (build the technical capacity and policy framework to implement the strategy)	Conservation strategies and management plans for coastal native woodlands based on scientific information generated by the project Conservation proposals accepted and implemented and a procedure agreed for their continued implementation	Conservation strategy in press and the main recommendations have been accepted by government conservation organisations and forestry companies have agreed to incorporate the findings of the project into their management plans.	NA
Output 1. Bio-quality analysis of coastal forests and woodlands in the Maule region	4-8 people trained in RBS methodology, digital maps of forest bio-quality, digital photographs in interactive website and botanical database	158 RBS plots completed, 5,000+ specimens identified and identifications confirmed by specialists. All incorporated into the University of Talca Herbarium. Databases of specimens and botanical images. Six people trained in RBS methodologies. 18 black star species identified out of 475 assessed.	
Activity 1.1 RBS plots		40 RBS plots originally proposed, 158 completed (see Fig. 8 in Arnold *et al.*, 2010) and classified into eight different vegetation types.	
Activity 1.2 Specimen databasing and identification.		5000+ specimens collected, identified and databased. All incorporated into the herbarium of the University of Talca. The whole of the herbarium of the University of Talca databased.	
Activity 1.3 Digital images of plants in field.		500+ images of plants recorded in the field, databased, keyworded.	
Activity 1.4 Species Star-ratings.		475 taxa given star-ratings. 18 species were rated as black star (high rating; see Table 5 of Arnold et al., 2010), 73 species were given gold	

		stars, 135 species blue stars and 249 species green stars (lowest rating; see Annex 7.3 in Arnold et al., 2010).
Activity 1.5 Bioquality analysis and 'heat' scoring for plots		Biodiversity analysis and 'heat' scores were been made for all plots.
Output 2. 2) PVA of model species (*G. keule*) and development of conservation models	Genetic research results, conclusions and conservation models available.	Data generated, analysed and written-up as D.Phil. thesis (Lander, 2009). Papers associated with the work are currently under review or published.
Activity 2.1. Genetic marker isolation and characterisation.		Eight microsatellite markers isolated and characterised; published in Lander et al (2007)
Activity 2.2. Geneflow and paternity data generation.		Completed and reported in Lander (2009).
Activity 2.3. Multivariate analysis of spatial and population parameters in relation to geneflow patterns.		Completed and reported in Lander (2009).
Activity 2.4. Statistical analysis of correlation between land use types and pollen flow patterns.		Completed and reported in Lander (2009).
Activity 2.5. Development of a model to describe variation in permeability of different land uses and combinations of land uses, if such variation is found.		Completed and reported in Lander (2009).
Activity 2.6. Development of insect-mediated pollen flow models in landscapes that are complex mosaics of different land uses		Completed and reported in Lander (2009).
Activity 2.7. Incorporation of analyses into CSMS.		Completed and reported in Lander (2009) and Anrold *et al*. (2010).
Output 3. Conservation and Sustainable Management Strategy (CSMS) agreed and implemented by stakeholders	stakeholder workshop conclusions available, implementation procedure defined and agreed	Stakeholder meetings completed and it has been agreed that the CSMS should be adopted by government departments and the private forestry companies. Both of these sectors have agreed to incorporate recommendations into their management strategies.
Activity 3.1. Stakeholder workshops		
Activity 3.2. Define and agree implementation procedures.		In press as Arnold *et al.* (2010)
Output 4. Biodiversity conservation skills and capacity increased in Maule Region	2 RBS Survey/Bio-quality Assessment training courses completed, project partners participate in field research programme.	Chilean RBS field teams are operating effectively. Three Chilean and one UK undergraduate trained. Talca Herbarium considerably enhanced.
Activity 4.1 RBS Survey and Bioquality courses.		Field-training course completed, along with course on data analysis. User-friendly software developed for data analysis.

Activity 4.2 Field teams identified.		158 surveys completed by field teams.
Activity 4.3 Undergraduate students involved in the research programme.		Three Chilean and one UK undergraduate trained.
Activity 4.4 Talca Herbarium databased and enhanced.		Whole of Talca herbarium available on-line (http://dps.plants.ox.ac.uk/bol/talca).
Output 5. Monitoring programme for critical areas	Monitoring guidance published as a specific technical monitoring guide) 1 or 2 local institutions establish monitoring prog. by end project	In press as Arnold *et al.* (2010).
Activity 5.1 Technical monitoring guide published.		In press as Arnold *et al.* (2010).
Activity 5.2 Establish monitoring programme.		Costings for CSMS have been presented in Arnold *et al.* (2010).
6) Environmental education prog. and participatory extension prog. with forest owners and general public	Project website, 2 radio programmes, 1 educational video, min. 5 school presentations, min. 3 university lectures	Project website is running, radio programmes transmitted and a DVD distributed. Five school presentations made and three university lectures have been given.
Activity 6.1 Project website		Website (in Spanish) at http://www.darwinmaule.cl/index.html.
Activity 6.2 Radio programmes and DVD		Radio programmes aired. DVD distributed.
Activity 6.3 School presentations and University lectures.		Five school presentations made and three university lectures have been given.

Annex 2 Project's final logframe, including criteria and indicators

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Goal: To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but poor in resources to achieve the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising out of the utilisation of genetic resources			
Purpose			
Develop a public-private biodiversity conservation strategy for coastal forest ecosystems in the Maule Region (build the technical capacity and policy framework to implement the strategy)	Conservation strategies and management plans for coastal native woodlands based on scientific information generated by the project Conservation proposals accepted and implemented and a procedure agreed for their continued implementation	New scientific publications Project reports Workshop reports Conservation Strategy documents Management plans of forest companies Sustainable forest management certification	No significant changes in Chilean Government's National Biodiversity Action Plan with respect to public-private conservation policies Private stakeholders, particularly forest enterprises, maintain favourable attitudes towards implementing conservation in the area Small forest owners and their representatives disposed to collaborate in planning and implementation of the strategy

Outputs			
1) Bio-quality analysis of coastal forests and woodlands in the Maule region	4-8 people trained in RBS methodology, digital maps of forest bio-quality, digital photographs in interactive website and botanical database	Project reports, maps, technical documents, herbarium specimens, plot data, photographs, website and botanical database	Access to private land facilitated by landowners, local resources (maps, aerial photos, libraries, botanical collections, satellite images, data bases, GIS, etc.) accessible
2) PVA of model species (*G. keule*) and development of conservation models	Genetic research results, conclusions and conservation models available	Lab. protocols, progress reports, peer reviewed publications	Agreed access to private land maintained
3) Conservation and Sustainable Management Strategy (CSMS) agreed and implemented by stakeholders	stakeholder workshop conclusions available, implementation procedure defined and agreed	Workshop materials and reports from participants, CSMS reports, forest management plans	Conflicts of interests between actors and management goals of specific land areas in respect to proposed conservation measures are resolvable
4) Biodiversity conservation skills and capacity increased in Maule Region	2 RBS Survey/Bio-quality Assessment training courses completed, project partners participate in field research programme.	Training course materials published on-line, participants course reports, online digital photos from RBS and data on key species.	Trained staff stay in posts (private/public), given opportunity to apply and disseminate skills, continued interest among public and private actors in conservation issues relevant to the region
5) Monitoring programme for critical areas	Monitoring guidance published as a specific technical monitoring guide) 1 or 2 local institutions establish monitoring prog. by end project	Conservation Manual for Maulino Forests Technical guide for conservation monitoring including geographical and thematic priorities.	Post-Darwin Initiative financial support for post-project monitoring activities obtained
6) Environmental education prog. and participatory extension prog. with forest owners and general public	Project website, 2 radio programmes, 1 educational video, min. 5 school presentations, min. 3 university lectures	Website, presentation and lecture materials published on-line, participant reports, project progress reports, interviews with actors and beneficiaries	N/A

Annex 3 Project contribution to Articles under the CBD

Project Contribution to Articles under the Convention on Biological Diversity

Article No./Title	Project %	Article Description
6. General Measures for Conservation & Sustainable Use		Develop national strategies that integrate conservation and sustainable use.
7. Identification and Monitoring		Identify and monitor components of biological diversity, particularly those requiring urgent conservation; identify processes and activities that have adverse effects; maintain and organise relevant data.
8. In-situ Conservation	50	Establish systems of protected areas with guidelines for selection and management; regulate biological resources, promote protection of habitats; manage areas adjacent to protected areas; restore degraded ecosystems and recovery of threatened species; control risks associated with organisms modified by biotechnology; control spread of alien species; ensure compatibility between sustainable use of resources and their conservation; protect traditional lifestyles and knowledge on biological resources.
9. Ex-situ Conservation		Adopt ex-situ measures to conserve and research components of biological diversity, preferably in country of origin; facilitate recovery of threatened species; regulate and manage collection of biological resources.
10. Sustainable Use of Components of Biological Diversity		Integrate conservation and sustainable use in national decisions; protect sustainable customary uses; support local populations to implement remedial actions; encourage co-operation between governments and the private sector.
11. Incentive Measures		Establish economically and socially sound incentives to conserve and promote sustainable use of biological diversity.
12. Research and Training	20	Establish programmes for scientific and technical education in identification, conservation and sustainable use of biodiversity components; promote research contributing to the conservation and sustainable use of biological diversity, particularly in developing countries (in accordance with SBSTTA recommendations).
13. Public Education and Awareness	10	Promote understanding of the importance of measures to conserve biological diversity and propagate these measures through the media; cooperate with other states and organisations in developing awareness programmes.
14. Impact Assessment and Minimizing Adverse Impacts		Introduce EIAs of appropriate projects and allow public participation; take into account environmental consequences of policies; exchange information on impacts beyond State boundaries and work to reduce hazards; promote emergency responses to hazards; examine mechanisms for re-dress of international damage.
15. Access to Genetic Resources		Whilst governments control access to their genetic resources they should also facilitate access of environmentally sound uses on mutually agreed terms; scientific research based on a country's genetic resources should ensure sharing in a fair and equitable way of results and benefits.

Article No./Title	Project %	Article Description
16. Access to and Transfer of Technology		Countries shall ensure access to technologies relevant to conservation and sustainable use of biodiversity under fair and most favourable terms to the source countries (subject to patents and intellectual property rights) and ensure the private sector facilitates such assess and joint development of technologies.
17. Exchange of Information		Countries shall facilitate information exchange and repatriation including technical scientific and socio-economic research, information on training and surveying programmes and local knowledge
19. Bio-safety Protocol		Countries shall take legislative, administrative or policy measures to provide for the effective participation in biotechnological research activities and to ensure all practicable measures to promote and advance priority access on a fair and equitable basis, especially where they provide the genetic resources for such research.
Other Contribution	20	Smaller contributions (eg of 5%) or less should be summed and included here.
Total %	100%	Check % = total 100

Annex 4 Standard Measures

Code	Description	Totals (plus additional detail as required)
Training Measures		
1a	Number of people to submit PhD thesis	1
1b	Number of PhD qualifications obtained	1
2	Number of Masters qualifications obtained	
3	Number of other qualifications obtained	
4a	Number of undergraduate students receiving training	4
4b	Number of training weeks provided to undergraduate students	
4c	Number of postgraduate students receiving training (not 1-3 above)	
4d	Number of training weeks for postgraduate students	
5	Number of people receiving other forms of long-term (>1yr) training not leading to formal qualification(ie not categories 1-4 above)	
6a	Number of people receiving other forms of short-term education/training (ie not categories 1-5 above)	6
6b	Number of training weeks not leading to formal qualification	5
7	Number of types of training materials produced for use by host country(s)	3
Research Measures		
8	Number of weeks spent by UK project staff on project work in host country(s)	11
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (s)	1
10	Number of formal documents produced to assist work related to species identification, classification and recording.	1
11a	Number of papers published or accepted for publication in peer reviewed journals	2
11b	Number of papers published or accepted for publication elsewhere	
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country	2
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country	1

Code	Description	Totals (plus additional detail as required)
13a	Number of species reference collections established and handed over to host country(s)	1
13b	Number of species reference collections enhanced and handed over to host country(s)	1
Dissemination Measures		
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	4
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	5
15a	Number of national press releases or publicity articles in host country(s)	1
15b	Number of local press releases or publicity articles in host country(s)	2
15c	Number of national press releases or publicity articles in UK	
15d	Number of local press releases or publicity articles in UK	
16a	Number of issues of newsletters produced in the host country(s)	
16b	Estimated circulation of each newsletter in the host country(s)	
16c	Estimated circulation of each newsletter in the UK	
17a	Number of dissemination networks established	
17b	Number of dissemination networks enhanced or extended	
18a	Number of national TV programmes/features in host country(s)	
18b	Number of national TV programme/features in the UK	
18c	Number of local TV programme/features in host country	
18d	Number of local TV programme features in the UK	
19a	Number of national radio interviews/features in host country(s)	
19b	Number of national radio interviews/features in the UK	
19c	Number of local radio interviews/features in host country (s)	2
19d	Number of local radio interviews/features in the UK	

Code	Description	Totals (plus additional detail as required)
Physical Measures		
20	Estimated value (£s) of physical assets handed over to host country(s)	
21	Number of permanent educational/training/research facilities or organisation established	
22	Number of permanent field plots established	
23	Value of additional resources raised for project	£270,000
Other Measures used by the project and not currently including in DI standard measures		
	Public lectures at University of Talca	3
	School presentations in Maule	5
	Papers submitted	3

Annex 5 Publications

Type * **(eg journals, manual, CDs)**	**Detail** **(title, author, year)**	**Publishers** **(name, city)**	**Available from** **(eg contact address, website)**	**Cost** **£**
(*) Journal	Flower and fruit production and insect pollination of the endangered Chilean tree, *Gomortega keule* in native forest, exotic pine plantation and agricultural environments. Lander, T.A., Harris, S.A. & Boshier, D.H. (2009)	*Revista Chilena de Historia Natural* 82: 403-12.	http://rchn.biologiachile.cl/pdfs/2009/3/Lander_et_al_2009.pdf	Free
(*) Manual	Propuesta de una estrategia de conservación para los bosques nativos de la sub-región Costera del Maule. Aportes a la política regional de biodiversidad en la región del Maule. Arnold, F.E., Sepúlveda, C., San Martín, J., Boshier, D.H., Penailillo, P., Lander, T.A., Garrido, P., Harris, S.A., Hawthorne, W.D. (2010)	University of Talca	Dr José San Martín, University of Talca.	Free
Journal	Isolation and characterization of eight polymorphic microsatellite loci for the endangered, endemic Chilean tree *Gomortega keule* (Gomortegaceae). Lander, T.A., Boshier D.H., Harris S.A. (2007)	*Molecular Ecology Notes* 7: 1332-1334	Dr S. Harris, University of Oxford	Free
DVD	El Tesoro del Maule (2008)	University of Talca		Free

Annex 6 Darwin Contacts

Ref No	15/023
Project Title	Conservation of endangered coastal biodiversity hotspots of Central Chile
UK Leader Details	
Name	Dr Stephen Harris
Role within Darwin Project	Project coordination, genetic analysis and biodiversity training
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Other UK Contact (if relevant)	
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Role within Darwin Project	
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Partner 1	
Name	Dr. José San Martín Acevedo
Organisation	Universidad de Talca
Role within Darwin Project	Biodiversity analysis and interaction with Chilean stakeholders
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