Vegetation of Península Valdés: Priority Sites for Conservation

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Abstract This chapter describes the main vegetation units of Península Valdés at scale 1:250,000 with emphasis on relevant physiognomic and floristic characteristics. Based on photogrammetry (aerial photograph pairs 1:60,000) and ground check, 18 dominant singular plant species arrangements (vegetation units) were identified reflecting the variety of environmental conditions at a mesoscale (1:250,000) within Península Valdés. At sites selected for ground check, floristic–physiognomic census including a complete floristic plant species list with the relative abundance of each species were performed. After that, censuses of species abundance were ordered by principal component analysis. The layer structure, the main life forms and the dominant species for each identified and mapped vegetation unit were described. Among them, we identified shrubby vegetation units at northern and central Península Valdés and, grassy vegetation units at southern Península Valdés. A map of vegetation units and some pictures of the most representative vegetation units complete the vegetation description. Moreover, this chapter includes a detailed description of the plant communities (resolution scale 1:1) characterizing four sites identified as priorities for ecosystem conservation.

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Priority sites for conservation are located in Salt marshes, Uplands and Plain Systems and Endorheic Basins. Some contrasts between conserved and degraded community states are also exemplified.

Keywords Desert steppes · Grass steppes · Patagonia · Salt marshes · Sandy grasslands · Sheep grazing · Shrub steppes

1 Introduction

The phytogeographical identity of the vegetation of Península Valdés has long been discussed by various authors due to the presence of characteristic *floristic elements* of two different *Phytogeographical Provinces.* Some specialists included the vegetation of Península Valdés in the Patagonian Phytogeographical Province (Lorentz 1876; Holmberg 1898; Kühn 1922, 1930; Cabrera 1976; Soriano 1956; Morello 1958; León et al. 1998). Other researchers referred the vegetation of this portion of Patagonia to the Monte Phytogeographical Province (Hauman 1920, 1926, 1931, 1947; Parodi 1934, 1945, 1951; Castellanos and Pérez Moreau 1944). Moreover, Frenguelli (1940) and Soriano (1950) defined the vegetation of Península Valdés as an ecotone between the vegetation of both Provinces. This debate continued since more recently, Roig and Martínez Carretero (1998) included vegetation of Península Valdés in the Monte while León et al. (1998) in the Patagonian Phytogeographical Province. In this contribution, we adopt the criteria of León et al. (1998).

Probably, all these discrepancies are due to the fact that despite sharing *floristic elements* characteristic of both Patagonian and Monte, most of the vegetation of Península Valdés lacks of *Larrea* species (main floristic components of the Monte) and has an abundant and extended presence of *Chuquiraga* species (main floristic components in the Central District of the Patagonian Province).

2 Main Plant Adaptive Strategies

The Península Valdés is characterized by vast terraces (Uplands and Plains System, see Chapter "Late Cenozoic Landforms and Landscape Evolution of Península Valdés") covered by discreet plant life forms arranged in a patchy structure. Native species present today are the result of plant adaptive responses to the prevailing arid conditions after the Andean uplift (see Chapter "Climatic, Tectonic, Eustatic, and Volcanic Controls on the Stratigraphic Record of Península Valdés"). These adaptive responses to aridity along with high intensity and frequency of dry winds, and relative low temperatures (Ares et al. 1990; see Chapter "The Climate of Península Valdés Within a Regional Frame") resulted in particular structural and functional adaptations. The main life forms in Península Valdés are shrubs (evergreen and deciduous), bunch perennial grasses, and forbs (Sala et al. 1989;

Golluscio and Sala 1993; Bertiller et al. 2006). Dominant evergreen shrubs show adaptations such as cushion form, small leaves, and green leafless stems. Epidermal pubescence is another adaptive feature giving a typical grey or green opaque colour to leaves. Drought deciduous shrubs may also be present in the shrubby canopy. Vegetation canopy in the northern-central Península Valdés consists of a patchily arranged shrubby matrix. Less conspicuous grass species and forbs are scattered in almost all inter-patch areas or associated to shrub patches. In contrast, sandy soils in southern Península Valdés are mainly covered by rhizomatous perennial grasses forming a continuous grass stratum with interspersed shrubs.

Most of the plant activity in the Península Valdés depends on soil water accumulated during the winter-spring precipitation period although precipitation pulses could also occur in autumn and summer (Ares et al. 1990; Barros and Rivero 1982, see Chapter "The Climate of Península Valdés Within a Regional Frame"). Increasing temperature and day length coupled with high soil moisture conditions in early spring leads to the reactivation of the vital functions in most species. This activity period is extended up to early–late summer depending on the rooting depth of the species (Bertiller et al. 1991; Campanella and Bertiller 2008). In this sense, the activity of deep rooted shrubs, both deciduous and evergreen, is more extended into the dry summer compared to that of perennial grasses with shallow rooting depth. The timing of flowering, with some exceptions, has a marked seasonality occurring only once in the year.

3 Description of the Main Vegetation Units (Scale 1:250,000)

Eighteen dominant singular plant species arrangements (vegetation units) reflect the variety of environmental conditions at a mesoscale (1:250,000) within Península Valdés (Bertiller et al. 1981). Based on photogrammetry (aerial photograph pairs 1:60,000) and ground check, 18 main vegetation units were identified in Península Valdés. At sites selected for ground check, floristic–physiognomic census (Mueller-Dombios and Ellemberg 1974) including a complete floristic plant species list with the relative abundance of each species were performed. After that, censuses of species abundance were ordered by principal component analysis. The layer structure, the main life forms and the dominant species for each identified and mapped vegetation unit were described (Bertiller et al. 1981). Nomenclature followed the Flora Patagónica (Correa 1969, 1971, 1978, 1984a, b, 1988, 1998, 1999), and was updated by the Data Base Flora Argentina (http://www.floraargentina.edu.ar/).

These dominant vegetation units range from shrubby steppes in the north and centre of Península Valdés to perennial grass steppes dominating in the south of Península Valdés (Fig. 1). The north of Península Valdés is mostly characterized by terraces and piedmont slopes (Uplands and Plains System, see Chapter "Late Cenozoic Landforms and Landscape Evolution of Península Valdés") covered by shrub and grass-shrub steppes, dominated by shrubs of the genus *Chuquiraga* and

perennial grasses of the genus *Nassella* and *Jarava*. The Great Endorheic Basins System characterizing the central portion of the Península Valdés are covered by shrub and the shrub-perennial grass steppes with predominance of shrubs (*Chuquiraga* spp., and *Cyclolepis genistoides*), and the perennial grass *Nassella tenuis.* The south portion of the Península Valdés is characterized by terraces covered in some places by West–East stabilized aeolian field. Terraces are colonized by patchy steppes consisting of a mosaic of perennial grass- and shrubby steppes. Stabilized aeolian field deposits are covered by perennial grass steppes with isolated shrubs and shrub steppes of *Hyalis argentea.* Moreover, active dunefield and playa lakes deposits without vegetation alternate with these vegetation units. Finally, coastal landforms around Península Valdés are covered by shrubby or grass-shrubby steppes.

3.1 Vegetation of System A: Uplands and Plains

3.1.1 Vegetation of the Terrace Level I

***Shrub steppe of Chuquiraga avellanedae and Schinus johnstonii* (*VU17*, Fig. 1)**

This shrubby steppe is the dominant vegetation unit in the Terrace level 1 occupying a narrow band in the Istmo Carlos Ameghino. The total vegetation cover is 40–50% consisting of a dominant shrubby stratum (ca. 40% cover, 50–200 cm tall) mostly represented by *C. avellanedae* and *S. johnstonii* along with *Condalia microphylla* and *Prosopidastrum globosum*. The other plant layers are a dwarf shrub stratum (1–5% cover, 5–10 cm tall) dominated by *Acantholippia seriphioides* and an herbaceous layer dominated by herbaceous perennial forbs: *Boopis anthemoides*, *Hoffmannseggia trifoliata*, and *Perezia recurvata* and by perennial and annual grasses *N. tenuis*, *Pappostipa humilis*, *Jarava neaei*, *Pappostipa speciosa*, *Poa ligularis* and *Schismus barbatus*.

3.1.2 Vegetation of the Terrace Level II

***Shrub steppe of Chuquiraga erinacea ssp. hystrix and C. avellanedae with perennial grasses* (*VU13*, Figs. 1 and 2a)**

This vegetation unit is mostly characteristic of central Península Valdés dominating the Terrace level 2 as well as piedemont pediments and bajadas (System B, see Sect. 3.2). The total plant cover is 60–80% and consists of a mosaic of shrubby and perennial grass patches. Shrubby patches are dominated by a tall layer (50% cover, 50–180 cm tall) represented by *C. erinacea* ssp. *hystrix*, *C. avellanedae* along with *Lycium chilense*, *S. johnstonii*, *C. microphylla*, and *Brachyclados megalanthus* with dwarf shrub and herbaceous perennial species (5–10 cm tall) covering 5% of the

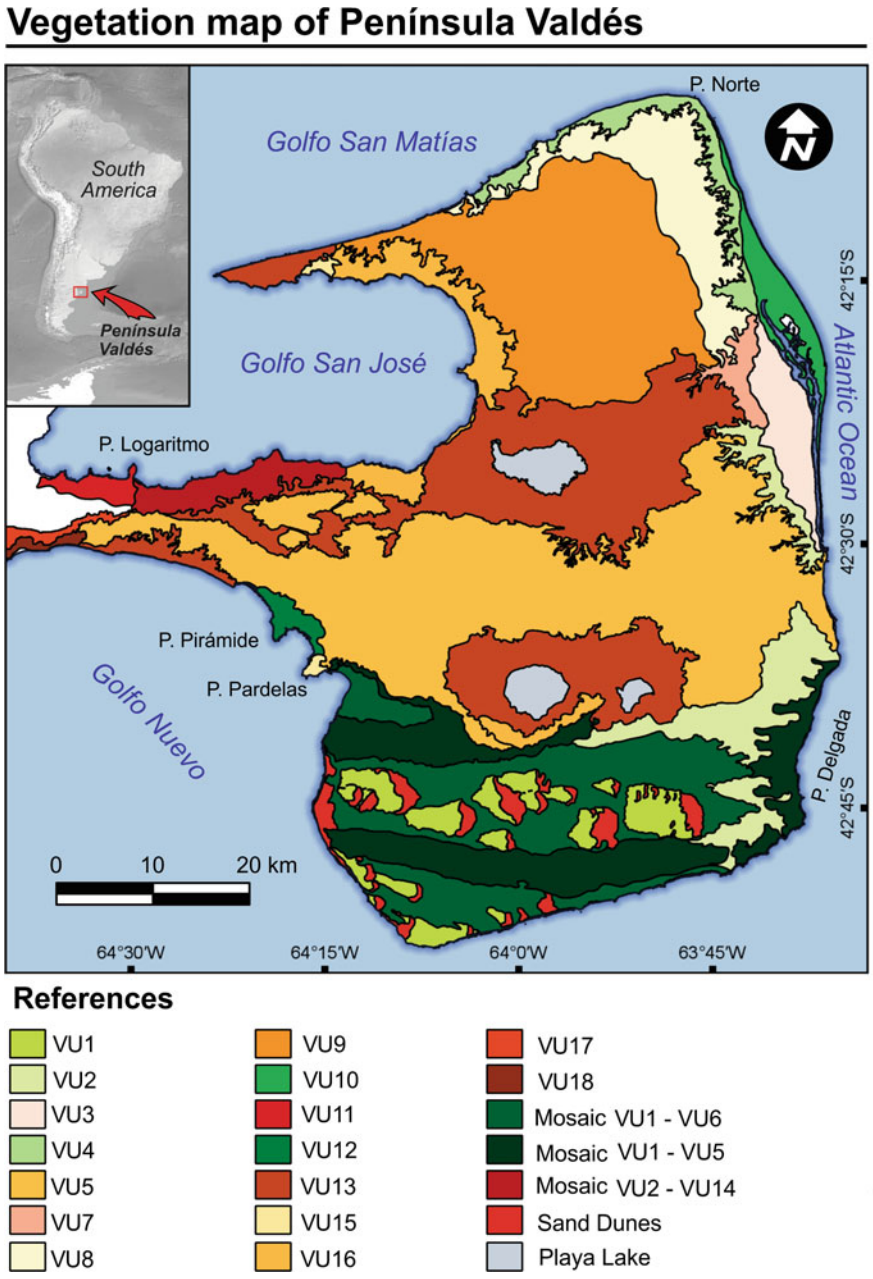
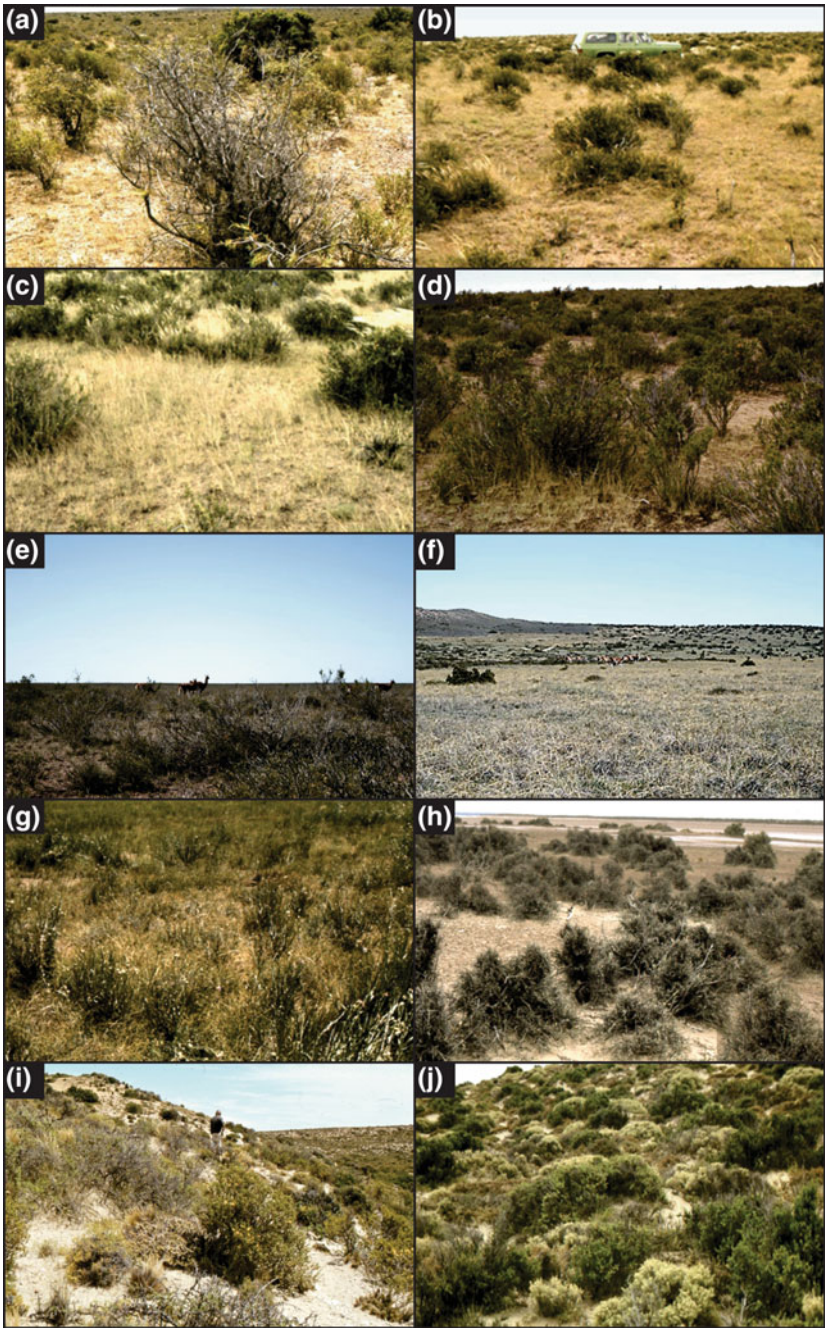


Fig. 1 Location of Península Valdés and Vegetation Units redrawn from Bertiller et al. (1981)


(a)
(b)
(c)
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(e)
(f)
(g)
(h)
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(j)

◀ **Fig. 2** Views of the main Vegetation Units of Península Valdés. **a** Shrub steppe of *Chuquiraga erinacea* ssp. *hystrix* and *Chuquiraga avellanedae* with perennial grasses (VU13); **b** Perennial grass steppe of *Piptochaetium napostaense*, *Nassella tenuis* and *Plantago patagonica* (VU2); **c** Mosaic VU2–VU5 (Shrub-perennial grass steppe of *Chuquiraga avellanedae* and *Nassella tenuis;* **d** Shrub-perennial grass steppe of *Chuquiraga avellanedae* and *Nassella tenuis* (VU5); **e** Shrub-perennial grass steppe of *Chuquiraga avellanedae* and *Nassella tenuis* (VU5); **f** Perennial grass steppe of *Sporobolus rigens* and *Nassella tenuis* (VU1); **g** Shrub steppe of *Hyalis argentea* (VU6); **h** Shrub steppe of *Chuquiraga erinacea* ssp. *hystrix*, *Cyclolepis genistoides*, and *Chuquiraga avellanedae* with perennial grasses (VU16); **i** Shrub steppe of *Chuquiraga avellanedae*, *Larrea divaricata* and *Nassauvia fuegiana* (VU14); **j** Shrub steppe of *Cyclolepis genistoides*, *Chuquiraga avellanedae*, and *Atriplex lampa* (VU15)

soil (*H. trifoliata*, *Baccharis darwinii*, *P. recurvata*, *Tetraglochin caespitosum*, and *A. seriphioides*). Perennial grass patches (15–20% cover, 5–10 cm tall) are dominated by *N. tenuis*, *Piptochaetium napostaense*, *P. speciosa*, *P. humilis*, with *J. neaei*, *P. ligularis*, with annual grasses (*S. barbatus* and *Bromus catharticus*) and the annual forb *Daucus pusillus*.

3.1.3 Vegetation of the Terrace Level III

The Terrace Level III is mainly covered by a two-phase mosaic (mosaic VU2–VU5, Fig. 1) consisting of the perennial grass steppe of *P. napostaense*, *N. tenuis*, and *Plantago patagonica* (VU2) and the shrub-perennial grass steppe of *C. avellanedae* and *N. tenuis* (VU5) characteristic of Terrace Level IV (see below). Also, pure patches of VU5 and a mosaic (VU1–VU6, Fig. 1) composed of the perennial grass steppe of *Sporobolus rigens* and *N. tenuis* (VU1) and the shrub steppe of *H. argentea*. (VU6), characteristic of the Stabilized aeolian fields (see Sect. 3.1.7), may cover in small patches Terrace Level III.

***Perennial grass steppe of P. napostaense and N. tenuis with P. patagonica and isolated shrubs of C. avellanedae* (*VU2*, Figs. 1 and 2b)**

This vegetation unit has a total plant cover of 60–70% and is dominated by a conspicuous herbaceous layer (40–50% cover, 20 cm tall) characterized by the perennial grasses *P. napostaense* and *N. tenuis* accompanied by *B. catharticus*, *S. barbatus*, and the annual herb *P. patagonica*. The shrubby layer (15% cover, 50–200 cm tall) is dominated by *C. avellanedae* along with *S. johnstonii*, *L. chilense*, and *Discaria americana*. There are also scattered dwarf shrubs (*Baccharis melanopotamica* and *T. caespitosum*) and herbaceous perennial herbs (*Paronychia chilensis* and *H. trifoliata*) covering 5% of the soil with a height ca. 10 cm. This vegetation unit is mostly patchily associated (mosaic VU2–VU5, Fig. 1) with the shrub-perennial grass steppe of *C. avellanedae* and *N. tenuis* (VU5), characteristic of the central portion of the Península Valdés (Fig. 2c).

3.1.4 Vegetation of Terrace Level IV

The dominant vegetation at Terrace Level IV consists of shrub-grass steppes and shrubby steppes with perennial grasses. The most conspicuous vegetation unit occupying these terraces in central Península Valdés is the shrub-perennial grass steppe of *C. avellanedae* and *N. tenuis* (VU5) while in the northern areas vegetation is represented by the shrub steppe of *C. avellanedae* and *C. microphylla* (VU9).

***Shrub-perennial grass steppe of C. avellanedae and N. tenuis* (*VU5*, Figs. 1 and 2d–e)**

The total plant cover is ca. 50% with a patchy arrangement consisting of shrubby and perennial grass patches. Shrubby patches (25% cover, 50–60 cm tall) are dominated by *C. avellanedae* along with *S. johnstonii* and *L. chilense*. Perennial grass patches (20–25% cover, 10 cm tall) are dominated by *N. tenuis* and *P. napostaense* with *P. ligularis* and *Nassella longiglumis*. Scattered dwarf shrub and herbaceous species (5% cover, 10 cm tall) represented by *H. trifoliata*, *P. chilensis* and *P. recurvata* are immersed in the perennial grass patches.

***Shrub steppe of C. avellanedae and C. microphylla* (*VU9*, Fig. 1)**

This vegetation unit has a plant cover of 50–60% with a presence of shrubby and grass layers. The shrubby layer (40% cover, 40–120 cm height) is dominated by *C. avellanedae*, *C. microphylla*, and *P. globosum* along with *B. megalanthus*, *L. chilense* and *S. johnstonii*. The grass layer (15% cover, 15 cm height) is represented by *N. tenuis*, *P. speciosa*, *J. neaei*, *P. napostaense*, *N. longiglumis* and *S. barbatus*.

3.1.5 Vegetation of Terrace Level V

This Terrace level is covered by the shrub steppe of *C. avellanedae* and *N. tenuis* (VU5), characteristic of the Terrace Level IV, and by a two-phase mosaic (mosaic of this vegetation unit and the perennial grass steppe of *P. napostaense* and *N. tenuis* with *P. patagonica* and isolated shrubs of *C. avellanedae* (VU2), characteristic of Terrace Level III (VU2–VU5, Fig. 1).

3.1.6 Vegetation of Terrace Level VI

The Terrace Level VI consists of shrub-grass steppes and shrubby steppes with perennial grasses. Three vegetation units colonize this terrace level: The shrub steppe of *C. avellanedae* and *C. microphylla* (VU9) also characteristic of Terrace Level IV (see Sect. 3.1.4), the shrub steppe of *C. avellanedae* and *C. erinacea* ssp *erinacea* (VU8), and the shrub steppe of *C. erinacea* ssp. *hystrix* and *C. avellanedae* with perennial grasses (VU13), characteristic of Terrace Level II.

***Shrub steppe of C. avellanedae and C. erinacea ssp. erinacea* (*VU8*, Fig. 1)**

This vegetation unit is characteristic of terrace levels at the northeastern Península Valdés. The total plant cover is 60–80% with two shrubby and a grass layers. The tall shrubby layer (30–40% cover, 50–100 cm height) is dominated by *C. avellanedae* and *C. erinacea* ssp. *erinacea*, accompanied with *L. chilense*, *C. microphylla*, *P. globosum* and *S. johnstonii*. The dwarf shrub layer (5% cover, 5–15 cm height) is represented by *P. chilensis*, *H. trifoliata*, *B. darwinii* and *P. recurvata*. The grass stratum (15–30% cover, 5–20 cm height) is dominated by *N. tenuis*, *J. neaei*, *P. speciosa* and *P. patagonica*. Other grasses less represented in this layer are *P. humilis*, *S. barbatus*, *P. ligularis*, *Vulpia myuros f. megalura* and *P. napostaense*.

3.1.7 Vegetation of the Stabilized Aeolian Fields

The Stabilized aeolian fields are covered by two main vegetation units: the perennial grass steppe of *S. rigens* and *N. tenuis* (VU1) and the dwarf shrub steppe of *H. argentea* (VU6). These vegetation units are mostly spatially arranged in a two-phase mosaic.

***Perennial grass steppe of S. rigens and N. tenuis* (*VU1*, Figs. 1 and 2f)**

The plant canopy covers between 70 and 80% and consists of a continuous perennial grass layer, 30 cm tall, covering 50–60% of the soil. This layer is dominated by *S. rigens* and *N. tenuis* with *P. napostaense*, *Panicum urvilleanum* and *Poa lanuginosa*. *S*cattered shrubs (*Lycium* spp., *Baccharis divaricata*) or perennial herbaceous plants (*P. chilensis*) are immersed in the perennial grass matrix covering between 10 and 30%.

***Dwarf shrub steppe of H. argentea* (*VU6*)**

This vegetation unit is patchily arranged in a mosaic (V1–V6, Figs. 1 and 2g) with the perennial grass steppe of *S. rigens* and *N. tenuis* (VU1). The plant cover varies between 70 and 90% and is characterized by a conspicuous shrubby layer dominated by the small shrub *H. argentea* (65–85% cover, 50 cm tall). This species may be accompanied by other shrubs (*B. divaricata*) or by dwarf shrubs (*A. seriphioides*) covering not more than 5% of the soil. *S. rigens*, *S. barbatus* and *P. lanuginosa* are the most frequent components of the herbaceous layer (5–10% cover, 5–25 cm tall).

3.2 Vegetation of System B: Great Endorheic Basins

3.2.1 Vegetation of the Piedmont Pediment and Bajada

Vegetation of Piedmont pediments and bajadas is mostly represented by the shrub steppe of *C. erinacea* ssp. *hystrix* and *C. avellanedae* with perennial grasses

(VU13), characteristic of the Terrace Level II (Fig. 2e) and small patches of the shrub steppe of *C. erinacea* ssp. *hystrix*, *C. genistoides* and *C. avellanedae* with perennial grasses (VU16).

***Shrub steppe of C. erinacea ssp. hystrix, C. genistoides, and C. avellanedae with perennial grasses* (*VU16*, Figs. 1 and 2h)**

The total plant cover is 40–60% and consists of a shrubby stratum (30–40% cover, 60–100 cm height) dominated by *C. avellanedae* and *Mulinum spinosum* along with *C. erinacea* ssp. *hystrix* and *C. genistoides*. The dwarf shrub layer (5% cover, 5–10 cm tall) is represented by *A. seriphioides* and *P. recurvata*. The grass layer (5–10 cm tall) covering 5% of the soil is formed by the perennials *P. humilis*, *J. neaei*, *N. tenuis*, and *P. speciosa* accompanied by the annual *S. barbatus*.

3.3 Vegetation of the System C: Coastal Zone

3.3.1 Vegetation of the Coastal Piedmont Pediment

The vegetation of the Coastal piedmont pediment is highly heterogeneous consisting of shrub-perennial grass steppes of *C. erinacea* ssp. *erinacea* and *N. tenuis* (VU4) and shrub steppes with highly variable species composition: Shrub steppe of *C. avellanedae*, *Larrea divaricata* and *Nassauvia fuegiana* (VU14), shrub steppe of *Senecio filaginoides* and *M. spinosum* (VU12), Shrub steppe of *C. genistoides*, *C. avellanedae*, and *Atriplex lampa* (VU15), Shrub steppe of *C. avellanedae* and *M. spinosum* (VU11), and Shrub steppe of *L. divaricata*, *C. avellanedae* and *P. globosum* (VU18), the shrub steppe of *C. avellanedae* and *C. microphylla* (VU9), characteristic of Terrace Level VI, the shrubby steppe of *C. microphylla* and *L. chilense* (VU7), and the shrub steppe of *C. erinacea* ssp. *hystrix* and *C. avellanedae* with perennial grasses (VU13), characteristic of the Terrace Level II. Also, small patches of the perennial grass steppe of *P. napostaense*, and *N. tenuis* with *P. patagonica* and isolated shrubs of *C. avellanedae* (VU2) cover this landform.

***Shrub-perennial grass steppe of C. erinacea ssp. erinacea and N. tenuis* (*VU4*, Fig. 1)**

This vegetation unit covers between 40 and 70% of the soil on narrow terrace flanks at northeastern Península Valdés. Plant canopy consists of three layers dominated by medium shrubs, perennial grasses, and dwarf shrubs, respectively. The medium shrub layer (40–70% cover, 80 cm height) is dominated *C. erinacea* along with *S. johnstonii*. The perennial grass layer (10–30% cover, 10 cm height) is dominated by *N. tenuis*, *N. longiglumis* and *P. napostaense* along with *B. catharticus*, *P. ligularis* and the annual herb *P. patagonica*. The dwarf shrub layer (5% cover, 10 cm tall) is composed by *A. seriphioides*, *B. darwinii and B. melanopotamica* accompanied by the perennial herbs *H. trifoliata* and *B. anthemoides*.

***Shrub steppe of C. avellanedae, L. divaricata and N. fuegiana* (*VU14*, Figs. 1 and 2i)**

This vegetation unit is characteristic of the Golfo San José (San José Gulf) coast and appears patchily arranged in a two-phase mosaic (VU2–VU14, Fig. 1) with the perennial grass steppe of *P. napostaense* and *N. tenuis* with *P. patagonica* and isolated shrubs of *C. avellanedae* (VU2). The total plant cover is ca. 30% with two discontinuous shrubby layers and scattered grasses. The tallest shrubby layer (30% cover, 60 cm tall) is dominated by *C. avellanedae* along with *L. divaricata*, *C. microphylla* and *S. johnstonii*. The dwarf shrub stratum (4% cover, 20 cm height) is dominated by *N. fuegiana* and *B. darwinii*. *N. tenuis* and *S. barbatus* are the most common grasses covering ca. 1% of the soil.

***Shrub steppe of S. filaginoides and M. spinosum* (*VU12*, Fig. 1)**

This vegetation unit occupies coastal piedmont pediments with aeolian deposits in the Golfo Nuevo. The total plant cover is 50% distributed in three layers. The shrubby layer (35% cover, 70–110 cm tall) is dominated by the medium shrubs *M. spinosum* and *S. filaginoides*, and the tall shrubs *L. chilense* and *S. johnstonii*. The dwarf shrub layer (10% cover, 30 cm tall) is formed by *B. darwinii* and *B. divaricata*. The lowest stratum (5% cover, 30 cm tall) is composed mostly of perennial grasses. *S. rigens* and *P. lanuginosa* dominate this layer along with *J. neaei*, *P. humilis*, and the annual grass *S. barbatus*.

***Shrub steppe of C. genistoides, C. avellanedae, and A. lampa* (*VU15*, Figs. 1 and 2j)**

This vegetation unit occupies coastal patches at the Golfo San José and Golfo Nuevo. The total plant cover is 50–70% with three plant layers. The shrubby layer (30–50% cover, 60–100 cm tall) is dominated by the medium shrub *C. avellanedae* and the tall shrub *C. genistoides*. The dwarf shrub layer (10–20% cover, 5–10 cm tall) consists of *A. seriphioides* and *B. darwinii* along with *H. trifoliata* and *Gutierrezia solbrigii*. Finally, the herbaceous layer (10–20% cover, 10 cm tall) is dominated by *P. speciosa*, *P. humilis* and *J. neaei*.

***Shrub steppe of C. avellanedae, and M. spinosum* (*VU11*, Fig. 1)**

This vegetation unit covers about 50% of the soil at coastal areas of the San José Gulf. This unit presents three plant layers (shrub, dwarf shrub, and herbaceous layers). The shrub layer (30–35% cover, 70–120 cm tall) is dominated by *C. avellanedae*, *M. spinosum*, along with *L. chilense* and *C. microphylla*. The dwarf shrub stratum (10–15% cover, 10 cm tall) is formed by *G. solbrigii* and *A. seriphioides*. The herbaceous layer (10–20% cover, 10 cm tall) consists of perennial grasses *N. tenuis*, *P. humilis*, *P. speciosa*, along with the annual grasses *B. catharticus* and *S. barbatus*.

***Shrub steppe of L. divaricata, C. avellanedae, and P. globosum* (*VU18*, Fig. 1)**

This vegetation unit covers about 50–60% of the soil at coastal areas of the Golfo Nuevo. This unit consists of three plant layers (shrub, dwarf shrub, and herbaceous layers). The shrub layer (50–60% cover, 50–120 cm tall) is dominated by *L. divaricata*, *C. avellanedae*, *P. globosum* and *B. megalanthus* along with *C. microphylla*, and *Junellia* spp. The dwarf shrub stratum (10–15% cover, 5–10 cm tall) is formed by *B. darwinii*, *G. solbrigii*, *A. seriphioides* and *H. trifoliata*. The herbaceous layer (ca. 5% cover, 5–10 cm tall) consists of perennial grasses: *N. tenuis*, *P. humilis* and *J. neaei*.

***Shrub steppe of C. microphylla and Lycium* spp. (*VU7*, Fig. 1)**

This vegetation unit covers about 60% of the soil in the east coast of Península Valdés. The plant canopy consists of two layers (shrubby and herbaceous layers). The shrubby layer (30% cover, 60–120 cm height) is dominated *C. microphylla*, *L. chilense*, and *C. avellanedae* accompanied by *Lycium gilliesianum* and *S. johnstonii*. The herbaceous layer (30% cover, 20 cm height) is dominated by *N. tenuis*, *J. neaei*, *P. humilis*, *P. napostaense*, *P. patagonica*, *N. longiglumis* and *S. barbatus*.

3.3.2 Vegetation of the Beach Ridges I–IV

***Perennial grass steppe of N. tenuis and N. longiglumis with shrubs of C. avellanedae* (*VU3*, Fig. 1)**

This vegetation unit covers about 85% of the soil at flat coast plains in Caleta Valdés and consists of three plant layers (perennial grass, dwarf shrub, and medium shrub layers). The perennial grass layer (40% cover, 20 cm tall) dominated by *N. tenuis*, *N. longiglumis*, *P. napostaense* with, *B. catharticus*, *P. ligularis* and the annual herb *P. patagonica*. The dwarf shrub layer (5% cover, 10 cm tall) consists of scattered dwarf shrubs (*B. melanopotamica*) accompanied by perennial herbs (*P. chilensis* and *H. trifoliata*). The medium shrub layer (40% cover, 30 cm tall) is dominated *C. avellanedae* along with *Lycium tenuispinosum*.

3.3.3 Vegetation of the Beach Ridges V

***Shrub steppe of S. johnstonii and L. chilense* (*VU10*, Fig. 1)**

This vegetation unit is characteristic of a narrow coastal plain at Caleta Valdés covering about 40% of the soil with two strata (shrubby and herbaceous) equally represented. The shrubby layer (20% cover, 50–100 cm height) is dominated by *S. johnstonii* and *L. chilense*. The herbaceous stratum (20% cover, 5–20 cm height) is dominated by *N. tenuis*, *J. neaei*, *P. speciosa*, *P. humilis* along with *P. ligularis* and *P. patagonica*.

4 Priority Sites for Conservation

Within the Península Valdés four priority sites for conservation (resolution scale 1:1) may be identified: Salt marshes, Uplands and Plains, The Great Endorheic Basin and Stabilized Aeolian field and Active Dunefields. Among them salt marshes deserve particular attention since they have unique and important ecological functions such as production and transport of nutrients and organic matter, and constitute specific areas for feeding, sheltering and/or nesting of a large number of marine and terrestrial organisms. In addition, inland sites of Península such as Uplands, Endorheic Basins, and Central rangelands deserve also attention since they are mostly submitted to disturbance processes triggered by grazing and water and wind erosion affecting not only plant canopy structure but also soils and ecosystem processes and services (see Chapter "Soil Degradation in Peninsula Valdes: Causes, Factors, Processes, and Assessment Methods").

4.1 Salt Marshes

The *salt marshes* are intertidal environments developed, in general, in estuarine or marine coasts, in which the slow movement of tidal water favours the accumulation of fine sediments (Fig. 1). They are colonized by halophytic herbs, grasses or low shrubs. While the salt marshes remain exposed to air most of the day, they are subject to periodic flooding product of fluctuations in the level of the adjacent water bodies, so these halophytes are tolerant both to immersion and hypersalinity (Adam 1990; Bortolus 2010). Because of their hydrological conditions and their location between the marine and terrestrial environments (see Chapter "Groundwater Resources of Península Valdés"), the salt marshes have unique features, and they are inhabited by both marine and terrestrial organisms (Mitsch and Gosselink 2000). However, they should not be considered *ecotones* (i.e. transition zone between two different ecosystems), because although they are composed of species from the surrounding environments (land or sea; Bortolus 2010) the salt marshes present an assemblage of species that characterizes and defines them.

4.1.1 Vegetation Communities of Salt Marshes

Plant community zonation is probably the most conspicuous feature characterizing salt marshes at the landscape scale (Adam 1990). Most salt marsh communities plants zonate in bands parallel to the coastline with specific species compositions (Fig. 3); usually changing with the relative elevation, the distance from the seashore, and the global position (Adam 1990). Few terrestrial plant species are able to survive in the low marsh, where tidal amplitudes and inundation frequency are high. However, as substrate elevation increases, tidal amplitude decreases and inundation

becomes less frequent. The highest marsh levels are commonly characterized by more complex plant communities with a large variety of ecological interactions going on (Adam 1990). Along the Atlantic coast of South America, the salt marshes show a particular geographic pattern (Bortolus et al. 2009; Idaszkin and Bortolus

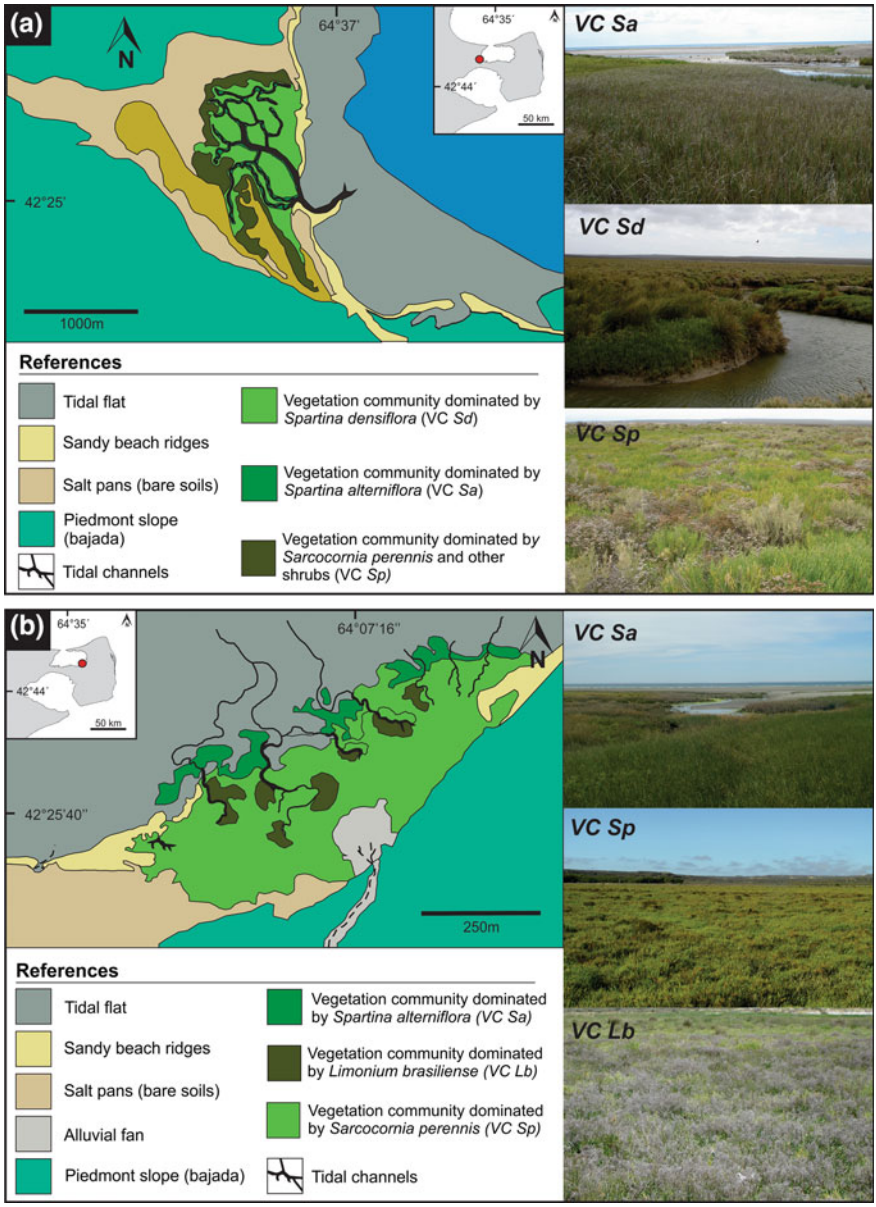

Fig. 3 Location and main vegetation communities of Riacho (**a**) and Fracasso (**b**) salt marshes

2011; Idaszkin et al. 2011). The northern salt marshes (i.e. located at the parallel 42° S or lower northern) are characterized by vegetation communities that dominated by the perennial cordgrasses *Spartina alterniflora* and *Spartina densiflora* (*Spartina*-marshes), while in the southern salt marshes (at latitudes greater than 43° S) plant communities are dominated by the succulent shrub *Sarcocornia perennis* with a rare or nil presence of *Spartina* species across the intertidal frame (*Sarcocornia*-salt marshes). In the Península Valdés region, between parallels 42° S and 43° S, these two types of salt marsh vegetation community overlap their geographic distribution. A feature shared by both vegetation communities is that *S. alterniflora*, occupies the lowest marsh level, and *S. perennis* and *S. densiflora* the highest one. While there are several salt marshes in Península Valdés, Riacho (42° 25′ S, 64° 37′ W; Fig. 3a) and Fracasso (42° 25′ S, 64° 07′ W; Fig. 3b) are the greatest salt marshes from the Península Valdés (Bortolus et al. 2009; Idaszkin et al. 2011).

In particular, Riacho is a *Spartina* marsh community, where *S. alterniflora* inhabits the low marsh and decreases its abundance towards higher marsh levels. These higher levels are commonly dominated by *S. densiflora*, accompanied by the shrubs *Limonium brasiliense*, *S. perennis* and *Atriplex vulgatissima* (Fig. 3a). On the other hand, the Fracasso salt marsh community is a *Sarcocornia*-marsh, where the presence of *S. alterniflora* has being increasing in the last decade in the low marsh. The high marsh is dominated by *S. perennis*, accompanied with *S. densiflora*, *Suaeda* spp. and *L. brasiliense* forming isolated patches in the more elevated spots (Fig. 3b).

4.1.2 Conservation Concerns

Salt marshes are widely recognized by the unique, and important ecological functions they provide, such as the high primary productivity on and the transport of nutrients and organic matter from and to the sea (Mitsch and Gosselink 2000). Currently, they are considered as one of the most productive environments in the world, and this high production is often essential for sustaining estuarine and coastal food chains (Weinstein and Kreeger 2000). Furthermore, salt marshes are critical to the maintenance of the regional integrity for both terrestrial and marine communities, because they constitute specific areas for feeding, sheltering and/or nesting of a large number of marine and terrestrial organisms (Mitsch and Gosselink 2000; Weinstein and Kreeger 2000; Adam 2002). Migratory and endemic birds, fish, mammals and invertebrates of great ecological and economic importance (e.g. mussels, clams and snails) are examples of organisms that depend on the existence and integrity of the salt marshes to ensure their survival (Bortolus 2006; Adam 2002). Both Fracasso and Riacho salt marshes are included in the RAMSAR site of Península Valdés wetlands.

4.2 Uplands and Plains

The Península Valdés region, as other areas of the extra-andean Patagonia, has been grazed by sheep (*Ovis aries*) since the beginning of the last century (Ares et al. 2003). There is evidence that sheep grazing in Patagonia have had negative effects on plant communities like the reduction in total plant cover, alteration of the spatial

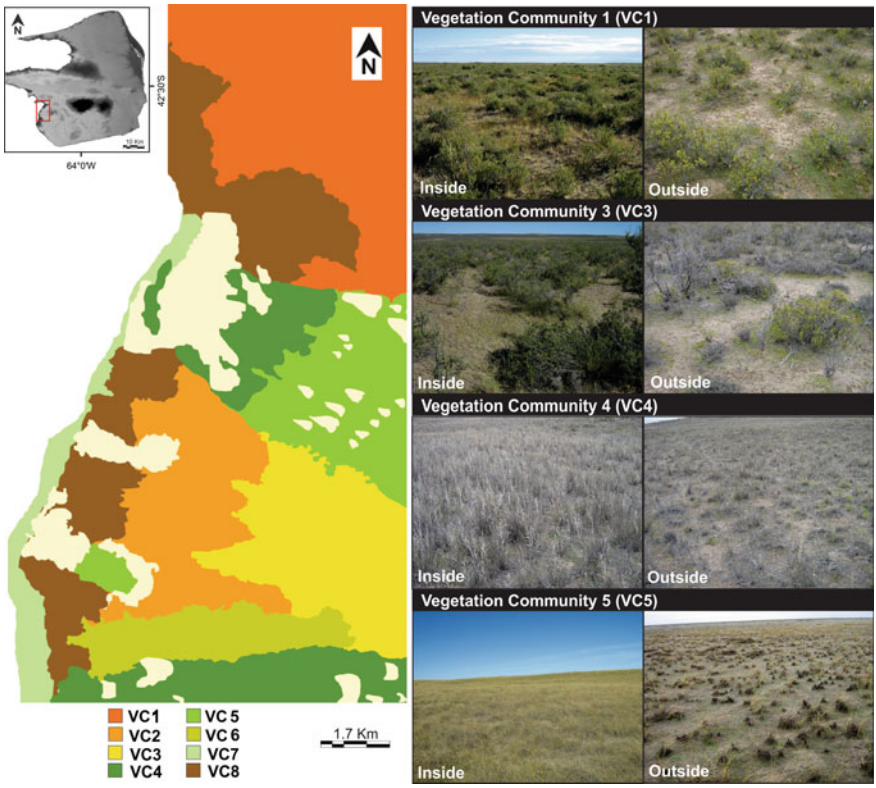

Fig. 4 Location and main vegetation communities of San Pablo de Valdés. VC1. Medium shrub steppe of *Chuquiraga avellanedae*, *Schinus johnstonii*, *Lycium ameghinoi*, *Menodora robusta* and *Acantholippia seriphioides;* VC2. Shrub-grass steppe of *Chuquiraga avellanedae*, *Nassella tenuis* and *Piptochaetium napostaense;* VC3. Tall shrub-grass steppe of *Chuquiraga erinacea* ssp. *hystrix*, *Chuquiraga avellanedae* and *Acantholippia seriphioides* with *Nassella tenuis*, *Piptochetium napostaense* and *Pappostipa speciosa;* VC4. Dwarf shrub steppe of *Hyalis argentea;* VC5. Grass steppe of *Sporobolus rigens* and *Nassella tenuis*; VC6. Grass-shrub steppe of *Sporobolus rigens*, *Nassella tenuis* and *Piptochaetium napostaense* with sparse shrub patches of *Chuquiraga erinacea* ssp. *hystrix*, *Acantholippia seriphioides*, *Mulinum spinosum* and *Baccharis divaricata;* VC7. Dwarf shrub steppe of *Hyalis argentea*, *Sporobolus rigens* and *Baccharis divaricata;* VC8. Mosaic of shrub, shrub-grass, and grass steppes. White areas are Active Dune Fields without vegetation. Photographs illustrate vegetation communities VC1, VC3, VC4 and VC5 inside San Pablo (*left*) and in adjacent sheep ranches (*right*)

structure of vegetation, soil degradation, and the reduction in the size of soil seed banks of herbivore-preferred species (Laycock 1995; Bertiller et al. 2002; Cipriotti and Aguiar 2005; Pazos and Bertiller 2008; Chartier et al. 2011). Despite the relative scarcity of specific studies, some of these impacts were also observed in the Península Valdés (Elissalde and Miravalles 1983; Blanco et al. 2008; Cheli 2009; Burgi et al. 2012). This raises important conservation concerns for these ecosystems considering the UNESCO World Heritage Site status of the area (Nabte et al. 2013).

A very important action taken for the conservation of representative terrestrial plant communities of the Península Valdés was the creation of strict reserves. This is the case of San Pablo de Valdés (henceforth San Pablo), a typical ranch dedicated to wool production that was converted into a wildlife reserve in 2005 by the local NGO "Fundación Vida Silvestre Argentina" (Fig. 4). This reserve added 7360 ha to the scarce 5% of protected lands of the arid Patagonia (Nabte et al. 2013). The immediate management actions taken were the removal of all domestic herbivores (ca. 3500 sheep), internal fences, and all structures related to grazing management.

4.2.1 Vegetation Communities of Uplands and Plains

San Pablo encloses a unique mosaic of plant communities representing the most extended vegetation units of Terrace Levels and Stabilized Aeolian field deposits in southern Península Valdés (Fig. 4) (Codesido et al. 2005). The main vegetation communities are

Medium shrub steppe dominated by the shrubs C. avellanedae, S. johnstonii, Lycium ameghinoi, Menodora robusta, and A. seriphioides **(VC1, Fig. 4)**

This community is established on Terrace Levels III. The total canopy cover ranges from 40 to 60%. The inconspicuous herbaceous layer is dominated by *N. tenuis*, *P. ligularis* and *P. lanuginosa*.

Shrub-grass steppe of C. avellanedae, N. tenuis and P. napostaense **(VC2, Fig. 4)**

This community is established on Stabilized Aeolian field deposits. The total canopy cover ranges from 45 to 60%. *C. erinacea* ssp. *hystrix* codominates the shrub layer.

Tall shrub-grass steppe of C. erinacea ssp. hystrix, C. avellanedae, and A. seriphioides with N. tenuis, P. napostaense and P. speciosa **(VC3, Fig. 4)**

This community is established on Terrace Levels and Stabilized Aeolian field deposits. The total plant cover ranges from 50 to 60%.

Dwarf shrub steppe of H. argentea **(VC4, Fig. 4)**

This community is established on undulated Active Dune Fields and Stabilized Aeolian field deposits. The total plant cover ranges from 80 to 90%, mostly represented by *H. argentea* with an incipient herbaceous layer dominated by *P. lanuginosa* and *N. tenuis*.

Grass steppe of S. rigens and N. tenuis **(VC5, Fig. 4)**

This community is established on undulated dune fields and Stabilized Aeolian field deposits. The total canopy cover ranges from 70 to 90%. *P. lanuginosa* and *P. urvilleanum* codominate the herbaceous layer. Also sparse shrub patches of *B. divaricata* are immersed in the grass matrix.

Grass-shrub steppe of S. rigens, N. tenuis and P. napostaense with sparse shrub patches of C. erinacea ssp. hystrix, A. seriphioides, M. spinosum and B. divaricata **(VC6, Fig. 4)**

This community is established on undulated dune fields and Stabilized Aeolian field deposits forming small patch mosaics with VC2 and VC5 and represents a degraded state of the grass steppe VC2.

Dwarf shrub steppe of H. argentea, S. rigens and B. divaricata **(VC7, Fig. 4)**

This community is established on coastal undulated Active Dune Fields and Stabilized Aeolian field deposits. The total plant cover ranges from 80 to 90% with presence of sparse blowouts.

Mosaic of shrub, shrub-grass and grass steppes **(VC8, Fig. 4)**

This plant community occupies heterogeneous landscapes associated with coastal Stabilized Aeolian field deposits and Small–Medium Closed Basins. It consists of a heterogeneous mosaic constituted by the plant communities described above. The conserved (San Pablo) and degraded (adjacent ranches) vegetation states of four of the above-mentioned plant communities are presented in Fig. 4. Additionally, Active Dune Fields without vegetation crossing eastwardly are distinctive components of the San Pablo landscape.

4.2.2 Conservation Concerns

San Pablo constitutes a unique opportunity in Península Valdés to describe the trajectory of plant communities under both livestock exclusion and grazing by native herbivores. A first vegetation survey carried out at the time of the reserve creation indicated that all these communities showed clear signs of degradation by livestock grazing (Codesido et al. 2005). Burgi et al. (2012) compared the structure and composition of plant communities VC1, VC3, VC4 and VC5 between San Pablo and adjacent ranches with sheep grazing production finding higher total plant cover, higher perennial-grass cover, and higher diversity of perennial grasses in San Pablo than in the adjacent grazed ranches (Fig. 4). Remarkably, all these changes were simultaneous with a steady increase of the guanaco density inside San Pablo (Marino et al. 2016). These results provide evidence on the need to conserve and protect terrestrial plant communities at relevant spatial scales serving as a basis for integrated management plans oriented to achieve ecological and economic

sustainability under the long-standing scenarios of land degradation in Patagonia (Nabte et al. 2013; Marino et al. 2016).

4.3 The Great Endorheic Basin

A pilot area of ca. 400 km^2 in the centre of Península Valdés (see site location in Fig. 5) was selected where soil erosion by water is prevalent (Fig. 5). The geomorphology of the area comprises both the Uplands and Plains as the Great Endorheic Basin Systems. It is conspicuous that the presence of accelerated erosion indicators such as pedestals, rills and bare soil on the Terrace Levels and gullies on slopes of the piedmont pediments and bajadas. On the east part, there is a large dried playa lake called Gran Salitral and central to the area there is a burnt area due to a fire occurred in February 2004. Extensive, continuous sheep grazing for wool production is the main land use of these rangelands. Six vegetation communities are dominant in the area.

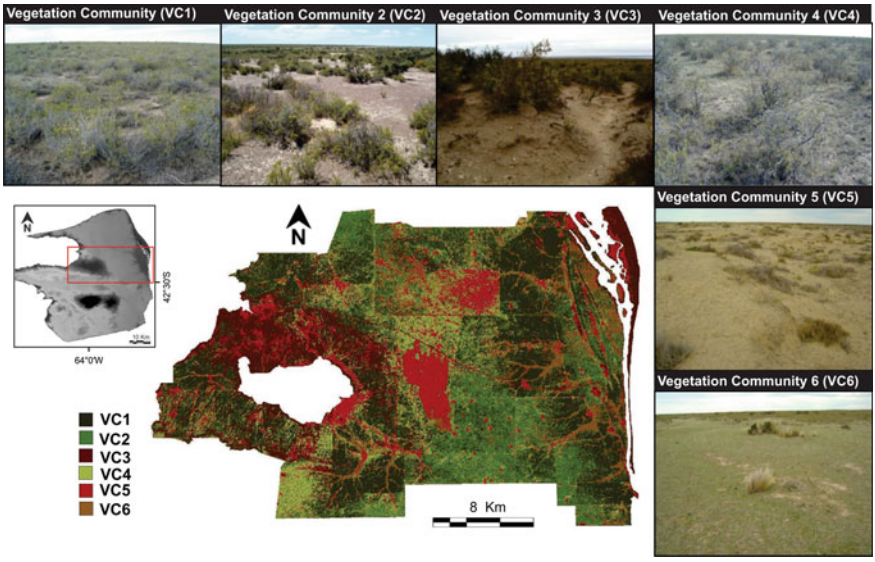

Fig. 5 Location and main vegetation communities of the Central Rangelands: VC1. Shrub-grass steppe of *Chuquiraga avellanedae*, *Condalia microphylla*, and *Nassella tenuis*, VC2. Shrub steppe of *Chuquiraga avellanedae* with desert pavement, VC3. Shrub-grass steppe of *Chuquiraga avellanedae*, *C. hystrix* and *Jarava and Pappostipa* species, VC4. Shrub-grass steppe of *Chuquiraga avellanedae*, *C. hystrix*, *Prosopidastrum globosum* and *Pappostipa* and *Jarava* species, VC5. Sandy grassland of *Nassella tenuis* and *Piptochaetium napostaense*, VC6. Grassland of *Nassella tenuis* and *Piptochaetium napostaense* with shrubs of *Chuquiraga avellanedae*

4.3.1 Vegetation Communities of the Great Endorheic Basin

***Shrub-grass steppe of C. avellanedae, C. microphylla, and N. tenuis* (*VC1*, Fig. 5)**

This community occurs along with alluvial bajadas dominated by Calciargid soils (see Chapter "Soil–Geomorphology Relationships and Pedogenic Processes in Península Valdés"). Vegetation cover is about 60–80%, where *C. avellanedae* and *C. microphylla* accounts for up to 50–60% of plant cover and occur along with *B. megalanthus*, *L. chilense* and *P. globosum*. Dominant grasses, *N. tenuis*, *J. neaei*, *P. speciosa and P. napostaense*, cover around 10–20% of the soil.

***Shrub steppe of C. avellanedae with desert pavement* (*VC2*, Fig. 5)**

This community forms extensive shrublands on Terrace Levels. It is dominated by the shrub species *C. avellanedae*, surrounded by *desert pavements*. Dominant soils are Natrargids (see Chapter "Soil–Geomorphology Relationships and Pedogenic Processes in Península Valdés"). Vegetation cover ranges from 30 to over 40%; shrub cover is around 25–35%, while grasses cover 5–10%. *S. johnstonii* and *P. globosum* are secondary shrub species in these communities. Grasses such as *N. tenuis*, *P. napostaense*, and less frequently, *P. humilis* and *P. ligularis may* occur scattered in the bare soil matrix.

***Shrub-grass steppe of C. avellanedae, C. erinacea ssp. hystrix and Jarava and Pappostipa species (VC3*, Fig. 5)**

This community occurs along the Piedmont pediments, characterized by Torriorthents soils and the presence of gullies and erosion escarpments of sandstone of the Puerto Madryn Formation (see Chapter "Geology of Península Valdés"). Vegetation cover ranges from 60 to over 70%; shrub cover is around 45–55%, while grasses cover 10–20%. The most conspicuous shrubs are *C. avellanedae* and *C. erinacea* ssp. *hystrix*, which occur with *L. chilense and S. johnstonii*. Grasses such as *N. tenuis*, *J. neaei*, *P. speciosa* accompanied by, less frequently, *P. humilis* and *N. longiglumis*, make up the herbaceous stratum.

***Shrub-grass steppe of C. avellanedae, C. erinacea ssp. hystrix, P. globosum and Pappostipa and Jarava species* (*VC4*, Fig. 5)**

This community occurs along the Terrace Levels, dominated by Haplocalcid soils and with a vegetation cover from 65 to over 85%. Shrub vegetation cover is about 50–60%, where *C. avellanedae*, *Chuquiraga hystrix*, and *P. globosum* account for up to 50% of plant cover and occurs along with grasses (20–30%) such as *N. tenuis*, *J. neaei*, and *P. speciosa* accompanied by, less frequently, *P. ligularis*.

***Sandy grassland of N. tenuis and P. napostaense* (*VC5*, Fig. 5).**

This community forms extensive grasslands on thin sandsheets on Terrace Levels with Haplocalcid soils. Vegetation cover ranges from 40 to over 50%; grasses (20–30%) such as *N. tenuis*, *P. napostaense*, *P. speciosa*, *and N. longiglumis* make

up the herbaceous stratum. Shrub cover is around 15–25%. The most conspicuous shrub is *C. avellanedae*, which occurs with *P. globosum* and other shrubs such as *S. johnstonii* and *L. chilense*.

***Grassland of N. tenuis and P. napostaense with shrubs of C. avellanedae* (*VC6*, Fig. 5)**

This community principally occurs on sandy sediment that filled the Holocene stream valleys that dissected the Coastal Piedmont Pediments with Haplocalcid soils. Vegetation cover is about 40–60%, where *N. tenuis* and *P. napostaense* accounts for up to 40–50% of grass cover and occur along with *P. speciosa* and *Nasella longiglumis*. Some shrubs (5–10%) *of C. avellanedae* and less frequently, *P. globosum* are present.

4.4 Vegetation Communities of Stabilized Aeolian Field and Active Dunefields

A pilot area is located in grazed lands in the southern portion of the Península Valdés dunefields (see site location in Fig. 6). The source of sediment for the aeolian landforms are the western sandy beaches of Golfo Nuevo where a continued supply of loose, sand-sized sediment is available to be transported inland by the prevailing

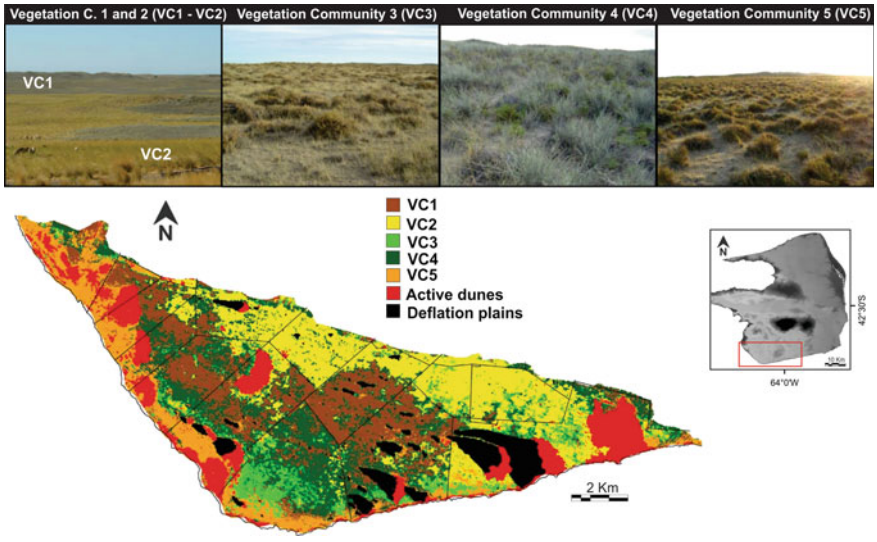

Fig. 6 Location and main vegetation communities of Dunefields: VC1. Grassland of *Sporobolus rigens* and *Aristida spegazzinii*, VC2. Subshrub steppe of *Hyalis argentea*, VC3. Shrub-grass steppe of *Brachyclados megalanthus*, *Mulinum spinosum* and *Nassella tenuis*, VC4. Grass-shrub steppe of *Nassella tenuis* and *Mulinum spinosum*. VC5. Shrub-grass steppe of *Mulinum spinosum* and *Hyalis argentea*

westerly winds (see Chapter "Late Cenozoic Landforms and Landscape Evolution of Península Valdés"). General features in the topography of dunefields are Stabilized aeolian field (relict aeolian landforms) and mega-patches of Active sand dunes with deflation plains. Relict aeolian landforms would include sand sheets and longitudinal dunes, which nowadays are mostly stabilized by psammophile plant species. The presence of blowouts on these areas is evidence of current erosive processes in the dunefield. Five vegetation communities dominate the area.

4.4.1 Vegetation Communities of Stabilized Aeolian Field and Active Dunefields

***Dwarf shrub steppe of H. argentea* (*VC1*, Fig. 6)**

Vegetation cover is about 90%; the dominant plant is *H. argentea* forming big dense patches. Other grass species associated are *P. urvilleanum*, *P. lanuginosa* and *S. rigens*.

***Grassland of S. rigens and Aristida spegazzinii* (*VC2*, Fig. 6)**

This grassland has around 75% of vegetation cover. *S. rigens* and *A. spegazzinii* account for up to 60–70% of cover and occur along with *P. urvilleanum*, *P. lanuginosa*, *N. tenuis* and *P. napostaense*. *Maihueniopsis darwinii* and *Marrubium vulgare* occurs on degraded areas.

***Shrub-grass steppe of B. megalanthus, M. spinosum and N. tenuis* (*VC3*, Fig. 6)**

This community is dominated by the shrub species *B. megalanthus* and *M. spinosum*, with *N. tenuis* (perennial grass) dominating the herbaceous stratum. The vegetation cover is about 65%.

***Shrub-grass steppe of M. spinosum and H. argentea* (*VC4*, Fig. 6)**

This community is dominated by the subshrubs species *M. spinosum* and *H. argentea*, with herbaceous secondary species such as *S. rigens*, *P. urvilleanum*, *P. lanuginosa* and *N. tenuis*. Some clumps of *B. divaricata* are found. Vegetation cover in this community is about 65%.

***Grass-shrub steppe of N. tenuis and M. spinosum* (*VC5*, Fig. 6)**

This community (with around 70% plant cover) is dominated by the grass species *N. tenuis* and the shrub *M. spinosum*. Grasses such as *S. rigens*, *P. urvilleanum* and *P. lanuginosa* are codominant species.

5 Perspectives and Future Work

This chapter provides a synthesis of the state of knowledge on the vegetation of Península Valdés and identifies priority sites for conservation programs. Future work should be aimed to intensify studies on the vegetation dynamics of these priority sites and also to recognize new sites which could be sensitive to degradation due to human activities.

Acknowledgements We are grateful to the Project of Ecology and Regional Development of Arid and Semiarid Regions (OEA-CONICET-INTA) and to the Centro Nacional Patagónico (CENPAT-CONICET) for supporting field research for the description of the Vegetation Units and to the Comisión Nacional de Actividades Espaciales (CONAE) from Argentina that supplied the satellite images. We also thank Fundación Vida Silvestre Argentina and landowners for granting the access to San Pablo de Valdés and the adjacent ranches, respectively. GEP acknowledges Victoria Rodríguez and Andrea Marino for important input in the San Pablo de Valdés work. GEP was partially supported by PIP 11220120100369CO. Research permissions were granted by Secretaría de Turismo y Áreas Naturales Protegidas and Dirección de Fauna y Flora Silvestre de Chubut. We also thank G. Bernardelo and Marta Collantes for their helpful comments in the revision of this chapter.

Glossary

Adaptation	The process of adjustment of an individual organism to environmental stress
Ecotone	Transitional zone between adjacent plant communities or biomes
Floristic composition	A list of plant species of a given area, habitat, or association
Floristic element	In phytogeography, a convenient term for any group of plants sharing a common feature of importance
Halophytic	Plant tolerating saline conditions
Life form	The characteristic structural traits of a plant species
Patchy	Contagious distribution
Perennial	Plants that persist for several years with a growth period each year
Physiognomic	Appearance of a plant community or vegetation
Phytogeographical Provinces	Geographical divisions characterized by floristic composition
Stratum	Horizontal layer of vegetation

Appendix: Floristic List

Family	Species and authors
Ephedraceae	*Ephedra ochreata* Miers
Juncaginaceae	*Triglochin concinna* Burtt Davy
Poaceae	*Amelichloa ambigua* (Speg.) Arriaga and Barkworth
	Aristida spegazzinii Arechav.
	Avena sativa L.
	Bromus catharticus Vahl
	Bromus unioloides Humboldt, Bonpland et Kunth
	Distichlis scoparia (Kunth) Arechav.
	Distichlis spicata L.
	Eremium erianthum (Phil.) Seberg and Lindle-Laursen
	Hordeum comosum J. Presl
	Hordeum euclaston Steud.
	Hordeum murinum L.
	Jarava neaei (*Nees ex Steud.*) Peñalillo
	Koeleria mendocinensis (Hauman) C.E. Calderón and Nicora
	Nassella longiglumis (Phil.) Barkworth
	Nassella tenuis (Phil.) Barkworth
	Panicum urvilleanum Kunth
	Pappostipa chysophylla (E. Desv.) Romasch.
	Pappostipa humilis (Cav.) Romasch.
	Pappostipa speciosa (Trin. and Rupr.) Romasch.
	Piptochaetium napostaense (Speg.) Hack.
	Poa lanuginosa Poir.
	Poa ligularis Nees ex Steud.
	Polipogon monspeliensis (L.) Desf.
	Schismus barbatus (L.) Thell.
	Spartina alterniflora Loisel
	Spartina densiflora Brongn.
	Sporobolus rigens (Trin.) E. Desv.
	Vulpia myuros (L.) C.C. Gmel. *megalura* Phil.
Amaryllidaceae	*Rhodophiala mendocina* (Phil.) Ravenna
Oleaceae	*Menodora robusta* (Benth.) A. Gray
Schoepfiaceae	*Arjona tuberosa* Cav.
Polygonaceae	*Polygonum brasiliense* K. Koch
Chenopodiaceae	*Atriplex lampa* (Moq.) D. Dietrich
	Atriplex sagittifolia Speg.
	Dysphania ambrosioides (L.) Mosyakin and Clements
	Sarcocornia perennis (Mill.) A.J. Scott.
	Suaeda argentinensis A. Soriano

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Family	Species and authors
	Suaeda divaricata Moq.
Nictaginaceae	*Bougainvillea spinosa* (Cav.) Heimerl
Aizoaceae	*Mesembryanthemum crystallinum* L.
Caryophyllaceae	*Cardionema ramosissima* (Weinm.) A. Nelson and J.F. Macbr.
	Cerastium arvense L.
	Cerastium glomeratum Thuill.
	Cerastium junceum Möschl
	Heniaria cinerea DC.
	Paronychia chilensis DC.
Capparaceae	*Capparis atamisquea* Kuntze
Rosaceae	*Tetraglochin caespitosum* Phil.
	Tetraglochin ameghinoi (Speg.) Speg.
Fabaceae	*Adesmia candida* Hook. f.
	Adesmia af. acuta Burkart
	Anarthrophyllum rigidum (Gillies ex Hook. and Arn.) Hieron.
	Hoffmannseggia trifoliata Cav.
	Prosopidastrum globosum (Gillies ex Hook. and Arn.) Burkart
	Prosopis alpataco Phil.
	Prosopis denudans Benth.
	Vicia pampicola Burkart *burkartii* Giangualani
Geraniaceae	*Erodium cicutarium* (L.) L'Hér. ex Aiton
Zygophyllaceae	*Larrea divaricata* Cav.
	Larrea nitida Cav.
Euphorbiaceae	*Euphorbia portulacoides* L.
	Euphorbia serpens Kunth
Anacardiaceae	*Schinus johnstonii* F.A. Barkley
Rhamnaceae	*Condalia microphylla* Cav.
	Discaria americana Gilles and Hook.
Malvaceae	*Malvela leprosa* (Ortega) Krapov.
Frankeniaceae	*Frankenia patagonica* Speg.
	Frankenia pulverulenta L.
Loasaceae	*Loasa bergii* Hieron.
Cactaceae	*Maihuenia patagonica* (Phil.) Britton and Rose
	Maihueniopsis darwinii (Hensl.) Ritter
Onagraceae	*Camissonia dentata* (Cav.) Reiche
	Oenothera versicolor Lehm
	Oenothera stricta Ledeb. ex Link *altissima* W. Dietr.
Apiaceae	*Bowlesia incana* Ruiz and Pav.
	Daucus pusillus Michx.
	Eryngium chubutense Neger ex Dusén
	Mulinum spinosum (Cav.) Pers.
Plumbaginaceae	*Limonium brasiliense* (Boiss.) Kuntze

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Family	Species and authors
Apocyanceae	*Phillibertia candolleana* (Hook. and Arn.) Goyder
Convolvulaceae	*Dichondra microcalyx* (Haller f.) Fabris
Polemoniaceae	*Gilia crassifolia* Benth.
Boraginaceae	*Amsinckia calycina* (Moris) Chater
	Lappula redowskii (Hornem.) Greene
	Pectocarya linearis (Ruiz and Pav.) D.C.
Verbenaceae	*Acantholippia seriphioides* (A Gray) Moldenke
	Glandularia aurantiaca (Speg.)Botta *aurantiaca*
	Mulguraea ligustrina (Lag.) N. O'Leary and P. Peralta var. *lorentzii* (Niederl. ex Hieron.) N. O'Leary and P. Peralta
Lamiaceae	*Marrubium vulgare* L.
Solanaceae	*Lycium ameghinoi* Speg.
	Lycium chilense Miers ex Bertero
	Lycium gilliesianum Miers
	Lycium tenuispinosum Miers
Plantaginaceae	*Plantago myosuros* Lam.
	Plantago patagonica Jacq.
Rubiaceae	*Galium richardianum* (Gilles ex Hook. and Arn.) Endl.ex Walp
Calyceraceae	*Boopis anthemoides* Juss.
Asteraceae	*Baccharis crispa* Spreng.
	Baccharis darwinii Hook. et Arn.
	Baccharis divaricata Hauman
	Baccharis gilliesii A. Gray
	Baccharis melanopotamica Speg.
	Baccharis spartioides (Hook. et Arn. Ex DC.) J. Remy
	Baccharis tenella Hook. et Arn.
	Baccharis triangularis Hauman
	Brachyclados megalanthus Speg.
	Chuquiraga aurea Skottsb.
	Chuquiraga avellanedae Lorentz
	Chuquiraga erinacea D.Don ssp. *erinacea*
	Chuquiraga erinacea D.Don ssp. *hystrix*(Don) C. Ezcurra
	Cyclolepis genistoides D.Don
	Gamochaeta chamissonis (DC.) Cabrera
	Grindelia chiloensis (Cornel.) Cabrera
	Gutierrezia solbrigii Cabrera
	Hyalis argentea D. Don ex Hook. and Arn. var. *latisquama* Cabrera
	Hypochaeris radicata L.
	Hysterionica jasionoides Willd.

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Family	Species and authors
	Nassauvia fuegiana (Speg.)Cabrera
	Nassauvia ulicina (Hook. f.) Macloskie
	Perezia recurvata (Vahl) Less.ssp. *recurvata*
	Noticastrum sericeum (Less.) Less. ex Phil.
	Senecio chrysocomoides Hook. et Arn.
	Senecio filaginoides DC.
	Sonchus asper (L.) Hill.

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