ANNEX 23
SUPPLEMENTING OF BASELINE
STUDY OF LAND ARTHROPODS PRESENT IN THE MEADOW IN THE AREA OF ENGORDA AND BOSQUE IN THE SECTOR OF AUCAYES-MAITENES, CORDILLERA ANDINA CENTRAL

1 INTRODUCTION

The Central Area in Chile is considered all over the world as a "hot spot" of wildlife biodiversity, with a high priority in conservation (Myers et al. 2000). Within this area the Central Andean range of mountains has an abundance of wildlife with different species, most of them native. Ecosystems present in the high hills of the Andes are essential to the development of their biological cycles. It is estimated that they might be biological corridors of migratory species (Peña, 1998).

Arthropods, insects in particular, due to their biological diversity and great number are good indicators of biodiversity (Anderson & Vondracek, 1999). Also, they play important roles in the ecosystems as well as to keep the biological diversity, as predators, herbivorous, pollinator, decomposers, and preys to numerous species (Moroni 1977, Collins & Thomas 1989).

Studies referred to insects associated to ecosystems in the Andes central range of mountains sign a large variety and the character of native species. However, studies about their distribution and dispersion are scarce (Vidal & Guerrero, 2007). In terms of conservation the arthropods of this area should be considered as inadequately known.

2 OBJECTIVES

The objective of the present study is to conduct a prospection of the arthropods associated to two of the ecosystems present in the Sector of Alto Maipo, Central Andes highland: 1) Highland meadow in Sector Engorda and 2) Sclerophyllous forest in Sector Aucayes-Maitenes as to identity species that might be affected by the Alto Maipo Project.

The specific objectives are as follow:

- Assess the specific make up of land arthropods present in both areas.
- Describe the relative significant number of species of arthropods gathered.
- Identify those species that might be impacted by the Project considering criteria such as whether they are native, specificity of the habitat or host and restricted distribution.

3 METHODOLOGY

3.1 SITES OF THE STUDY

Site selection for the sampling was based on the ecosystems to be intervened by the Project. That is, environments that were representative of the areas to be intervened during the different activities associated to the location and execution of the Project. Once these ecosystems are defined, representative sectors are the selected as to establish the sampling points of the arthropods. Finally two areas of study were established representing the main ecosystems to intervene:

- Highland Meadow, Sector Engorda. Approximate location UTM coordinates: 19 H 407500 6265000. Approximately Height: 2500m. Sampling points were established in this area of the study for flying arthropods and epigeal.

- Schlerophyllous Forest, Sector Aucayes- Maitenes. Approximate location UTM coordinates: 19 H 382500 6287500. Approximately Height: 1250m. Sampling points for foliage arthropods and epigeal were established in this area.

Details about the composition and distribution of the vegetation in these areas can be found in the respective Baseline (Chapter 5).

3.2 SAMPLING METHODOLOGIES FOR ARTHROPODS

Sampling was conducted in March 15-16, 2008. This date coincides with the end of the reproductive period of many insect species which ensures that results will be a representative sample of the biodiversity of these organisms associated to the environments under the prospect.

3.2.1 Meadows in Sector Engorda

Butterflies

Determination of the composition and abundance of butterflies associated to the meadows in the Sector Engorda was done based on observations in three daily transects located parallel to the course of Maipo ravine. A 30m distance was considered between transects. Transects had an approximate surface area of 1,000m and 10 meter wide. UTM coordinates of the extension of transects were 19 H 407090 6259224 to 19 H 407837 6259406. Approximate time to cover each transect was 1 hour. Specimens observed in each transect were captured using an air entomological net. Determinations were conducted as per Peña & Ugarte, 1996. The specimens were released once the determination was completed.

Epigeal Arthropods

Three sampling sectors were established to determine the composition and relative abundance of epigeal arthropods (soil) associated to the meadows in Sector Engorda. Table 1 shows the location points. Five barber-type intersection traps were buried at each sector using a mixture of 50% alcohol and vehicle refrigerant. The traps were buried for 24 hr.

The collected material was transferred to plastic jars and taken to the laboratory for further review. The material was reviewed using stereoscopic lenses and the specimens were identified and counted. The determinations were done in accordance with specific entomological keys for each group (see Bibliography).

3.2.2 Forest in Sector Aucayes-Maitenes

Foliage Arthropods

Three daily transects located parallel to the course of Colorado Ravine were established to determine the composition and relative abundance of foliage arthropods associated to Sector Aucayes-Maitenes . A 10m distance was considered between transects. Transects had an approximate coverage of 200m. UTM coordinates for the extension of transects were 19 H 382893 6288301 to 19 H 382998 6288173. Approximate time to cover each transect was 1 hour. Capturing of arthropods associated to foliage was done by beating the branches, approximately 10 per tree in 10 trees in the transect. 60 trees were sampled in two days. The material was received in nets, transferred to glass containers to be further taken to the laboratory. The material was reviewed using stereoscopic lenses and the specimens were identified and counted. The determinations were done in accordance with specific entomological keys for each group (see Bibliography).

Epigeal Arthropods

Three sampling sectors were established to determine the composition and relative abundance of epigeal arthropods associated to the forest in Sector Aucayes-Maitenes. Table 1 shows the location points. Five barber-type intersection traps were buried at each sector using a mixture of 50% alcohol and vehicle refrigerant. The traps were buried for 24 hr. The collected material was transferred to plastic jars and taken to the laboratory for further review. The material was reviewed using stereoscopic lenses and the specimens were identified and counted. The determinations were done in accordance with specific entomological keys for each group (see Bibliography).

Table 1
Location points Barber traps

Points of meadows Sector Engorda	UTM Coordinates (m)
1	19 H 407138 6259202
2	19 H 407123 6259255
3	19 H 407103 6259422
Points Bosque Sector Aucayes- Maitenes	**UTM Coordinates (m)**
1	19 H 382970 6288171
2	19 H 382950 6288206
3	19 H 382944 6288224

3.3 IDENTIFICATION CRITERIA FOR SPECIES THAT CAN BE IMPACTED BY THE PROJECT

Identification of those species that might be impacted by the Project considering criteria such as whether they are native, specificity of the habitat or host, restricted distribution, and degree

of movement (vagility). The information was obtained from data available in specific bibliography (see Bibliography) when existing.

It should be pointed out that the fauna of arthropods in Chile is not yet considered for categorization under states of conservation mainly due to lack of information (Díaz-Paéz *et. al*, 2004).

4 RESULTS

4.1 MEADOWS SECTOR ENGORDA

Butterflies

98 individuals represented in 6 species and 4 families of Lepidoptera (butterflies) were detected in observations in the meadows in Sector Engorda (Table 2). The most prominent species is *Yramea lathonioides* (61.2%) (Table 3). Out of the 6 species detected, 2 are native and 3 are from both Chile and Argentina. In the species detected *Yramea lathonioides* has a high level of specificity in the use of habitat and restricted altitude distribution, being preferably present in high grass environments (1,700 and 3,200 m.a.s.l) (Table 2). The rest of the species are widely geographically distributed and are present in different types of habitat. However, for most of them their specific ecological requirements and hosts are yet unknown (Table 2).

Table 2
List of Species of Butterflies detected in meadows in Sector Engorda

Specie	Local name	Longitudinal Distribution	Altitude Distribution	Native from	Habitat	Host
HESPERIIDAE						
Butleria elwesi Evans, 1939	Hesperia de Elwes	Regions V- X	Coastal - Andean	Chile, Argentina (Neuquén-Chubut)	Several environments	Not known
LYCANIDAE						
Strymon eurytulus Hubner, 1819	Licena tornasol común	Regions III- X	Coastal - Andean	Chile	Several environments	Not known
NYMPHALIDAE						
Yramea lathonioides (Blanchard 1982)	Mariposa pintada de la altura	Regions III- XII	1,700-3,200 m.a.s.l.	Chile, Argentina (from Mendoza to the south)	Pajonales	Not known
Vanesa carye (Hubner, 1806)	Mariposa colorada común	Regions I- XII	Coastal - Andean	From Venezuela to Chile	Several environments	Several species of family Malvaceae
Cosmosatyrus chilensis chiliensis (Guerín, 1832)	Satírido negro común	Regions III- XII	Coastal - Andean	Chile, Argentina (Chubut-Santa Cruz)	Natural grass and bushes	Not known

Specie	Local name	Longitudinal Distribution	Altitude Distribution	Native from	Habitat	Host
PIERIDAE						
Tatochila autodice blanchari (Butler, 1881)	Mariposa blanca común	Regions I- X	Coastal - Andean	Chile	Several environments	Different species (e.g., *Brassic*a, *Tropaeolum*)

Table 3
Relative Abundance of Species of Butterflies, Meadows in Sector Engorda

Specie	Relative Abundance
Butleria elwesi Evans, 1939	1.02%
Strymon eurytulus Hubner, 1819	1.02%
Yramea lathonioides (Blanchard 1982)	61.2%
Vanesa carye (Hubner, 1806)	2.04%
Cosmosatyrus chilensis chiliensis (Guerín, 1832)	27.5%
Tatochila autodice blanchari (Butler, 1881)	7.14%

Epigeal Arthropods

Samplings taken in the meadows in Sector Engorda recorded a total of 187 specimens from 11 species of epigeal arthropods (Table 4). The most diversified order was Coleopterous (6 spp). The most prominent species were Eupodidae sp. (68.89%) and *Iridomyrmex humilis* (17.64%) (Table 5). A total of 6 species are native from Chile, most of them with wide geographical distribution, and low specificity in use of habitat. However, for most cases information is unknown about host or about any other specific ecological requirement (Table 4).

Table 4
List of Species of Epigeal Arthropods detected in meadows in Sector Engorda

Specie	Local name	Longitudinal Distribution	Altitude Distribution	Native from	Habitat	Host
ACARI						
Eupodidae *Eupodidae sp.*	Acaro rojo	Not known	Not known	Familia Cosmopolita	Wetlands	Not specified
COLEOPTERA						
Bruchidae *Lithraeus* sp.	Bruco	Not specified	Up to 3500 masl	Chile	Forest and scrubland	Litre and other schlerophyllous species
Carabidae *Mimodromius chilensis*	Cascarudo	Regions IV- X	Up to 3500 masl	Chile	Forest and scrubland	Not specified
Curculionidae *Cylydrorhinus* sp.	Gorgojo	Regions III- X	Up to 4000 masl	Chile	Low vegetation	Not specified
Staphyllinidae *Eudera sculptilis*		Not specified	Not specified	Chile	Forest and scrubland	Not specified
Staphyllinidae *Atheta obscuripennis*		Not specified	Not specified	Chile	Forest and scrubland	Not specified
Tenebrionidae *Scotobius punctatus*	Tenebrio	Regions III- IX	Not specified	Chile	Several environments	Not specified
HOMOPTERA						
Psyllidae **Psyllidae *sp.***	Saltadores	Not specified	Not specified	Familia Cosmopolita	Several environments	Not specified
Cicadellidae ***Exitianus obscurinervis***	Langostino venas oscuras	Regions I- VI	Not specified	America	Several environments	Different species of grass
HYMENOPTERA						
Formicidae *Iridomyrmex humilis*	Hormiga Argentina	Regions I- XII	Not specified	Cosmopolitan	Several environments	Not specified

Table 5
Relative Abundance of Epigeal Arthropods collected in meadows in Sector Engorda

Specie	Relative Abundance
Eupodidae *sp.*	68.89%
***Lithraeus* sp.**	0.53%
Mimodromius chilensis	0.53%
Curculionidae *Cylydrorhinus* sp.	1.6%
Eudera sculptilis	3.2%
Atheta obscuripennis	0.53%
Tenebrionidae *Scotobius punctatus*	2.67%
Psyllidae *sp.*	3.74%
Exitianus obscurinervis	0.53%
Iridomyrmex humilis	17.64%

4.2 FOREST IN SECTOR AUCAYES-MAITENES

Foliage Arthropods

A total of 60 specimens were found in Sector Aucayes-Maitenes which include 10 species and 4 orders of insects (Table 6). The most diversified order in the species was Hemiptera (4 spp) while the most abundant was *Leptoglossus chilensis* (26.6%) (Table 7). 2 of the species detected are native and 3 are from both Chile and Argentina. Most have a wide geographic distribution and low specificity in the use of habitat and host (Table 6).

Table 6
List of species of Arthropods collected in foliage of schlerophyllus forest
Sector Aucayes-Maitenes

Specie	Local name	Longitudinal Distribution	Altitude Distribution	Native from	Habitat	Host
COLEOPTERA						
Cerambycidae ***Strongylaspes limae*** Guérin-Menéville, 1830	Cruz de Malta	Regions III-VIII	Not specified	South America	Several environments	Lenga, quillay and other native trees
Coccinellidae ***Adalia angulifera*** Mulsant 1850	Chinita	Regions III- X	Not specified	Southern tip of America	Several environments	Different hosts
Curculionidae ***Cyphometopus sp.*** Blanchard, 1851	Gorgojo, burrito	Regions I- X	Not specified	Chile	Several environments	Native vegetation
HEMIPTERA						
Coreidae ***Leptoglossus chilensis*** Spinola	Chinche del campo y frutales	Regions III- X	Not specified	Chile and Argentina	Several environments	Several fruit trees
Pentatomidae ***Podisus chilensis* (Spinola)**	Chinche de espina negra	Regions V- X	Not specified	Chile and Argentina	Several environments	Different species of native bushes and trees
Pentatomidae ***Nezara viridula* Lineo**	Chinche verde de campo	Regions V-XII	Not specified	World distribution	Several environments	Different hosts
Reduviidae ***Zelus cervicalis*** Stal	Chinche	Regions V-VI	Not specified	Introduced	Low vegetation, Central valley, low Andean hills	Different hosts
HYMENOPTERA						
Formicidae ***Camponotus chilensis*** Smith, 1858	Hormigón negro	Regions III- X	Not specified	Chile and Argentina	Several environments	Different hosts
Formicidae ***Camponotus distinguendus*** (Spinola)	Hormiga peluda blanca	Regions III- X	Not specified	Chile and Argentina	Several environments	Different hosts
ORTHOPTERA						
Acrididae ***Trimerotopes ochraceipennis*** (Blanchard)	Langosta cordillerana	Regions I- XII	Coastal -3500m	Chile	Dry, open and sunny places	Different species of grass, herbaceous.

Table 7
Relative Abundance of Epigeal Arthropods collected in forest in Sector Aucayes-Maitenes

Specie	Relative Abundance
Strongylaspes limae Guérin-Menéville, 1830	1.66%
Adalia angulifera Mulsant 1850	18.33%
Cyphometopus sp. Blanchard, 1851	5%
Leptoglossus chilensis Spinola	26.6%
***Podisus chilensis* (Spinola)**	3.33%
***Nezara viridula* Lineo**	6.67%
Zelus cervicalis Stal	15%
Camponotus chilensis Smith, 1858	13.3%
Camponotus distinguendus (Spinola)	8.33%
Trimerotopes ochraceipennis (Blanchard)	1.66%

Epigeal Arthropods

A total of 56 specimens were found in the schlerophyllous forest in Sector Aucayes-Maitenes which include 12 species of insects (Table 8). The most diversified order was Coleoptera (5 spp). The most prominent species were *Diplocoelus* sp. (32.14%) and *Camponotus chilensis* (30.35%) (Table 9). 3 of the species detected are native and 2 are from both Chile and Argentina (Table 8). Most have a wide geographic distribution and low specificity in the use of habitat. In some cases information about host and other specific ecological requirements is unknown (Table 8).

Table 8
List of species of Epigeous arthropods collected in foliage of schlerophyllus forest Sector Aucayes-Maitenes

Specie	Local name	Longitudinal Distribution	Altitude Distribution	Native from	Habitat	Host
BLATTARIA						
Blattellidae ***Blatella germanica*** (Lineo)	Barata germánica	Regions I- XII	Not specified	Cosmopolitan	Several environments	Different hosts
COLEOPTERA						
Archeocrypticidae **Archeocrypticidae sp.**		Not specified	Not specified	Not specified	Not specified	Not specified
Biphyllidae ***Diplocoelus sp.***		Not specified	Not specified	Not specified	Not specified	Not specified
Carabidae ***Callidula nigrofasciata*** (Solier)	Carábido de manchas amarillas	Regions IV- X	Up to 1500 masl	Chile and Argentina	Rocky and bush environments	Not specified
Staphyllinidae ***Atheta obscuripennis***		Not specified	Not specified	Chile	Bush	Not specified

Specie	Local name	Longitudinal Distribution	Altitude Distribution	Native from	Habitat	Host
Tenebrionidae ***Nycterinus rugiceps australis*** Peña 1971	Tenebrio	Regions V-VI	Coastal -2800 masl	Chile	Several environments	Not specified
HOMOPTERA						
Cicadellidae ***Exitianus obscurinervis*** (Stal)	Langostino de venas oscuras	Regions I- VI	Not specified	America	Several environments	Different species of grass
HYMENOPTERA						
Formicidae ***Camponotus chilensis*** Smith, 1858	Hormigón negro	Regions III- X	Not specified	Chile and Argentina	Several environments	Different hosts
Formicidae ***Solenopsis gayi*** (Spinola)	Hormiga fuego	Regions I- XII	Not specified	Cosmopolitan	Different habitat	Not specified
Formicidae ***Iridomyrmex humilis*** (Mayr)	Hormiga Argentina	Regions I- XII	Not specified	Cosmopolitan	Different habitat	Not specified
ORTHOPTERA						
Grillidae ***Acheta assimilis*** (Fabricius)	Grillo alado negro	Regions I- XII	Not specified	Cosmopolitan	Humid places protected from the sunlight	Different hosts
Grillidae ***Hoplosphyrum griseus*** (Philippi)	Grillo chico alado	Regions IV- X	Not specified	Chile	Different habitat	Different hosts

Table 9
Relative Abundance of Epigeal Arthropods collected in schlerophyllus forest in Sector Aucayes-Maitenes

Specie	Relative Abundance
Blatella germanica (Lineo)	1.78%
Archeocrypticidae sp.	1.78%
Diplocoelus sp.	32.14%
Callidula nigrofasciata (Solier)	1.78%
Atheta obscuripennis	1.78%
Nycterinus rugiceps australis Peña 1971	1.78%
Exitianus obscurinervis (Stal)	3.57%
Camponotus chilensis Smith, 1858	30.35%
Solenopsis gayi (Spinola)	1.78%
Iridomyrmex humilis (Mayr)	1.78%
Acheta assimilis (Fabricius)	8.9%
Hoplosphyrum griseus (Philippi)	12.5%

5 CONCLUSIONS

The Project area does not have preferred habitat or habitat mostly sensitive for populations of insects that have an interests of conservation for scientific, agricultural purposes or any other, likely to be impacted by the Project in terms of deterioration of the surface, intrinsic characteristics or their fragmentation.

Collection of arthropods in sectors La Engorda and Aucayes-Maitenes registered a total of 37 species in the following orders: LEPIDOPTERA, COLEOPTERA, HEMIPTERA, HOMOPTERA, HYMENOPTERA, BLATTARIA, and ORTHOPTERA, and ACARI (in the arachnids). Out of the total of species recorded, 12 are native from Chile and 8 from Chile and Argentina and most of them have a geographic distribution within the country and low specificity in the use of habitat. While this might suggest species have a low degree of susceptibility from the Project, there is an obvious lack of information about their host or any other specific ecological requirements.

Based on available information the butterfly Yramea lathonioides, could be potentially sensible to works in sector La Engorda -use of habitat and altitude distribution, as it is preferably in high grass areas, from 1,700 to 3,200 masl. However given its wide geographic distribution and continuous presence in high Andean habitat it is possible to conclude that PHAM entails no hazard to the population of this species. Also, intervention in the area of La Engorda will have a reduced magnitude or spatial expression therefore no significant effect is expected on the specimens of this species.

Finally, with regard to special measures for environmental management associated to the group of land arthropods, no impacts requiring specific measures are foreseen.

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ANEXO 23
APÉNDICE 1
REGISTRO FOTOGRÁFICO

Foto 1. Área de influencia del proyecto, Sector La Engorda.

Foto 2. Trampa de captura artrópodos epígeos, Sector Aucayes-Maitenes.