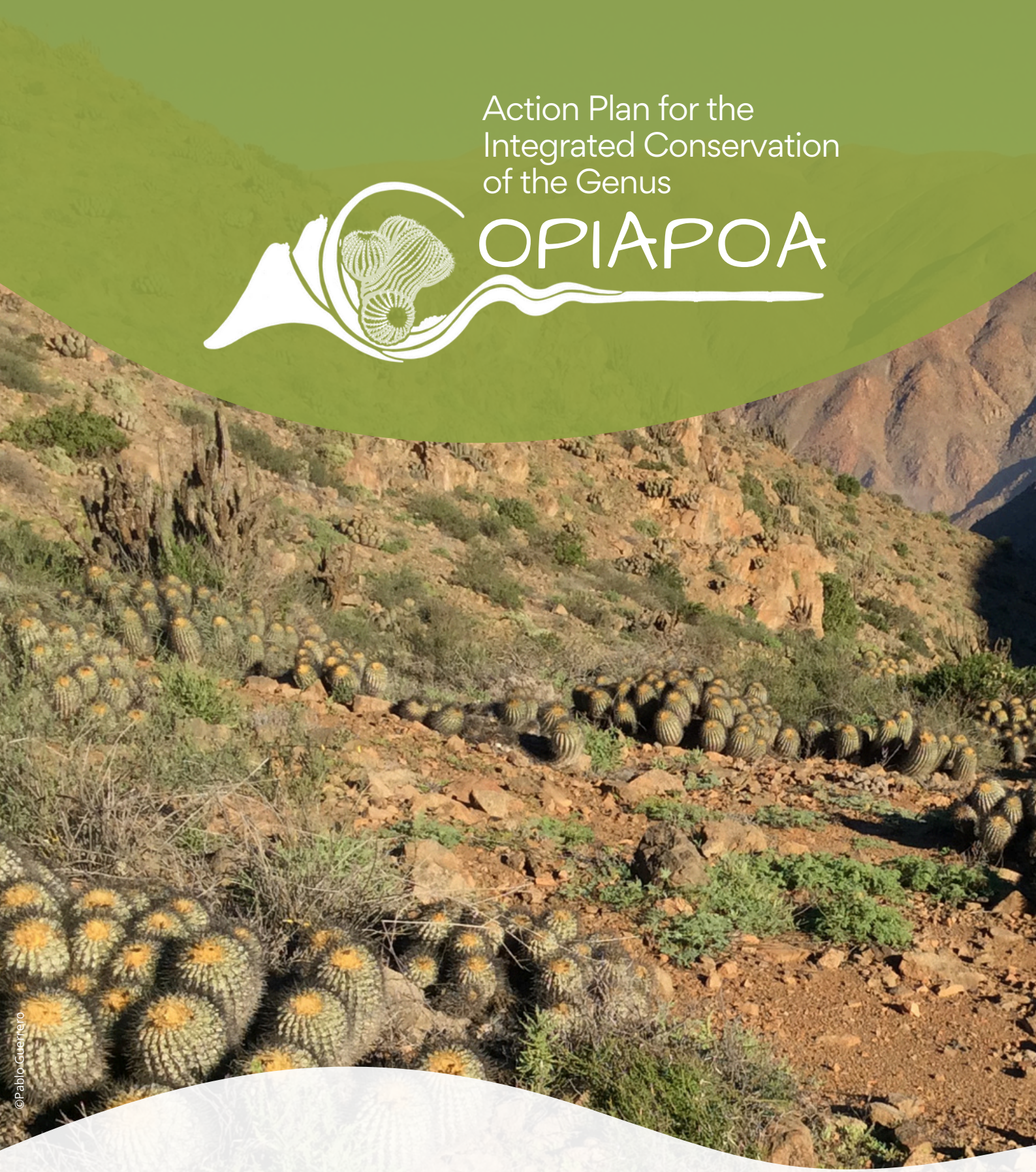
# Action Plan for the Integrated Conservation of the Genus OPIAPOA



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**Convenors:** Ministerio de Medio Ambiente de Chile, the International Union for the Conservation of Nature (IUCN) Species Survival Commission's (SSC) Cactus and Succulent Plants Specialist Group (CSSG), and Chester Zoo.

**Organizing Committee:** Ministerio de Medio Ambiente de Chile; Corporación Nacional Forestal (CONAF); Instituto Forestal (INFOR) and Instituto de Investigaciones Agropecuarias (INIA INTIHUASI) of the Ministerio de Agricultura de Chile; Universidad de Concepción; Instituto de Ecología y Biodiversidad (IEB); the IUCN SSC CSSG; Chester Zoo, and; the IUCN SSC Conservation Planning Specialist Group (CPSG) / Centre for Species Survival Brazil (CPSG | CSS Brazil)

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**How to cite this document:**

Goettsch B., Bamford P., Guerrero P. C., Rojas L., Cordero-Schmidt E., Rocha F. L., Carabantes J. A., Cattabriga, A., Figueroa S., Gazmuri M. C., Grimberg M., Hernández J. A., Martínez R., Parra Valdivia A., Peña C. M., Pillet M., Rojas Salinas L. A. & Sandoval A. C. (2025). Plan de Acción para la Conservación Integrada del Género Copiapoa. Chile. 66 pp.

# Action Plan for the Integrated Conservation of the Genus

Planning Workshop for the Integrated Conservation of the Genus

OPIAPOA

Chile

ONLINE WORKSHOP

**Agosto - Octubre, 2022**

# FOREWORD

**Dr Bárbara Goettsch**
Co-Chair IUCN SSC Cactus and
Succulent Plants Specialist Group

*On behalf of the IUCN SSC Cactus and Succulent Plants Specialist Group, I would like to express my deepest thanks to all those who contributed their time and knowledge to the development of the Plan. They will also be key to its implementation. I am sure that the Plan for the Integrated Conservation of the Genus Copiapoa will serve as an example for the development of many other plans that will benefit our much-loved cacti.*

*Working in the field of biodiversity conservation is an increasingly challenging task, that often feels like swimming against the tide. The issues that we try to address are monumental, and sometimes seem insuperable. At times it feels as if our work is a mere act of faith.*

*Efforts such as the development of the Plan for the Integrated Conservation of the Genus Copiapoa demonstrate that, as challenging as conservation can be, the unattainable can be possible. Partnerships and collaboration are essential, and the Plan is proof of it.*

*The development of the Plan was an intense undertaking that, thanks to the dedication of the planning workshop's organisers, facilitators, and participants, has been successful. It is an ambitious conservation plan, but without it, the long-term survival of this wonderful genus of cacti would not be guaranteed. I am excited to think about the implementation work and the challenges and lessons that we will face in the process.*

**Charif Tala**

Department of Species Conservation, Natural Resources and Biodiversity Division, Ministerio del Medio Ambiente

*Copiapoa is a fascinating genus of cacti, endemic to Chile, which has captured the interest of countless people dedicated to its research, conservation, and contemplation, but also of others who, due to unregulated collecting, have become a threat to their survival. This factor, together with others, has resulted in the fact that today more than 90% of Copiapoa species are classified as threatened.*

*The Ministry of the Environment is responsible for proposing policies and formulating plans that establish basic criteria and preventative measures to support the recovery of native flora. This framework administers the national procedure for assessing the state of conservation, and coordinates the creation of species recovery, conservation, and management plans (RECOGE Plans). Both instruments are pillars for the management of native biodiversity.*

*In this context, the proposal formulated in the framework of the Planning Workshop for the Integrated Conservation of the Genus Copiapoa, convened by the International Union for the Conservation of Nature's (IUCN) Cactus and Succulent Plants Specialist Group (CSSG) and Chester Zoo, constitutes a valuable contribution and a step forward for the conservation of this Chilean endemic genus.*

*Through this workshop, which was attended by a large number of national and international specialists, we explored the threats that affect these species throughout their range. These anthropogenic threats need to be analysed from a variety of perspectives, in order to be effectively addressed.*

*A tremendously valuable point of this joint and collaborative work, involving stakeholders from the public and private sectors, is the commitment between institutions to work toward the conservation of these species and their habitat, so that the results of this workshop may be the basis for the preparation of a Chilean national plan, that will become national public policy, under the format of a future RECOGE Plan. The challenge to move in this direction has now been launched.*

# EXECUTIVE SUMMARY

The cactus genus *Copiapoa* is endemic to northern Chile. Over half of its 32 species and seven subspecies are threatened [IUCN Red List of Threatened Species (2024): 14 spp. Critically Endangered (CR), 15 spp. Endangered (EN); 6 spp. Vulnerable (VU); 4 spp. Least Concern (LC)], and many only exist within highly limited geographic ranges that do not overlap with protected areas. *Copiapoa* cacti face a number of direct threats, including illegal collection of wild specimens for trade, construction of mining and urban infrastructure and of associated services (transportation routes; water and electricity supply), offroad motorsports, and grazing from free-ranging livestock. Further to these immediate threats, it is likely that the impacts of climate change in coastal areas of the Atacama Desert will alter the very narrow environmental parameters within which these species are able to survive, putting them at even greater risk of extinction.

This document is the product of a virtual conservation planning workshop that took place between August and October 2022. The workshop was convened by Chile's Ministry of the Environment, The IUCN Species Survival Commission's (SSC) Cactus and Succulent Plants Specialist Group (CSSG), Chester Zoo, and the IUCN SSC Conservation Planning Specialist Group / Centre for Species Survival Brazil (CPSG / CSS Brazil). It brought together stakeholders from Chile, Mexico, Europe and the U.S.A, including researchers, government bodies, NGOs, botanical gardens and specialist nurseries.

The programme of the workshop, which was designed and facilitated by CPSG / CSS Brazil, included introductory presentations on the current conservation status of *Copiapoa* cacti, a rigorous analysis of threats and reassessment for the IUCN Red List. The participants worked together to define the vision and scope of the Plan, and to establish goals, indicators of success, objectives, strategy lines, and actions. A Working Group has been established to coordinate implementation of the plan and to oversee its monitoring and evaluation, with agreed mechanisms and timeframes for reporting. The Working Group will also adapt the Plan to the Chilean national conservation-planning framework (RECOGE).

The Plan has a projected lifespan of eight years. We fully expect the focal species and their habitats to require further conservation efforts beyond this timeframe, and our hope is that the Plan will be reviewed and renewed when that moment arrives. In the intervening time, we will work to establish case studies of robust and holistic conservation management that will inspire and inform further action for the conservation of cacti in Chile and beyond.

# Adriana Hoffmann Jacoby

1940 - 2022

This document is dedicated to the memory of Adriana Hoffmann, biologist, botanist and environmentalist who was fundamental in the study of Chilean cacti.

## Adriana Hoffmann Jacoby

1940 – 2022

Adriana Hoffmann is an icon for the protection of the environment in Chile. Recognized both for her contributions to science and for her activism, her name will always be linked to the study and dissemination of Chilean flora and its conservation.

She was the author of the first field guide on Chilean flora (“Flora Silvestre de Chile: Zona central”, 1978), and of “Cactáceas en la Flora Silvestre de Chile” (1989). In addition to her botanical guides, she also published works that highlighted the protection of the environment, and the native ecosystems of Chile, among them, “De Cómo Margarita Flores puede Cuidar su Salud y Ayudar a Salvar el Planeta” (1990), and “La Tragedia del Bosque Chileno” (1998).

In parallel to her outreach efforts through the written word, Adriana also worked tirelessly for the protection of nature through organizations such as Agrupación de Defensores del Bosque Nativo and Fundación Lahuén. From March 2000 to October 2001, she held the position of Director of the Comisión Nacional del Medio Ambiente. During this period, improvements were implemented in the Environmental Impact Assessment System, the creation of the Sendero de Chile began, and work was undertaken to improve air quality in Santiago, and for the implementation of environmental education programs.

Highlights of her scientific achievements include the identification and description of more than 100 species of cacti.

In 1997, Hoffmann was recognized by the United Nations as being amongst the 25 most outstanding environmentalists of the decade. In 2003 she received the Luis Oyarzún Award from the Universidad Austral de Chile.

In 2015, recognizing Adriana's considerable influence in promoting environmental awareness and protection, Chile's Ministry of the Environment created the Adriana Hoffmann Environmental Training Academy. This was established to meet growing public demand for environmental education and education for sustainable development, to update knowledge of environmental issues, and regulatory and legal processes amongst public sector professionals, and to train workers from the public and private sectors in environmental matters relevant to their respective competencies.

We add our voice to these recognitions by dedicating this workshop to the memory of Adriana Hoffmann. Like her, we will dedicate all our efforts, enthusiasm and dedication to the conservation of all species of the genus *Copiapoa* and, like her, we say that “Nature has given us love”.

# CONTENTS



# ABBREVIATIONS AND ACRONYMS

**CEAZA** – Centre for Advanced Research in Arid Areas
**CONAF** – National Forestry Corporation
**CONAMA** – National Environment Commission
**SSC** – IUCN Species Survival Commission
**CSS Brazil** – IUCN SSC Center for Species Survival Brazil
**CSSG** – IUCN SSC Cactus and Succulent Plants Specialist Group
**CPSG** – IUCN SSC Conservation Planning Specialist Group
**EAE** – Strategic Environmental Assessment
**WG** – *Copiapoa* Action Plan Working Group
**IEB** – Ecology and Biodiversity Institute
**INFOR** – Forestry Institute
**INIA** – Institute of Agricultural Research
**Instituto Milenio BASE** – Millenium Institute of Biodiversity of Antarctic and Subantarctic Ecosystems
**IPT** – Territorial Planning Tools
**MINAGRI** – Ministry of Agriculture
**MNHN** – National Museum of Natural History
**MMA** – Ministry of the Environment
**MOP** – Ministry of Public Works
**Planes RECOGE** – Plans for the Recovery, Conservation and Management of Species
**SAG** – Agriculture and Livestock Service
**SEA** – Environmental Assessment Service
**SEIA** – Environmental Impact Assessment System
**SERNAPESCA** – National Fisheries and Agriculture Service
**SNASPE**– National System of Protected Wild Areas of the State
**SUBPESCA** – Fisheries Undersecretary
**IUCN** – International Union for the Conservation of Nature

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# ABOUT THE WORKSHOP

# WORKSHOP PROCESS

The process for this workshop was designed and facilitated by:

**The IUCN SSC Conservation Planning Specialist Group** (IUCN SSC CPSG) has been working for 40 years with wildlife agencies, conservation organisations, zoos and similar entities to develop strategic conservation plans for individual species, protected areas and conservation organizations.

**The Centre for Species Survival Brazil** (CSS Brazil) is a three-way partnership among the SSC Chair's Office, the SSC Conservation Planning Specialist Group (CPSG) and Parque das Aves. CSS Brazil combines the experience and resources of the three co-founders to improve the capacity of the IUCN Species Survival Commission to Assess, Plan, Act and influence policies for the survival of species in Brazil, and throughout South America.

The workshop followed the IUCN SSC CPSG Principles & Steps for Species Conservation Planning. These principles are: plan to act, promote inclusive participation, use sound science, ensure good design and neutral facilitation, reach decisions through consensus, generate and share products quickly, and adapt to changing circumstances. The design tools, combined with knowledge-based facilitation skills, can be applied to a wide variety of conservation planning needs. This planning process can be applied to any taxon; consequently, the number of stages and planning terminology have been kept as simple as possible. This is to emphasize that good planning is the first and most essential stage in supporting species conservation, but it is simply a process and not an end in itself.

## SPECIES RECOVERY, CONSERVATION AND MANAGEMENT PLANS (PLANES DE RECUPERACIÓN, CONSERVACIÓN Y GESTIÓN DE ESPECIES - PLANES RECOGE)

The Chilean Ministry for the Environment's Species Recovery, Conservation and Management (RECOGE) plans have been conceived as a legal tool for improving the conservation status of native fauna, flora and fungi species, both within and outside of protected areas.

The creation of these plans considers not only action-planning, but also implementation. To this end, they include the participation of a wide range of public institutions with competency in conservation, and seek to improve coordination between them, the private sector, and civil society. They have the flexibility to allow for the development and implementation of single or multi-species plans. These plans can be implemented throughout the distribution range of the species, or only in a part of it.

In Chile, public agencies have extensive experience in preparing conservation plans. Among the institutions that have written the history of Chilean conservation are the National Forestry Corporation (CONAF), the National Environmental Commission (CONAMA), a forerunner of the current Ministry for the Environment (MMA), the Agriculture and Livestock Service (SAG) and the Subsecretary of Fisheries (SUBPESCA). Many of the RECOGE plans have been built on the basis of experience and studies undertaken over many years by these institutions. In this sense, the Planning Committee's efforts to strengthen inter-institutional collaboration have been fundamental in bringing these institutions together.

The Planning Committee has the role of advising and supporting the Ministry in the creation of the plans, as well as supervising their implementation. It was created by Supreme Decree No. 1/2014, through which the Regulations for the Preparation of RECOGE plans were approved. That document specifies the objectives, structure and content of the plans, establishes the procedure for preparing them, and defines the Planning Committee itself.

This committee is made up of the Ministry of the Environment (MMA), which chairs it; the Subsecretary of Fisheries and Aquaculture (SUBPESCA), the National Fisheries and Aquaculture Service (SERNAPESCA), the Agriculture and Livestock Service (SAG), the National Forestry Corporation (CONAF), the National Museum of Natural History (MNHN) and three professionals from non-profit organizations chosen through a competition application process. The Committee's purpose is to advise and support the creation of the plans and to supervise their implementation.

A fundamental task of the Planning Committee is to prioritize the species that will be the subject of a plan, and to define the members of a planning group made up of representatives of public bodies, professionals, researchers and academics, the local community and people from civil society with an interest in conservation. Regional and local stakeholders are sought to systematize the available information on the species and threats. Starting from this background, and using a standardized methodology, the preparation group prepares the written document, containing the action plan.

This action plan sets out specific actions for working toward the objectives that have been established by the planning group. These activities are grouped according to each stated objective, with associated deadlines for their implementation and monitoring indicators to verify the effectiveness of the actions.

This final report of the Planning Workshop for the Integrated Conservation of the Genus *Copiapoa*, constitutes an effort to systematize the information available for the 32 species and seven subspecies of this genus, allowing for the preparation and implementation of a Recovery, Conservation and Species Management plan for these species.

# COMPONENTS OF THE PROCESS

## INSTRUCTIONS

At the beginning of each of the activities, a brief presentation was made explaining the specific concepts to be worked on (Vision, Challenges/Threats, Objectives, Actions, Prioritization of Actions). Examples were given, and the working group approach was explained.

## PLENARIES

These were whole group discussion phases, in which the group reflected more deeply on what it had been building. Whoever wished to speak was invited to request the floor and have their turn. In the plenary session, the contributions made by the participants were taken into account, discussed and validated.

## ASYNCHRONOUS WORKING

The participants were asked to work on some tasks (review of threats, drafting proposals for goals, etc.) individually, outside of the virtual meeting times. This allowed for a more efficient use of time during the workshop, thus freeing up more time for discussion among participants.

## GROUP WORK

Based on the threat situation model and its impacts on *Copiapoa*, three thematic groups were created. The participants were separated into working groups according to their affinity and experience with each topic.

### 1. Legislation, Enforcement and Habitat

This group worked on topics such as: small, medium and large-scale productive activities, human intrusions and disturbances, energy production, and transport infrastructure. They discussed threats and contributing factors that primarily impacted on the reduction of habitat availability and suitability, and the limitation of population size and/or dynamics. These issues were considered from a perspective of legislation, enforcement, permits and authorizations.

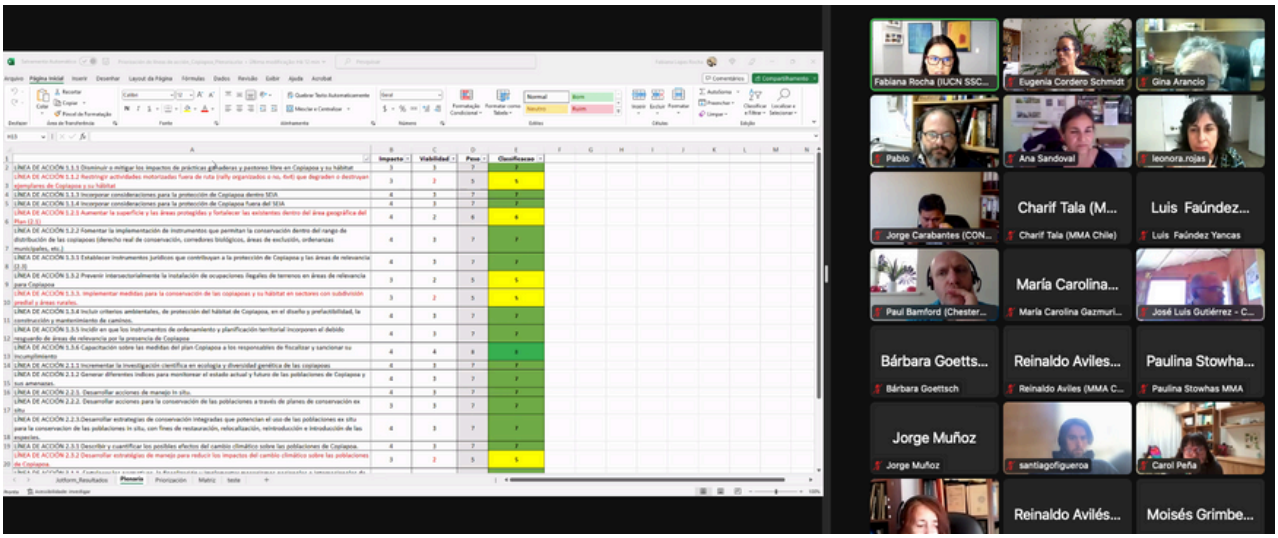
### 2. Intensive Management (*in situ* / *ex situ*), Climate Change, and Knowledge Gaps

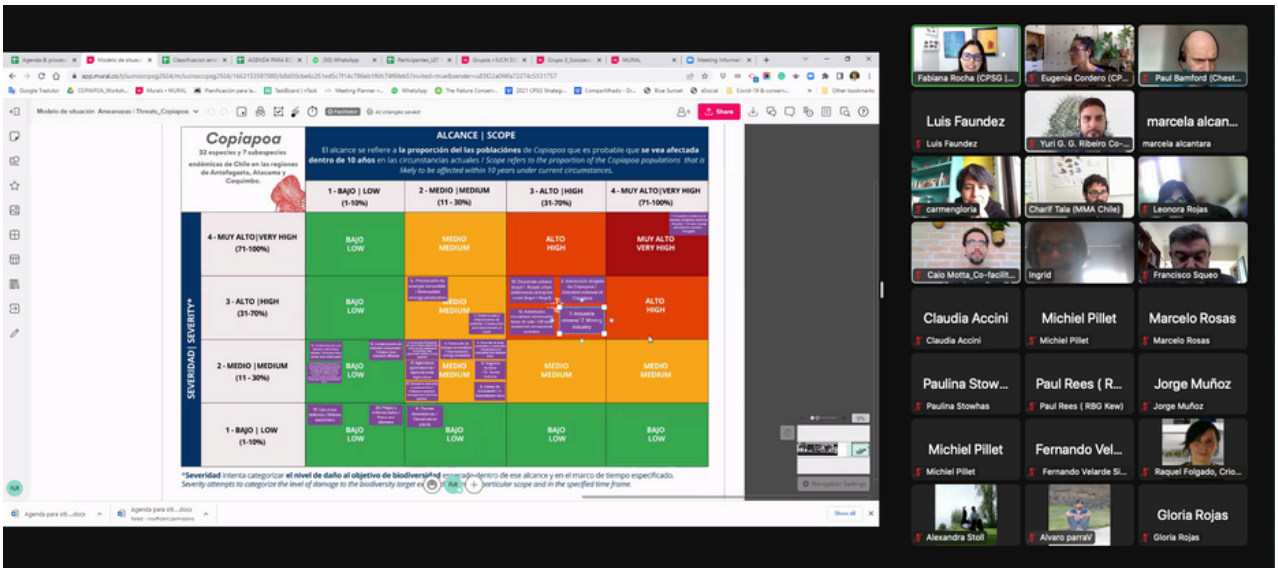
This group worked on topics such as: intensive *in situ* management, climate change and extreme weather events, possible *ex situ* roles to support *in situ* conservation, and information gaps. They discussed the threats and contributing factors that had as main impacts the loss of individuals from the wild and the potential reduction for future conservation strategies. These

discussions were informed from a perspective of *ex situ* management (botanical gardens, nurseries, collections), *in situ* conservation and research.

### 3. Socioeconomic and Political

This group focused on targeted plant extraction and illegal trade (local, regional and global). They discussed threats and contributing factors that resulted in the loss of individuals from the wild, the suppression of generational renewal, and the limitation of the size and/or dynamics of populations. These issues were considered from a socio-cultural, socioeconomic, and enforcement and legislation (national and global CITES) perspective.



**THREAT ANALYSIS:**

A review of threats was conducted by the facilitation team, in which threats previously identified in the Recovery, Conservation and Management Plan for the Coastal Flora of Northern Chile, and in the most recent IUCN Red List assessment for the genus *Copiapoa* were compiled. This document served as the basis for initiating a discussion on the threats and contributing factors that affect the genus *Copiapoa* within its current known distribution.

The participants undertook an initial review of these threats, in which they added new threats to the list, as well as contributing additional information on their impacts and scope at the geographical and species affected levels.

- Situation model:

The model was developed by the facilitation team, based on the threat analysis. It was presented in a plenary and improved by a small group of facilitators and volunteer participants (Luis Faundez and Moisés Grimberg).

- Threat classification:

The degree to which each threat affects the *Copiapoa* genus was considered. Twenty threats were classified according to their scope, severity and urgency.

## 1. SCOPE

This refers to the proportion of *Copiapoa* populations (considering all subpopulations of all *Copiapoa* species) that are likely to be affected within the next 10 years.

| 1 - LOW | 2 - MEDIUM | 3 - HIGH | 4 - VERY HIGH | I DON'T KNOW |
|---|---|---|---|---|
| The threat is likely to be very limited in scope, affecting populations in a small proportion (**1-10%**) of their occurrence. | The threat is likely to be restricted in scope, affecting populations in part (**11-30%**) of their occurrence. | The threat is likely to be widespread in scope, affecting populations in a large part (**31-70%**) of their occurrence. | The threat is likely to be widespread in scope, affecting populations in all or most (**71-100%**) of their occurrence. | I do not have sufficient information to classify this threat. |

## 2. SEVERITY

Severity seeks to categorize the level of damage that is expected to occur to populations of *Copiapoa* species within the scope of the threat and within the specified time frame (10 years).

| 1 - LOW | 2 - MEDIUM | 3 - HIGH | 4 - VERY HIGH | I DON'T KNOW |
|---|---|---|---|---|
| Within the scope, the threat is only likely to slightly degrade/reduce *Copiapoa* populations by **1-10%** within ten years or three generations. | Within the scope, the threat is likely to moderately degrade/reduce *Copiapoa* populations by **11-30%** within ten years or three generations. | Within the scope, the threat is likely to seriously degrade/reduce *Copiapoa* populations by **31-70%** within ten years or three generations. | Within the scope, the threat is likely to destroy, eliminate or reduce *Copiapoa* populations by **71-100%** within ten years or three generations. | I do not have sufficient information to classify this threat. |

## 3. URGENCY

This is the necessity of taking immediate action to address the threat. Is the threat occurring now and is the need for action now imminent? Will the threat occur within the next few years and could action be taken with less urgency? If we act now, could we avoid a significant investment of resources in the future? Urgency defines whether the action needs to occur NOW, 5 years from now, or 15+ years from now.

| 1 - LOW | 2 - MEDIUM | 3 - HIGH | 4 - VERY HIGH | I DON'T KNOW |
|---|---|---|---|---|
| >15 years from the present - long term | 15 years from the present | 10 years from the present | 5 years from the present | I do not have sufficient information to classify this threat. |

## CRITERIA

1) Magnitude = Severity * Scope

| | | SCOPE | | | |
|---|---|---|---|---|---|
| | | **Very high** | **High** | **Medium** | **Low** |
| **SEVERITY** | **Very high** | Very high | High | Medium | Low |
| | **High** | High | High | Medium | Low |
| | **Medium** | Medium | Medium | Medium | Low |
| | **Low** | Low | Low | Low | Low |

2) Final score = Magnitude * Urgency

| | | URGENCY | | | |
|---|---|---|---|---|---|
| | | **Very high** | **High** | **Medium** | **Low** |
| **MAGNITUDE** | **Very high** | Very high | High | Medium | Low |
| | **High** | High | High | Medium | Low |
| | **Medium** | Medium | Medium | Medium | Low |
| | **Low** | Low | Low | Low | Low |

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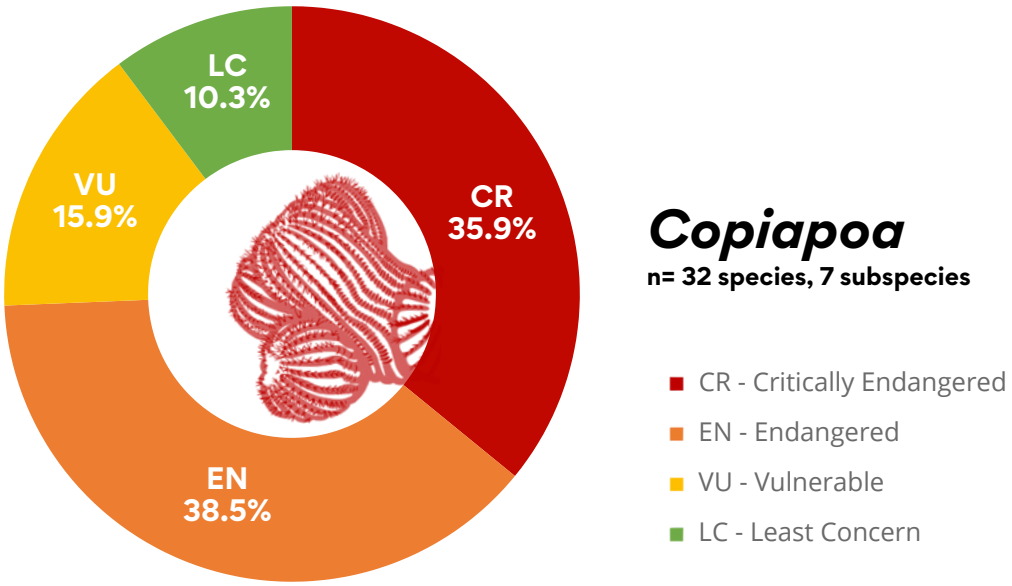
## VISION

The vision is a brief statement that describes the desired future state of the species. The components that should be included in a vision are representativity (species distribution) and replicability, functionality, and consideration for human needs and/or desires linked to the species. The process of collectively crafting the vision during the workshop began with a guided visualization: participants were asked to relax while imagining an ideal future for the genus *Copiapoa*. Participants were then asked to distil their visualization into three essential words/elements around which the vision statement would be built. These were inputted into a word cloud, from which six volunteers (Moisés Grimberg, Carmen Gloria Ossa, Paul Bamford, Leonora Rojas, Beatriz Ramírez and Paulina Stowhas) elaborated five proposed vision statements. These were presented to the other participants in a plenary session in which the group selected two statements that were merged and with feedback from the group. Subsequently, three volunteers (Paul Bamford, Paulina Stowhas and Reinaldo Avilés) were tasked with incorporating the suggestions from the plenary and presenting a new draft that was agreed upon as the final vision.

## SCOPE

This component refers to the scope of the Plan in terms of the number of species and subspecies, as well as its geographic reach.

**Species scope:** the participants agreed to follow the same taxonomy that was used in the most recent IUCN Red List assessment (2024), which recognises 32 species and seven subspecies of *Copiapoa*.



**Geographical scope:** the entire known distribution of the genus *Copiapoa* was be considered in the Plan.

**Surface area of presence (km²)**

The minimum convex polygon method was used to calculate the extent of occurrence, based on records and collections, which resulted in an area of 62,474.5 km².

**Surface area of occupancy (km²)**

The area of occupancy was calculated using the IUCN method, with a grid made up of 2 x 2 km quadrats, in which any quadrat that intersect with the points of records and collections of the species are counted. This resulted in an area of 3,176 km², including presence in Protected Areas.

## GOAL & PERFORMANCE INDICATORS

The goal is a formal statement that specifying the desired changes in regard to threats and contributing factors that are necessary in order to achieve the objectives of the plan to be achieved within a certain time frame. A good goal meets the criteria of being: result-oriented, measurable, specific, achievable, practical and time-bound. **A time frame of eight years has been established for this Plan.** During this time, monitoring reviews (M) will be undertaken every two years, an adaptive management review (AM) will be undertaken after four years, and a final evaluation review (FE) will take place eight years after the publication of the workshop report.


*From publication of the* ***Final Workshop Report***

The goal was created during a plenary brainstorming session in which participants discussed the status change that they hope to achieve for the species. Two volunteers were asked to write proposals for the text. During the following session, these statements were reviewed in plenary, and worked on in more detail, whilst also defining indicators of achievement.

## OBJECTIVES OF THE PLAN

These are the desired outcomes that contribute to the goal being achieved. Formal statements that define the Plan's intended final impacts were drafted for each of the working groups:

1.Legislation, Enforcement and Habitat.

2.Intensive Management (*in situ/ex situ*), Climate Change, and Knowledge Gaps.

3.Socioeconomic and Political

## STRATEGY LINES AND MONITORING INDICATORS

The strategy lines refer to the strategy to be followed for achieving the Plan's objectives. These were developed by the working groups.

Monitoring indicators are measurable results related to a specific outcome, such as a species' status, changes to a threat, progress toward an objective, or the association between two or more of these variables.

## ACTIONS

An action is a specific activity or set of tasks to be undertaken in order to work toward the objectives of a given strategy line. They should be directly linked to their corresponding strategy line and objective, focused, feasible and appropriate.

For each action, the following was established:

- Year of execution: estimated start dates for the execution of the action, according to the strategic planning cycle.
- Timeframe: variable format field, which may indicate frequency or duration, depending on the nature of the activity.
- Expected outcome: the direct result obtained by carrying out the action. It must be measurable, tangible, demonstrate the execution of the action and fall within the scope of the Workshop participants' attributions and competencies (e.g. map, brochure, minutes, article, etc.).
- Responsible party: The party or parties, legal entities or individuals, as the case may be, that has the competence, capacity or feasibility to carry out a given action or specific functions within the action. They are responsible for execution of the action and for presenting any results that may be achieved. However, they are not solely responsible for carrying out the action.

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## SIGN-OFF OF ACTIONS AND PRIORITIZATION OF STRATEGY LINES

During the final Workshop session (March 30, 2023) the participants reviewed and validated the 88 actions using polls developed in Jotform. Participants were asked about the extent to which they agreed with the content of each action (on a scale of 1 to 5), and only the actions that scored a high level of disagreement (majority of votes on 1 or 2) were discussed in the plenary.

A simplified prioritization exercise was undertaken for the 23 strategy lines. We based our prioritization on the Open Standards strategy ranking method, which uses two criteria: conservation impact and implementation feasibility.

**Conservation impact**

*If implemented, will the strategy line result in the desired changes in a species' status?*

**Very high:** the strategy line is very likely to completely mitigate a threat or achieve an objective.

**High:** the strategy line is likely to help mitigate a threat or achieve an objective.

**Medium:** the strategy line could possibly help to mitigate a threat or achieve an objective.

**Low**: the strategy line is unlikely to make a significant contribution toward mitigation of the threat or achieving the target.

There are at least two dimensions that are included in this rating, and which must be integrated into the rating: likelihood of positive impact and magnitude of change.

**Viability of implementation**

Can the strategy line be implemented with the available time, budget and staffing resources, and with consideration for any relevant ethical concerns?

**Very high:** the strategy line is ethically, technically and financially feasible.

**High:** the strategy line is ethically and technically feasible but may require additional resourcing.

**Medium:** the strategy line is ethically feasible, but technically or financially difficult without substantial additional resources.

**Low:** the strategy line is not ethically, technically or financially feasible.

These ratings are then aggregated to give an overall summary rating for the strategy lines. The threat ranking was also taken into consideration during this process.

## WORKSHOP STRUCTURE

**Planning Workshop for the Integrated Conservation of the Genus *Copiapoa***

**WEEK 1**

**Day 1**

**Leveling session on *Copiapoa***

- Natural history and ecology of the genus *Copiapoa*
- Updates on the taxonomy of the genus *Copiapoa*
- Species distribution models for *Copiapoa* under climate change
- Assessing the extinction risk for *Copiapoa (Cactaceae)* species
- Protection and conservation of species of the genus Copiapoa: an approach from the management of SNASPE
- BGCI's Global Conservation Conservation Consortia

**Day 2**

Create the vision
**Threat** analysis
**Situation model** discussion - part 1

**WEEK 2**

**Day 3**

**Vision** validation - part 1
**Scope and goal** discussion - part 1
**Situation model** discussion - part 2

**Day 4**

**Vision** validation - part 2, final validation
**Threat classification** - part 1
Presentation and discussion on potential role for ***ex situ* management possibilities**

**Day 5**

**Threat classification** - part 2, final validation
**Objectives** - group work
**Objectives** plenary - part 1

**WEEK 3**

**Day 6**

**Scope and goal** discussion - part 2, final validation
**Objectives** plenary - part 2
Defining **strategy lines** - part 1, group work

**Day 7**

Definition of **strategy lines & indicators** - part 2, group work
**Strategy lines** plenary - part 1

**WEEK 4**

**Day 8**

Define **actions** - Year of execution and timeframes; Outcome; Responsible parties

**Day 9**

Final **target %** Plenary
Continuation - Define **actions**
**Next steps**

**2023.1**

**Day 10**

Final **validation of the Plan**
Define **governance**, monitoring group
Next steps, **implementation**

**Final product**
Action Plan with dual publication

Ministerio del Medio Ambiente
Gobierno de Chile

IUCN SSC Species Survival Commission

### DEFINING SUCCESS

Define the core elements of a future state for the species that represents the desired outcomes, both for conservation and for other relevant stakeholder needs or values.

### UNDERSTANDING THE SYSTEM

Gather the best available information on the biology, history, management, status and threats to the species, the obstacles to addressing those threats, and opportunities or options for successful intervention.

### DECIDING WHERE TO INTERVENE

Determine where in the system to intervene and recommend and prioritize the changes needed to achieve the desired future state.

### AGREE HOW TO INTERVENE

Identify a variety of approaches to achieve the recommended changes, compare their relative costs, benefits and feasibility, and choose which one(s) to pursue.

### AGREE HOW TO INTERVENE

Agree on what will be done to implement the chosen approach, when and by whom, and what measures will be used to measure progress or completion of specific tasks.

### SPECIFY WHAT NEEDS TO BE DONE

Agree on what will be done to implement the chosen approach, when and by whom, and what measures will be used to indicate progress or completion of specific tasks.

### PREPARE TO IMPLEMENT

Agree on how key individuals and organizations will communicate, coordinate, make decisions, and track and report on progress as they move forward together to implement the plan.

### SHARE, LEARN AND IMPROVE

Create the plan quickly, share it broadly and strategically to maximize conservation impact, and capture lessons learned to develop more effective conservation planning processes.

# ABOUT THE FINAL PRODUCT

**This document is intended as a resource for use by stakeholders relevant to the conservation of the genus *Copiapoa*, including, but not limited to:**

- Workshop participants, as a record of the actions, initiatives and collaborations that were discussed;
- State government agencies in the species' range, to help guide, inform and coordinate the development of local, regional or national initiatives in strategic planning and implementation of actions for the conservation of the *Copiapoa* genus;
- Individuals, institutions and *ex situ* facilities (botanical gardens, nurseries, seed banks, herbaria, among others) that work with *Copiapoa*, to help inform their priorities;
- Non-governmental conservation organizations and community groups, to guide and inform their priorities and work plans; and
- Donor organizations, to guide priority actions for financial support.

The implementation of this Action Plan will be monitored over a period of 8 years, with monitoring every two years and with detailed adaptive management to be conducted after four years, and a final evaluation at the end of the eighth year.

Progress will be reported through the publication of progress reports, which will be available on the website www.plancopiapoa.org.

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# STAKEHOLDERS

The workshop was attended by 35 stakeholders, representing 20 institutions relevant to the conservation of the *Copiapoa* genus. The complete list of participants is in APPENDIX I.

## ACADEMIA

Centro de Estudios Avanzados en Zonas Aridas
Instituto de Ecología y Biodiversidad
Museo Nacional de Historia Natural de Chile
University of Arizona
Universidad de Concepción
Universidad de La Serena
Universidad de Valparaíso

## GOVERNMENT

Ministerio del Medio Ambiente (Antofagasta, Atacama and Coquimbo Regions)
Ministerio de Agricultura - CONAF (Antofagasta and Atacama Regions and Central Office)
Ministerio de Agricultura - INFOR
Ministerio de Agricultura - INIA INTIHUASI
Ministerio de Agricultura - SAG
Ministerio de Obras Publicas

## BOTANICAL GARDENS

Chester Zoo
Huntington Botanical Gardens
Jardin Botánico Nacional de Chile
Royal Botanic Gardens Kew

## PRIVATE SECTOR

Biota Gestión y Consultorías Ambientales Ltda.

## IUCN SPECIALIST GROUP

IUCN SSC Cactus and Succulent Plants Specialist Group

## NURSERIES

Vivero Cactus Lagarto
Mondocactus

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# CURRENT KNOWLEDGE ABOUT THE GENUS *COPIAPOA*

## Natural history and ecology of the genus *Copiapoa*

Pablo C. Guerrero [1, 2, 3]

*1 Departamento de Botánica, Universidad de Concepción, Chile; 2 Instituto de Ecología y Biodiversidad (IEB), Chile; 3 Instituto Milenio de Biodiversidad de Ecosistemas Antárticos y Subantárticos (BASE), Chile.*

*Copiapoa* is an iconic genus of cacti, distributed along the coast of the Atacama Desert. They are endemic to the hyper-arid coastal zone, and their origin would be related to the establishment of the current conditions of extreme aridity. In this sense, relict ancestral populations have probably remained in the Taltal-Paposo area. The species have evolved numerous adaptations that allow them to persist under conditions of extreme aridity. For example, the stems of *Copiapoa* grow in a northerly orientation, producing an increase in the incidence of shortwave radiation in the meristem, which in turn increases the temperature in the growth and flowering tissue, whilst minimizing the incidence of sunlight on the side of the cactus, thus reducing the negative effects of radiation. The intensification of hyper-aridity, due to the reduction of fog and precipitation, has severe consequences for the recruitment of new individuals, inducing mortality in seedlings, which - due to their slow growth rate - remain small in size for decades, with reduced water storage capacity. In addition, there is evidence of a systematic process of population impoverishment, due to the high mortality of adult individuals. Towards the northern distribution of the genus, the deleterious effects of the intensification of hyper-aridity are more severe, with local extinctions (e.g., the northern population of *Copiapoa solaris*), or with clear indications of high extinction risk (e.g., *Copiapoa humilis* subsp. *tocopillana*). Although the genus *Copiapoa* has numerous adaptations that optimize the efficient use and storage of water, the trend towards an increase in hyper-aridity would have serious consequences on population dynamics, especially in species with a more northerly distribution, and those species that suffer from other threats, such as illegal extraction of specimens.

FONDECYT 1211441 and FB210006

## Updates in the taxonomy of *Copiapoa* Britton & Rose

Carol Peña

*Departamento de Ciencias y tecnología vegetal, Universidad de Concepción, Campus Los Ángeles*

The genus *Copiapoa,* belonging to the family Cactaceae, is endemic to Chile, and distributed mainly along the country's northern coast, between the regions of Antofagasta and Coquimbo. The taxonomy of the genus is complex, due to the homogeneity of its reproductive features, and the fact that the vegetative features are usually not very informative, particularly if only a fragment of the plant is available. In recent years, changes have been made to the nomenclature of some species. Some of these changes have been based on the International Code of Botanical Nomenclature, where the principle of priority has not been respected, for example in *C. gigantea* (formerly *C. cinerea* subsp. *haseltoniana*) or *C. conglomerata* (formerly *C. ahremephiana*). Other changes have been established, based on the results of the study that was conducted by Larridon *et al*. (2015), where phylogenetic analyses showed that some taxa that were historically treated as subspecies, actually corresponded to full species, such as *C. atacamensis* (formerly *C. calderana* subsp. *atacamensis*) or *C. fiedleriana* (formerly *C. coquimbana* subsp. *fiedleriana*), to mention a few examples.

The current taxonomic classification is based on the proposal made by Walter & Guerrero (2022), and subsequent revisions, in which they recognize 32 species and 7 subspecies.

## The genus *Copiapoa* under climate change

Michiel Pillet

*The University of Arizona, Department of Ecology & Evolutionary Biology; IUCN SSC Cactus and Succulent Plants Specialist Group; Prickly Prospects Cactus Nursery*

*Copiapoa* is one of the most endangered genera of cacti, threatened mainly by changes in land use and illegal extraction. However, the present and future impact of climate change is unknown, which makes resilient conservation planning difficult. A common perception is that future climates will be favorable for cacti because they are physiologically and morphologically specialized to withstand hot and arid conditions. However, all species are somewhat adapted to the historical climate within their distributional range, suggesting that a warmer, more arid climate could negatively impact them. We modeled exposure to climate change through distributional forecasts for 23 *Copiapoa* taxa under three Representative Concentration Trajectories (RCTs 2.6, 4.5, 8.5) for 2050 and 2070. Our analyses show that five species (22% of modeled species) experienced a reduction in favorable climate, increasing to 16 (70% of modeled species) when dispersal beyond current distribution is not allowed. Five of these taxa are projected to experience a decline greater than one-quarter of their distribution at present. Some of the taxa are geographically clustered, facilitating targeted conservation actions. The production of many forecasts under a variety of statistical and climatic scenarios allows us to quantify uncertainty. Almost half of the uncertainty arises from dispersal distance. Therefore, more information on *Copiapoa*'s dispersal ability is urgently needed.

## Assessment of extinction risk in species of the genus *Copiapoa* (Cactaceae).

Angelica Ma Villalobo López

*Departamento de Botánica, Universidad de Concepción*

Drivers associated with human activities have accelerated the rate of species extinction and significantly altered ecosystem properties. Direct drivers vary in their importance within and between systems, as well as in the extent to which they are increasing their impact. Climate change is expected to increasingly affect all aspects of biodiversity, from individual organisms, through populations and species to the composition and functioning of ecosystems.

However, the global status of plant species, i.e. their probability of extinction in the near future, remains poorly known. Only 19,374 out of an estimated total of approximately 300,000 species have been assessed according to the current IUCN Red List criteria. The extinction risk of plant species is comparable to that of mammals and higher than that of birds, and this situation is worrying because there is evidence to suggest that the conservation status of plant species is particularly serious. Despite the small proportion of plants whose threat status has been assessed, they constitute a high percentage of all threatened species currently on the IUCN Red List. For example, among the angiosperms, the Cactaceae are one of the plant families whose species are most prone to extinction, with almost one-third of the ca. 1,500 species assessed and considered as threatened. Amongst the Chilean flora, Cactaceae is a diverse family that requires urgent conservation actions, as it presents high levels of endemism in that country (>90%) and most of the species are threatened by human activities (Duarte et al., 2014; Hoffmann & Walter, 2004; Larridon et al., 2014; Marticorena, 1989). Cactaceae are a dominant floristic element that determines the phytogeography and vegetation structure of the Atacama Desert and Mediterranean Chile (Armesto et al., 1979; Duarte et al., 2014; Rundel, 1991) and are a crucial group for the global hotspot defined as "Chilean winter rainfall-Valdivian forests" (Arroyo et al., 1999, 2004, Duarte et al., 2014). The Atacama Desert (Duarte et al., 2014; Pablo C. Guerrero et al., 2013) and the Mediterranean center of Chile harbor a great diversity of cacti, most of which represent endemic lineages (genera and species) (Duarte et al., 2014; Pablo C. Guerrero et al., 2013), one of which is the genus *Copiapoa* (Britton & Rose). Taking into account these developments, it is proposed to reevaluate the conservation status of the genus *Copiapoa* (Britton & Rose), for Chile based on its current geographic distribution patterns and the trends of change during the last decades in the geographic distribution of the species. Little is known about these species, and due to the general lack of knowledge about the conservation status of their populations in Chile, the research question was posed: What is the current conservation status of the genus *Copiapoa* (Cactaceae) in Chile? For this reason, we chose to evaluate them according to the IUCN red list criteria, which allows us to categorize the conservation status of the species at the national level, based on aspects such as their geographic distribution, number of individuals, population trends, environmental status and use/exploitation of the species. Finally, this reassessment suggested changes as regard to the assessment that was undertaken more than 12 years previously. We determined 14 species to be Critically Endangered, 15 Endangered, 6 Vulnerable and 4 Least Concern. Nine species were moved from a lower threat to a higher threat category, and 15 species that were not evaluated during the 2008 to 2012 period were added. Furthermore, four species were downlisted

to a lower threat category: in the case of *Copiapoa* dealbata, this is due to much of its population being within the Llanos del Challe National Park; *Copiapoa fiedleriana* was downlisted from EN to VU due to it having assimilated populations that were previously listed as a separate species, thus increasing its range to a much wider area, extending from Huasco to the south of Caldera. Regarding the threat of illegal trafficking, the taxa that are most threatened include *Copiapoa cinerea* subsp. *cinerea*, *Copiapoa cinerea* subsp. *columna-alba*, *Copiapoa cinerea* subsp. *krainziana* and *Copiapoa conglomerata*. These species have been, and continue to be, affected by trafficking so much so that in 2020, 838 individual cacti, including specimens of *Copiapoa* were seized in Italy, as a result of the so-called "Operation Atacama". This serves as a stark reminder that cacti hold a powerful attraction for collectors. The information presented here represents the key outcomes of preliminary data analysis from my Master's degree thesis in Botany. At present we are undertaking another type of analysis, looking at the diameter of the bodies of cacti as a biological factor of measurement; the final analysis will provide more specific results, allowing us to complete and deepen the results presented here.

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# Protection and conservation of species of the genus *Copiapoa*: an approach from the management of the National System of State Protected Wild Areas (SNASPE).

Moises Grimberg Pardo

*Protected Areas Management Department, Corporación Nacional Forestal. Ministerio de Agricultura - Gobierno de Chile.*

The SNASPE areas with the greatest diversity of *Copiapoa* species are: Paposo Norte Natural Monument, La Chimba National Reserve and Morro Moreno National Park, in the Antofagasta Region, and; Pan de Azúcar National Park and Llanos del Challe National Park, in the Atacama Region. Aspects of the management of these areas associated with the protection of cacti include access control, patrolling and enforcement, research, capacity building, conservation education, and monitoring, among others.

There is a need to promote the implementation of *in situ* and *ex situ* conservation tools within integrated conservation planning, with the aim of ensuring the conservation of these species in the long term.

The key threats to the *Copiapoa* genus, include the removal of wild specimens, off-road motorsports, and civil infrastructure development (road construction and improvement). The protocols, oversight, and effectiveness of compensation measures (relocation of individuals) for projects that intervene in the habitat of natural populations of cacti need to be considered. It is suggested that a vulnerability analysis be applied to species of the *Copiapoa* genus, in order to obtain a more accurate forecast of the threat that climate change poses to populations.

Finally, some factors that contribute to these threats occurring *in situ* are mentioned, including the following: High commercial interest in international trafficking, inadequate regulations for their protection, lack of coordination, oversight and management, research gaps, under-representation of populations in officially protected areas, and their being undervalued by society at large.

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# *COPIAPOA* ACTION PLAN

## SPECIES

32 Species and 7 subspecies endemic to Chile.

This number is based on the most recent IUCN Red List assessment for the genus *Copiapoa* and may be subject to change as the assessment is under review.

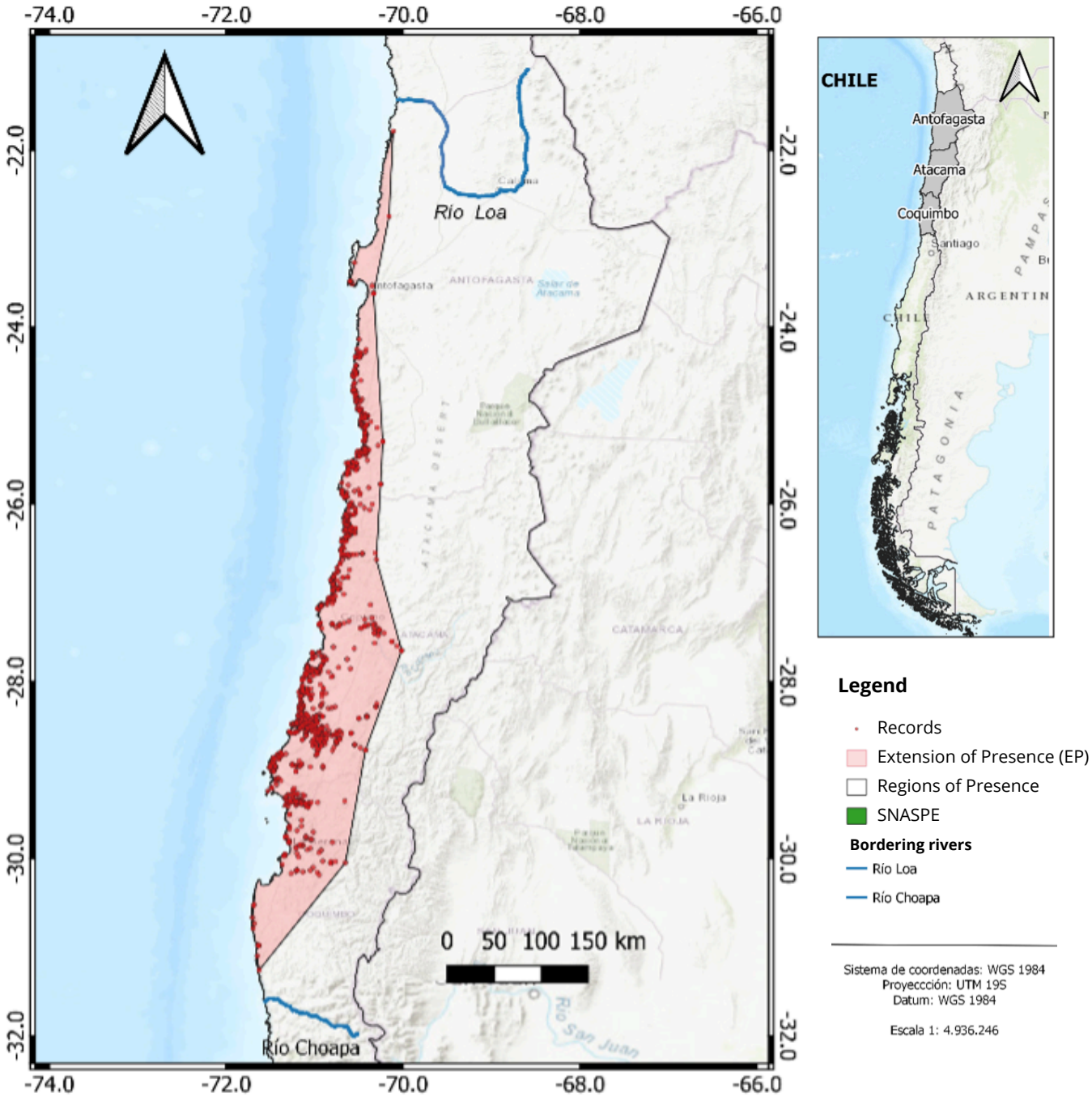
| | |
|---|---|
| *Copiapoa angustiflora* | CR |
| *Copiapoa aphanes* | CR |
| *Copiapoa armata* | VU |
| *Copiapoa atacamensis* | EN |
| *Copiapoa australis* | CR |
| **Copiapoa calderana* | VU |
| *Copiapoa cinerascens* | EN |
| **Copiapoa cinerea* | LC |
| ***Copiapoa cinerea cinerea* | EN |
| ***Copiapoa cinerea columna-alba* | EN |
| ***Copiapoa cinerea krainziana* | CR |
| *Copiapoa conglomerata* | CR |
| **Copiapoa coquimbana* | LC |
| *Copiapoa dealbata* | LC |
| *Copiapoa decorticans* | CR |
| *Copiapoa desertorum* | EN |
| *Copiapoa echinoides* | VU |
| *Copiapoa esmeraldana* | CR |
| *Copiapoa fiedleriana* | VU |
| *Copiapoa gigantea* | VU |

| | |
|---|---|
| *Copiapoa grandiflora* | EN |
| **Copiapoa humilis* | EN |
| ***Copiapoa humilis humilis* | EN |
| ***Copiapoa humilis tenuissima* | CR |
| ***Copiapoa humilis tocopillana* | CR |
| ***Copiapoa humilis variispinata* | CR |
| **Copiapoa hypogaea* | EN |
| *Copiapoa laui* | EN |
| *Copiapoa leonensis* | CR |
| *Copiapoa longispina* | CR |
| *Copiapoa longistaminea* | LC |
| *Copiapoa marginata* | VU |
| **Copiapoa megarhiza* | EN |
| *Copiapoa mollicula* | CR |
| **Copiapoa montana* | EN |
| *Copiapoa rupestris* | EN |
| *Copiapoa serpentisulcata* | EN |
| *Copiapoa solaris* | CR |
| **Copiapoa taltalensis* | EN |

** New species*
*** New subspecies*

## GEOGRAPHICAL

The entire known distribution of the genus *Copiapoa*, from south of the Loa River (Antofagasta Region) to north of the Choapa River (Coquimbo Region), and mainly along the coast, but with some geographic expansions towards the interior of the Huasco, Los Choros and Elqui valleys, reaching up to 1,500 meters above sea level.



# ANALYSIS AND RANKING OF THREATS

The threats identified for the *Copiapoa* genus are listed below, ranked according to scope, severity, magnitude and urgency.

| Threat | Scope | Severity | Magnitude | Urgency | Overall ranking |
|---|---|---|---|---|---|
| 01. Climate change and extreme weather - Droughts | 4 | 4 | 4 | 4 | 4 - VERY HIGH |
| 10. urban settlements along the coast (legal / illegal) | 3 | 3 | 3 | 4 | 4 - VERY HIGH |
| 02. Directed removal of Copiapoa | 3 | 3 | 3 | 4 | 4 - VERY HIGH |
| 13. Off-road motorized recreational activities | 3 | 3 | 2 | 4 | 3 - HIGH |
| 03. Construction and improvement of roads | 2 | 3 | 2 | 4 | 3 - HIGH |
| 09. Pipelines for transporting water (desalination plants) & mining pipelines | 2 | 2 | 2 | 3 | 2 - MEDIUM |
| 05. Renewable energy production | 2 | 3 | 2 | 3 | 2 - MEDIUM |
| 06. Transmission lines | 2 | 2 | 2 | 3 | 2 - MEDIUM |
| 11. Development of commercial and industrial areas | 2 | 2 | 2 | 2 | 2 - MEDIUM |
| 07. Mining industry | 2 | 3 | 2 | 3 | 2 - MEDIUM |
| 12. Tourist Industry | 2 | 2 | 2 | 3 | 2 - MEDIUM |
| 08. Desalination plants | 2 | 2 | 2 | 3 | 2 - MEDIUM |
| 04. Thermoelectric energy production | 2 | 2 | 2 | 2 | 2 - MEDIUM |
| 17. Agroindustrial agriculture | 2 | 2 | 2 | 2 | 2 - MEDIUM |
| 18. Extensive livestock management and free grazing | 2 | 3 | 2 | 2 | 2 - MEDIUM |
| 14. Pollution from industrial effluents | 1 | 2 | 1 | 1 | 1 - LOW |
| 15. Pollution from refuse and solid waste | 1 | 2 | 1 | 1 | 1 - LOW |
| 16. Pollution due to iron deposition product of emissions generated by industrial plant (pellets), port infrastructure system and thermoelectric power | 1 | 2 | 1 | 1 | 1 - LOW |
| 19. Military excercises | 1 | 1 | 1 | 1 | 1 - LOW |
| 20. Pests and diseases | 1 | 1 | 1 | 1 | 1 - LOW |



## 1. Climate Change | Very high

**Description**

Changes in bioclimatic variables, such as spatio-temporal alterations in precipitation and temperature at the local, regional and global scales, are the most tangible expressions of climate change, producing severe impacts on the state of ecosystems. Being perennial plants that occupy extremely arid habitats, the survival of *Copiapoa* species is strongly dependent on the availability of water in numerous fog ecosystems that are highly dependent on precipitation and coastal fog (camanchaca).

A reduction in precipitation leads to a water deficit, affecting the water table's capacity to replenish, and reducing water retention in the soil. The decreasing frequency of rainfall in the northern zone of the Atacama Coastal Desert, combined with higher temperatures, subjects plants to high abiotic stress. Additionally, when rare and unpredictable rainfall occurs, it can fall in short periods of time causing erosion and landslides. These factors cause direct mortality of seedlings (decreased recruitment rates) and adults; they inhibit growth rates and cause fragmentation and reduction in the distribution of some species. Shorter periods of moisture can potentially induce lower reproductive success (seed production), due to the reduced presence of pollinators, and reduced flower and fruit production. Vegetative development, branch formation and growth may also be affected by drought.

Species distribution models suggest that the main sources of uncertainty regarding the impacts of climate change are dispersal rates and the identification of the environmental variables that determine the distribution limits of *Copiapoa* species. The exact magnitude of climate change is in itself is less important than the capacity for population dispersal. The myrmecochorous nature of seed dispersal (dispersal by ants), and long generational turnover times make it very unlikely that any species of *Copiapoa* can geographically track their suitable climate, if it shifts latitudinally or altitudinally.

**Knowledge gaps:**

- More information is needed on seed dispersal in *Copiapoa*, particularly the dispersal agents and distances traveled.

- Regarding the identification of range boundary drivers for *Copiapoa*, more information is needed on the role of edaphic variables, such as soil type specificity. Given that coastal fog is a crucial element in determining the status of lomas ecosystems, the development of fog projections under climate change scenarios is crucial.
- For long-term population persistence, we need more information on the recruitment niche of *Copiapoa* and its relationship to coastal fog. It is likely that most of the observations on which climate change projections are based were from adult plants, and the climate tolerance of seedlings is likely to be much more limited. The lack of knowledge about the recruitment niche affects the accuracy of population projections for the remaining *Copiapoa* populations.

**Impacts**

- Reduces flowering
- Reduces genetic diversity and effective population size
- Reduces seed production
- Reduces recruitment rate
- Increases adult mortality
- Generates local extinctions
- Limits population size
- Limits ecosystem carrying capacity
- Reduces habitat availability and quality
- Affects abundance and diversity of pollinators and seed dispersers.

**Geographic scope**

The full geographic scope of the Plan.

**Species scope**

All 32 species and 7 subspecies.
Under the assumption that dispersal will be very limited or nonexistent within the next half-century, species distribution model projections suggest that the following taxa will experience significant habitat losses due to climate change:
*C. atacamensis, C. cinerascens, C. cinerea subsp. cinerea, C. cinerea subsp. krainziana, C. dealbata, C. echinoides, C. fiedleriana, C. gigantea, C. grandiflora, C. humilis, C. laui, C. longistaminea, C. megarhiza, C. montana, C. serpentisulcata* and *C. solaris.*

Median range projections for *C. cinerea subsp. cinerea, C. dealbata, C. grandiflora, C. laui, C. serpentisulcata* predict a 25% loss in distribution. Species for which median projections suggest no range reduction include *C. armata, C. calderana, C. cinerea subsp. columna-alba, C. conglomerata, C. coquimbana, C. marginata,* and *C. rupestris*.

The species scope given here represents a summary of 2,160 estimates per species for several climate scenarios and statistical parameterizations. Parameters that were varied include variable selection method, correlation filtering of variables, time point, RCP, GCM, dispersal distance, model complexity, and thresholding method. Taxa with fewer than six records were not modelled, in order to obtain robust models; duplicate records and records in the same grid cell were automatically removed, and after this filtering, the threshold was applied. The design of conservation plans for individual species, and of protected areas, must consider climatically suitable habitat, both in the present and in the future, in order to increase resilience and improve the likelihood of achieving conservation goals.

## 2. Urban development - legal and illegal | Very high

**Description**

This threat relates to permissive development policies for the coastline in the northern macrozone, where large tracts of land are occupied, either for livelihood activities (settled by people who harvest seaweed) or recreational (second home) purposes. It is not related to real estate projects.

**Impacts**

- Increase in invasive exotic species such as dogs and cats.
- Causes erosion through the creation of tracks and trails.
- Clearing and crushing of plant species.
- Pollution from liquid and solid waste; light and noise pollution.
- Removal of seeds and plants.
- Lack of security for fieldwork (high-risk areas associated with drug trafficking)
- Reduces seedling survival
- Reduces habitat quality and quantity
- Limits population size

**Geographic scope**

Coastal areas of the northern macrozone (from Atacama Region to the Peruvian border).

**Species scope**

All 32 species and 7 subspecies.

## 3. Targeted extraction of *Copiapoa* | Very high

**Description**

The vast majority of *Copiapoas* are extracted for commercial, recreational, subsistence, research or cultural purposes. Most worrisome is the illegal extraction of *Copiapoa* plants and seeds by collectors and non-collectors. The seeds are saved, exchanged and/or germinated, while the plants are cultivated by the collectors themselves, or sold in an informal national and international market. operations to seize illegally-held cacti, the CITES database and observations on websites and social networks corroborate the existence and magnitude of this threat. An increased regulatory oversight, the creation and implementation of effective standards, along with actions that discourage the removal of seeds and plants from habitat (e.g., regulated nurseries that provide germplasm to collectors and horticulturists) have the potential to reduce the direct removal of seeds and plants.

**Knowledge gaps**

- It is necessary to identify populations (geographic areas) where direct seed and plant removal is greatest, such as specific road sections, areas with high endemism, or areas with limited traffic that are easily accessible.
- The annual rate of seed and plant removal is still poorly known.
- Research is needed into the effect of seed removal on population dynamics.
- It is likely that the removal of adult plants has a greater impact on population. viability than seed removal, due to the high reproductive value of adults. As is the case for many other cacti, it appears that *Copiapoa* recruitment is highly episodic, depending on interannual variations in rainfall. Although it is probable that the removal of seeds will have a negative effect on the population growth, the importance of seed production as a regulator of *Copiapoa* population growth must be researched within a demographic framework.

**Impacts**

- Loss of seeds and/or individuals from the wild
- Reduces genetic diversity and effective population size.
- Reduces seed production due to the removal of adult plants
- Reduces seed availability in the demographic cycle of plants
- Reduces recruitment rate
- Increases adult mortality
- Affects population structure and reproductive success (generally the most attractive and vigorous individuals are removed).

**Geographic scope**
The full geographic scope of the Plan.

**Species scope**
All 32 species and 7 subspecies.

## 4. Off-road recreational motorsport activities | High

**Description**
This threat relates to people who spend time in nature, or travel in cars, motorcycles, or trucks, away from established transportation routes, usually for recreational reasons (e.g. rally competitions). *Copiapoa* individuals are destroyed by trampling and vehicle traffic, as well as associated extraction of flora for ornamental purposes.
The impacts of rally competitions (both national and international) are not restricted to the moment when these events take place, but also after the competition, in locations where they are repeated systematically. Other people who are followers of these types of competitions want to use the same routes, thus perpetuating them over time.

**Impacts**
- Reduces survival of individual seedlings
- Reduces survival of mature individuals
- Loss of seeds and/or individuals from the wild
- Reduces habitat quality
- Creates tracks and trails
- Crushing of native flora
- Creates suspended dust
- Generates all types of waste, particularly non-degradable waste, such as plastics, with resulting general deterioration of the habitat.

**Enlaces**
¿Cuál es el impacto de las actividades 4×4 en el patrimonio cultural y natural de Chile?

**Geographic scope**
From the Atacama Region to the north

**Species scope**
*Copiapoa angustiflora, C. armata. C. australis, C. cinerascens, C. cinerea, C. cinerea* subsp. *cinerea, C. cinerea* subsp. *columna-alba, C. dealbata, C. fiedleriana, C. echinoides, C. armata, C. gigantea, C. humilis, C. humilis humilis, C. hypogaea, C. laui, C. grandiflora, C. longistaminea, C. leonensis, C. margarinata, C. calderana, C. megarhiza, C. serpentisulcata, C. mollicula,* and *C. taltalensis.*

## 5. Construction and improvement of roads | High

**Description**

The construction, maintenance, and improvement of roads, along with related activities, including alluvial control measures such as walls, gabions, and flood control reservoirs. These measures cause severe habitat destruction and fragmentation. They also facilitate the occurrence of other threats such as the removal of seeds and plants, invasion of allochthonous species, vandalism, accumulation of garbage, etc.

**Impacts**

- Reduces habitat quantity and quality
- Produces population fragmentation
- Promotes the accumulation of garbage and pollution
- Removal of seeds and/or plants from the wild
- Limits population size

**Geographic scope**

The full geographic scope of the Plan, with special attention on the Ruta 1 highway, that will link Antofagasta with Atacama, including a section that will cut through the Pan de Azucar National Park.

## 6. Water transportation pipes (desalination plants) and ore pipelines | Medium

**Description**

The construction of aqueducts and mineral pipelines throughout the genus' range is essential for supplying water to population centers, or for transporting minerals between mining sites in the interior to shipping facilities on the coast. These linear routes are usually accompanied by a maintenance road, and associated infrastructure (e.g., pumping stations, inspection/maintenance huts, emergency dump valves) every few miles. On average, the width of the impact can reach 50 m, over the entire length of the route.

**Impacts**

- Direct destruction of habitat during the construction stage.
- Dust emissions due to vehicle traffic during the operation stage.
- Pipeline ruptures can empty their contents and affect areas beyond the actual route. This may be relevant in some critical points far from safety valves and in areas of ravines and steep slopes.

**Geographic scope**
Coast of the northern macrozone (from Atacama Region to the Peruvian border).

**Species scope**
*Copiapoa armata, C. atacamensis, C. australis, C. calderana, C. cinerascens, C. cinerea, C. cinerea subsp. cinerea, C. cinerea subsp. columna-alba, C. cinerea subsp. krainziana, C. conglomerata, C.dealbata, C. decorticans, C. desertorum, C. echinoides, C. esmeraldana, C. fiedleriana, C. gigantea, C. grandiflora, C. humilis, C. humilis subsp. humilis, C. humilis subsp. tenuissima, C. humilis subsp. tocopillana, C. humilis variispinata, C. hypogaea, C. laui, C. leonensis, C. longispina, C. longistaminea, C. marginata, C. megarhiza, C. mollicula, C. montana , C. rupestris, C. serpentisulcata, C. solaris,* and *C. taltalensis.*

## 7. Construction and operation of renewable energy plants | Medium

**Description**
The construction and operation of renewable energy plants have a direct impact on *Copiapoa* populations through the disturbance of wild areas that provide habitat for various species. The extent and magnitude of the impact on habitat varies according to the type of renewable energy. For example, photovoltaic panels occupy a large surface area, and therefore their construction and operation involve extensive removal of vegetation cover. However, in some wind farms, the extent of the impact can also be very significant. For example, at the Sarco Wind Farm (southern coast of the Atacama Region), the area occupied by the towers and maintenance roads is significant.

**Impacts**
- Direct destruction of habitat during the construction stage.
- Dust emission due to vehicle traffic during the operation stage.
- Loss of individuals: mortality associated with the rescue and relocation of individuals as an environmental compensation measure can outweigh the benefits of these measures.

**Geographic scope**
Coastal plains in the northern macrozone (from Atacama Region to the Peruvian border).

**Species scope**
*Copiapoa coquimbana, C. armata, C. fiedleriana, C. gigantea,* and *C. megarhiza*

## 8. Transmission lines | Medium

**Description**

The construction and operation of high-voltage power lines cause significant environmental impacts. The siting of the towers and their maintenance damages the habitat, causes dust emissions, and enables the removal of individuals. This leads to population fragmentation, especially for those species that grow in groups. Their installation requires access roads and the removal of vegetation to install the towers. Maintaining cable tension also has an impact on vegetation.

**Impacts**

- Loss of individuals: mortality associated with the rescue and relocation of individuals as an environmental compensation measure can outweigh the benefits of these measures. Many times, individuals are extracted from other unaffected sectors, in order to have "rescued" individuals at the site, causing further damage to natural populations, especially due to the uncertain future of these individuals and their loss from the population.

**Geographic scope**

Atacama and Coquimbo Regions. In the Region of Antofagasta they are in specific areas (Tocopilla- south of Antofagasta, Paposo, Cifuncho).

**Species scope**

*Copiapoa calderana, C. megarhiza* y *C. fiedleriana, C. humilis tocopillana, C. gigantea, C. armata, C. cinerea columna-alba, C. coquimbana, C. dealbata, C. desertorum, C. echinoides, C. marginata. C. leonensis,* and *C. rupestris.*

## 9. Development of commercial and industrial areas without consideration for the conservation of *Copiapoa* | Medium

**Description**

These activities are a threat because of the scarce regulations for the protection of native flora, and insufficient access to technical information for the regulatory authorities; mitigation, recovery, and compensation measures lack an adequate scientific justification, and there are insufficient land-use planning instruments, and too few protected areas. This threat includes civil infrastructure development that falls under the jurisdiction of the Environmental Impact Assessment System (Sistema de Evaluación de Impacto Ambiental - SEIA).

**Impacts**

- Reduces seedling survival
- Reduces survival of mature individuals
- Loss of seeds and/or individuals from the wild
- Affects genetic variation
- Reduces quality and quantity of habitat availability
- Population fragmentation
- Local extinction

**Geographic scope**

This threat affects flora in areas associated with population centers.

**Species scope**

*Copiapoa echinoides, C. fiedleriana,* and *C. longispina.*

## 10. Mining | Medium

**Description**

In coastal areas, there are small, medium and large-scale mining activities. These activities not only affect the surface area that is directly impacted by the installation of the projects but also spoil heaps downhill from the mine. This is especially true for small-scale mining projects located on steep slopes, which, due to their size, are not included in the environmental assessment system. The operation of the mining site can create extensive emissions of particulate matter that can affect the photosynthetic capacity of plants, and of gasses that contribute to global warming and the climate crisis. Furthermore, the effects of the mining industry are not limited to the activities involved in the extractive processes, but also include the effects of other related works, such as roads, transmission lines and pipelines.

**Impacts**

- Reduces seedling survival
- Removal of individuals from the wild
- Reduces quantity and quality of habitat
- Limits population size
- Contributes to global warming, with local consequences due to its impacts on habitat quality.
- Contamination by particulate matter affecting plant physiology

**Geographic scope**

Coastal area south of Tocopilla to Caleta Michilla and from Caleta El Cobre to Cifuncho in the Antofagasta Region. From Chañaral to Caleta Sarco, in the Atacama Region.

**Species scope**
*C. armata, C. calderana, C. cinerea, C. cinerea subsp. columna-alba, C. gigantea, C. humilis, C. humilis subsp. tocopillana, C. serpentisulcata, C. solaris, C. desertorum, C. marginata* and *C. rupestris*

## 11. Unregulated tourism without consideration for the conservation of *Copiapoa* | Medium

**Description**
This threat is caused by the lack of exclusion zones for tourist activities, such as observation of the flowering desert or off-road motorsports (for tourism, recreation, or other purposes).

**Impacts**
- Reduces seedling survival
- Reduces survival of mature individuals
- Loss of seeds and/or individuals from the wild
- Reduces habitat quality
- Limits population size

**Geographic scope**
The full geographic scope of the Plan.

**Species scope**
*Copiapoa calderana, C. cinerea, C. cinerea subsp. columna-alba, C. coquimbana, C. dealbata,* and *C. longistaminea.*

## 12. Desalination plants | Medium

**Description**
Due to the limited availability of water, the high demand from large mining projects in the region, and the need to supply drinking water in urban centers, there is a strong push to build seawater desalination plants along the coast of the region.
These facilities take up habitat, require extensive infrastructure (both on-site and along access roads), and consume considerable electrical power to transport desalinated water to the points of demand. Both the construction of the plant and the power lines and pipelines that are necessary for their operation represent a serious threat. Pipes, power lines, and associated access roads, are built in areas where the camanchaca supplies humidity to *Copiapoas*.

**Impacts**

- Reduces seedling survival
- Reduces survival of mature individuals
- Removal of individuals from the wild
- Reduces quantity and quality of habitat

**Geographic scope**

From south of Tocopilla to the northern limit of Pan de Azúcar National Park in the Antofagasta Region, and the entire coast of the Atacama Region.

**Species scope**

*Copiapoa angustiflora, C. aphanes, C.armata, C. atacamensis, C. australis, C. calderana, C. cinerascens, C. cinerea, C. cinerea cinerea, C. cinerea subsp. columna-alba, C. cinerea subsp. krainziana, C. conglomerata, C. coquimbana, C.dealbata, C. decorticans, C. desertorum, C. echinoides, C. esmeraldana, C. fiedleriana, C. gigantea, C. grandiflora, *C. humilis, C. humilis subsp. humilis, C. humilis subsp. tenuissima, C. humilis subsp. tocopillana, C. humilis subsp. variispinata, C. hypogaea, C. laui, C. leonensis, C. longispina, C. longistaminea, C. marginata, C. megarhiza, C. mollicula, C. montana , C. rupestris, C. serpentisulcata, C. solaris,* and *C. taltalensis.*

## 13. Production of thermoelectric energy | Medium

**Description**

The construction and operation of thermoelectric plants have a direct impact on *Copiapoa* populations due to the disturbance of wild areas that provide habitat for various species. These projects cause the removal of plant biomass in the area where they are located. In addition, there are emissions of particulate matter and greenhouse gases that have effects on plant populations at different scales. For example, soot deposition can affect the photosynthetic capacity of a plant at the local level, while the combustion of fossil fuels generates gas emissions that contribute to global warming and climate crisis.

**Impacts**

- Decrease in the quality and quantity of habitat
- Removal of individuals
- Reduces seedling survival
- Limits population size
- Contributes to global warming, with local consequences by affecting habitat quality.
- Contamination by particulate matter that affects plant physiology.

**Geographic scope**
In areas where there are thermoelectric plants, specifically in the towns of Tocopilla, Mejillones, Antofagasta, Taltal (Paposo) in the Antofagasta region, and in Huasco, Vallenar in the Atacama region.

**Species scope**
*C. atacamensis, C. solaris, C. fiedleriana, Copiapoa gigantea, C. humilis subsp. tocopillana, C. humilis,* and *C. australis.*

## 14. Industrial agriculture | Medium

**Description**
This threat includes productive activities that are not covered by the SEIA, in an area of the coast where there is insufficient regulation and oversight. The expansion of land for agricultural use modifies the habitat used by plant species, and results in illegal waste dumps, with their consequent impacts on the flora.

**Impacts**
- Reduces seedling survival
- Reduces survival of mature individuals
- Decreases genetic diversity
- Reduces quality and quantity of habitat availability
- Limits population size

**Geographic scope**
Copiapó, Huasco and Elqui valleys.

**Species scope**
*Copiapoa armanta, C. coquimbana, C. dealbata, C. fiedleriana,* and *C. megarhiza*

## 15. Extensive livestock management and free grazing | Medium

**Description**
This refers mainly to unsustainable livestock practices, with goats and donkeys consuming native plants and enabling the spread of introduced plant species.

**Links:**
Rodeo de burros, ventana al turismo de Atacama.

**Impacts**

- Reduces seed germination
- Reduces survival of individual seedlings
- Reduces survival of mature individuals
- Loss of seeds and/or individuals from the wild
- Affects genetic variation
- Reduces habitat quality
- Limits population size

**Geographic scope**

Mostly occurring in the Paposo area, where there are records of livestock farmers releasing animals (mainly goats) for free grazing. In Punta de Choros and along the coast of Huasco province, feral livestock - especially donkeys - trample and consume heads and even entire individuals of *Copiapoa* and other cacti. They also occur in the Los Choros and Elqui Valleys.

**Species scope**

*Copiapoa aphanes, C. armata, C. australis, C. dealbata, C. gigantea, C. humilis, C. humilis subsp.humilis, C. coquimbana,* and *C. fiedleriana*.

## 16. Pollution from industrial discharge | Low

**Description**

Waterborne contaminants, such as nutrients, toxic chemicals and/or sediments from industrial sources, including mining, energy production, and other resource extraction industries.

**Impacts**

- Reduces habitat suitability
- Limits population size

**Geographic scope**

Chañaral, Huasco and Vallenar

**Species scope**

*C. cinerascens, C. fiedleriana*

## 17. Pollution from garbage and solid waste | Low

**Description**
This issue is associated with population centers, especially informal residential areas, which do not have municipal collection services, leading to the creation of improvised dumps containing all kinds of waste, including hazardous materials (batteries, refrigerants, oils and others).

**Impacts**
- Habitat fragmentation
- Reduces habitat quality
- Pollution, affecting flora and fauna.
- Modification of microhabitats
- Loss of individuals
- Introduction of agricultural pests.
- Loss of seed stock

**Geographic scope**
Chañaral, Huasco, Taltal, Copiapó y Vallenar.

**Species scope**
*Copiapoa armata, C. calderana, C. dealbata, C. fiedleriana, C. grandiflora, C. cinerea cinerea, c. cinerea columna alba, C. gigantea,* and *C. megarhiza.*

## 18. Airborne industrial emissions from iron pellet manufacturing, port infrastructure and thermoelectric power. | Low

**Description**
Certain industrial activities cause airborne iron deposition. The pollutant is deposited on *Copiapoa* habitats and individuals, impacting on the plant's capacity for photosynthesis and gas exchange.

**Impacts**
- Reduces seedling survival
- Reduces habitat quality
- Pollution affects flora and faunal communities.

**Geographic scope**
Coast of Atacama Region.

**Species scope**
*Copiapoa calderana, C. grandiflora, C. fiedleriana, C. australis*

## 19. Military exercises

| Low

**Description**

Trampling of plants by vehicular traffic, and the installation of camps. Habitat destruction caused by military exercises with real weaponry.

**Impacts**

- Reduces seedling survival
- Reduces survival of mature individuals
- Loss of seeds and/or individuals from the wild
- Reduces habitat quality
- Likely soil and seed bank compaction
- Creation of trails and tracks
- Crushing of native flora
- Dust emissions
- Creation of all types of waste, particularly non-degradable waste such as plastics, causing associated habitat deterioration

**Geographic scope**

Coast of Antofagasta Region, south of Taltal

**Species scope**

*Copiapoa rupestris, C. cinerea subsp.columna-alba, C. desertorum, C. humilis subsp. tenuissima* (military areas south of Caleta Coloso), and *C. atacamensis* (La Chanida).

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## 20. Pests and diseases | Low

**Description**

Some *Copiapoa* species are affected by pathogens such as *Fusarium oxysporum* found in populations of *C. solaris*.

**Impacts**

- Reduces seedling survival
- Reduces survival of mature individuals
- Decreases seed production
- Spread of infectious diseases.

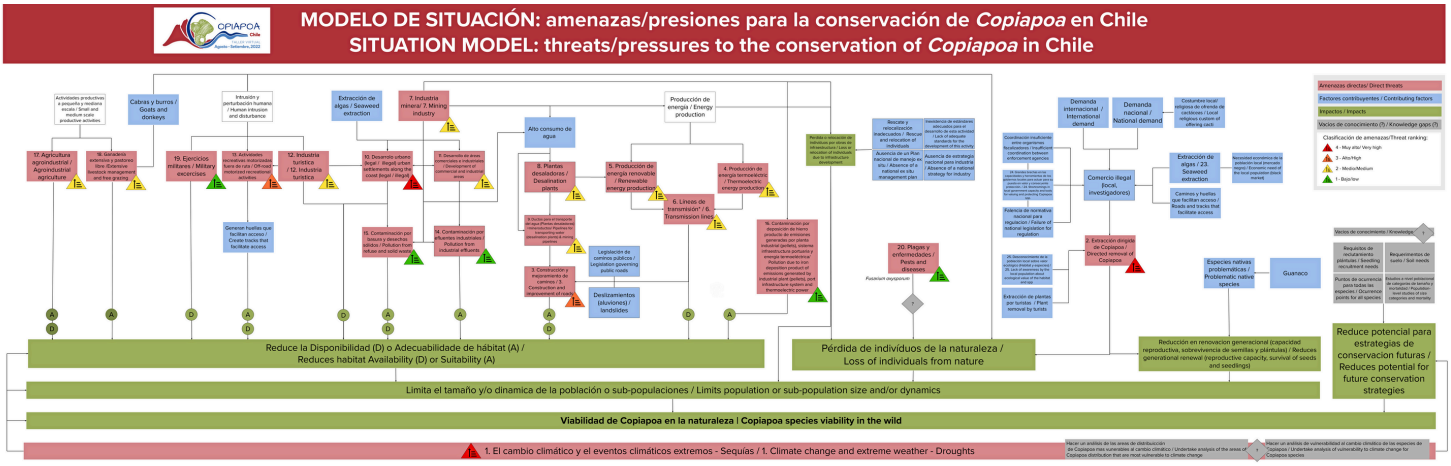
**Geographic scope**

Coast of Antofagasta Region.

**Species scope**

*Copiapoa solaris*

# SITUATION MODEL




**To see the complete situation model in better resolution click here**

Cacti of the genus *Copiapoa*, and their habitats, are valued, conserved, and restored through actions that are coordinated globally between public and private stakeholders, ensuring their long-term viability, and creating a meeting point between people and the natural environment within the identity of the communities that coexist with them in Chile.

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# GOAL

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Within 8 years of the plan's implementation, 25% of threatened (CR, EN, VU) *Copiapoa* species show signs* of stabilization or recovery. Furthermore, at least 50% of the populations of threatened species are present in protected areas, and an additional 25% within other effective area-based conservation measures**, and at least 50% of *Copiapoa* species for which it is technically defined as being necessary, will have *ex situ* conservation plans underway, integrated with population management, recovery, restoration and research programs.

**Signs: presence of seedlings, reduction in the presence of deceased adults, control of habitat destruction and illegal trade.*
***Other effective area-based conservation measures: self-nomination as Protected National Assets.*

**Indicators**

- % of *Copiapoa* species with stable or increasing population trends.
- % of populations of threatened (CR, EN, VU) species that are present in protected areas or other effective area-based conservation measures.
- % of *Copiapoa* species, for which it is technically defined as being necessary, that are safeguarded in *ex situ* collections, and available for conservation needs.

## 1. Legislation, enforcement and habitat

**1.1:** Foster the adoption of habitat protection standards and criteria amongst development projects (small, medium and large scale), and other relevant anthropogenic activities, within the known distribution areas of species of the *Copiapoa* genus.

**1.2:** Increase the protection of populations of threatened (CR, EN, VU) *Copiapoa* species and their habitats through protected areas or other effective area-based conservation measures, including the creation and/or strengthening of coordinated intersectorial oversight and control.

**1.3:** Include the protection of *Copiapoa* in the development and evaluation of Territorial Planning Instruments (IPT) and sectoral policies (strategic environmental evaluation SEA, public and private company policies, native forest law), including the creation and/or stregthening of intersectorially coordinated oversight and control.

## 2. Intensive management (*in situ / ex situ*), climate change, and knowledge gaps

**2.1:** Strengthen lines of research necessary to evaluate, inform and measure the effectiveness of conservation actions, *in situ* and *ex situ*.

**2.2:** Develop and implement integrated management strategies, both *in situ* and *ex situ*, to support the resilience of populations and mitigate threats.

**2.3:** Describe and quantify possible effects of climate change on *Copiapoa* populations to propose mitigation strategies for impacts throughout its range.

## 3. Socioeconomic and political

**3.1:** Prevent, combat and control the illegal extraction of *Copiapoas.*

**3.2:** Increase knowledge and awareness of the species of the Copiapoa genus, creating an identity in the territory and transforming the local community into agents of protection, raising awareness of the genus at the national level, and promoting best practice among growers and enthusiasts globally.

To view the full spreadsheet of actions, click HERE

## 1.Legislation, enforcement and habitat

**1.1 Foster the adoption of habitat protection standards and criteria amongst development projects (small, medium and large scale), and other relevant anthropogenic activities, within the known distribution areas of species of the *Copiapoa* genus.**

| STRATEGY LINE | MONITORING INDICATOR |
|---|---|
| 1.1.1 Reduce or mitigate the impacts of livestock practices and free grazing on *Copiapoa* species and their habitat | Reduction in the amount of grazing livestock, mainly goats and donkeys within areas that are relevant for *Copiapoa* (Huasco to Los Choros, Taltal to Paposo). |
| 1.1.2 Restrict off-road motorised activities (official and unofficial rallies, 4x4) that degrade or destroy *Copiapoa* plants and their habitat. | Reduction in off-road motorized activities. |
| 1.1.3 Incorporate considerations for the protection of *Copiapoa* within the National Environmental Impact Assessment System. | Percentage/number of projects incorporating standards and criteria for the protection of *Copiapoa*. |
| 1.1.4 Incorporate considerations for the protection of *Copiapoa* outside of the National Environmental Impact Assessment System. | Number of sectorial considerations or instructions developed and disseminated. |

**1.2: Increase the protection of populations of threatened (CR, EN, VU) *Copiapoa* species and their habitats through protected areas or other effective area-based conservation measures, including the creation and/or strengthening of coordinated intersectorial oversight and control.**

| STRATEGY LINE | MONITORING INDICATOR |
|---|---|
| 1.2.1 Increase the surface area of natural populations of *Copiapoa* species within officially protected areas. | Increase in the extent of protected areas, relative to the initial baseline and over time. |
| 1.2.2 Encourage the implementation of measures that facilitate conservation within the distribution range of *Copiapoa* species (e.g. legal measures to foster conservation on private land, biological corridors, exclusion zones, municipal bylaws, etc.) | Surface are with *Copiapoa* populations incorporated into conservation measures based on areas other than Protected Areas |

| **1.3 Include the protection of *Copiapoa* in the development and evaluation of Territorial Planning Instruments (IPT) and sectoral policies (strategic environmental evaluation SEA, public and private company policies, native forest law), including the creation and/or stregthening of intersectorially coordinated oversight and control.** | |
|---|---|
| **STRATEGY LINE** | **MONITORING INDICATOR** |
| 1.3.1 Establish legal instruments that contribute to the protection of *Copiapoa* natural populations and areas of relevance | Number of *Copiapoa* species incorporated in the DS 68/2009 MINAGRI. |
| 1.3.2 Prevent illegal land occupation in areas that are relevant for *Copiapoa* through intersectoral action. | % of measures to reduce or reverse illegal occupation that have been evaluated<br><br>Protocol established and implemented |
| 1.3.3. Implement measures for the conservation of *Copiapoa* species and their habitat in areas with property subdivisions, and in rural areas. | Increase in measures for the conservation of *Copiapoa* and their habitat that are under implementation |
| 1.3.4 Include environmental criteria for the protection of *Copiapoa* habitat in the design and prefeasibility phase, and construction and maintenance of roads. | Increased consideration of environmental criteria related to *Copiapoa* habitat. |
| 1.3.5 Ensure that land use planning tools incorporate the necessary protection measures for areas where *Copiapoa* populations are present. | Number of Territorial Planning Tools with built-in protection measures |
| 1.3.6 Provide training on the *Copiapoa* plan for parties responsible for monitoring and sanctioning non-compliance. | Number of training activities carried out.<br><br>Number of institutions included.<br><br>Number of participants in the training activities. |

## 2. Intensive management (*in situ / ex situ*), climate change and knowledge gaps

| **2.1 Strengthen lines of research necessary to evaluate, inform and measure the effectiveness of conservation actions, *in situ* and *ex situ*.** | |
|---|---|
| **STRATEGY LINE** | **MONITORING INDICATOR** |
| 2.1.1 Increase in scientific research on *Copiapoa* systematics, ecology and taxonomy. | Percentage of threatened (VU, EN and CR) *Copiapoa* species for which scientific and ecological research is in progress or has been published.<br><br>Number of research projects undertaken. |
| 2.1.2 Initiate monitoring of population dynamics and threats to priority species | Survey of threats, including baseline information.<br><br>Diagnosis of current and emerging threats.<br><br>Demographic analysis carried out. |

| **2.2 Develop integrated management strategies, *in situ* and *ex situ*, to support population resilience and to mitigate threats** | |
|---|---|
| **STRATEGY LINE** | **MONITORING INDICATOR** |
| 2.2.1 Develop actions for *in situ* management | Partnerships established with private landowners<br><br>Publication dissemination of legal good practice standards for reserach and colection<br><br>Publication/dissemination of guidelines for mitigation and compensation plans, and their oversight<br><br>Creation of expert group to inform intensive management actions<br><br>Publication/dissemination of criteria for the implementation of intensive *in situ* management measures<br><br>Feasibility evaluation for the use of *in situ* propagated seeds for the conservation of wild populations. |

| | |
|---|---|
| 2.2.2. Develop actions for the conservation of populations through the use of *ex situ* conservation tools. | Publication and dissemination of a report detailing how the RECOGE Plan for *Copiapoa* and the National Plan for *Ex Situ* Conservation of Flora (in preparation MMA) are linked.<br><br>Publication and dissemination of a survey of collections and global management plan for the *ex situ* conservation of *Copiapoa*.<br><br>Number of collections participating in the Chilean network of management for the *ex situ* conservation of *Copiapoa*.<br><br>Publication and dissemination of technical guidelines for germination, cultivation, pollination, seed production, and seed viability/longevity tests with cold storage in *ex situ* populations. |
| 2.2.3.Develop integrated conservation strategies that promote the use of *ex situ* populations for the conservation of *in situ* populations, for the purposes of restoration, relocation, reintroduction and introduction of species. | Publication and dissemination of the *ex situ* strategy for the conservation of *Copiapoa*.<br><br>Number of nurseries and collectors participating in best practice campaign.<br><br>Increased availability of *ex situ* cultivated seeds and plants.<br><br>Number of people trained to control the illegal trade.<br><br>Formation of expert group to inform intensive management actions.<br><br>Publication/dissemination of criteria for the implementation of intensive *ex situ* management measures. |
| **2.3 Describe and quantify possible effects of climate change on *Copiapoa* populations to propose mitigation strategies for impacts throughout its range.** | |
| **STRATEGY LINE** | **MONITORING INDICATOR** |
| 2.3.1 Describe and quantify the possible effects of climate change on *Copiapoa* populations. | Publication and dissemination of climate change models.<br><br>Publication and dissemination of research on variations in water availability.<br><br>Publication and dissemination of research report on population dynamics in relation to climate change and water availability. |
| 2.3.2 Develop management strategies to reduce the impacts of climate change on *Copiapoa* populations | Publication and dissemination of action plan for each species. |

## 3. Socioeconomic and political

| **3.1 Prevent, combat and control the illegal extraction of *Copiapoas*** | |
|---|---|
| **STRATEGY LINE** | **MONITORING INDICATOR** |
| 3.1.1. Strengthen enforcement and implementation of national and international regulations to control illegal harvesting and trade of *Copiapoa* and its parts. | Number of regulations that apply.<br><br>Number of national and international mechanisms implemented. |
| 3.1.2. Establish a network of nurseries for formal production and sale, with a national and international certification and traceability system, to promote legal trade in *Copiapoa*. | Formation of the network and number of participants; implementation of a network work programme.<br><br>Formation of certification and traceability system. |

| **3.2 Increase knowledge and awareness of the species of the *Copiapoa* genus, creating an identity in the territory and transforming the local community into agents of protection, raising awareness of the genus at the national level, and promoting best practice among growers and enthusiasts globally.** | |
|---|---|
| **STRATEGY LINE** | **MONITORING INDICATOR** |
| 3.2.1. Develop and implement an outreach programme that includes global education, outreach and communication for cacti with a focus on *Copiapoa*, which is integrated into national curriculum-adjusted education programmes, focused on decreasing demand for illegal harvesting and trade and identity promotion. | Education, Dissemination and Communication Programme developed in a participatory manner.<br><br>Implementation of the Education, Dissemination and Communication Programme.<br><br>Number of institutions participating in the implementation of the plan. |
| 3.2.2. Develop an engagement programme through citizen science initiatives and active protection of *Copiapoa* populations. | Engagement programme developed in a participatory manner.<br><br>Implementation of the programme.<br><br>Number of people participating in these initiatives.<br><br>Citizen science platform/application implemented.<br><br>Number of people collaborating on the platform. |

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# PRIORITIZATION OF STRATEGY LINES

## PRIORITIZATION

Listed below are the 23 strategy lines in order of descending priority, according to their expected conservation impact (1 - 5) and feasibility of implementation (1 - 5). These scores are then added up to give an overall priority rating.

| STRATEGY LINES | Impact | Viability | PRIORITY | |
|---|---|---|---|---|
| 1.3.6 Provide training on the *Copiapoa* plan for parties responsible for monitoring and sanctioning non-compliance. | 4 | 4 | 8 | Very high |
| 1.1.3 Incorporate considerations for the protection of *Copiapoa* within the National Environmental Impact Assessment System. | 4 | 3 | 7 | High |
| 1.1.4 Incorporate considerations for the protection of *Copiapoa* outside the Environmental Impact Assessment System. | 4 | 3 | 7 | High |
| 1.3.1 Establish legal instruments that contribute to the protection of *Copiapoa* natural populations and areas of relevance. | 4 | 3 | 7 | High |
| 1.3.5 Ensure that land use planning tools incorporate the necessary protection measures for areas where *Copiapoa* populations are present. | 4 | 3 | 7 | High |
| 2.1.1 Increase in scientific research on *Copiapoa* systematics, ecology and taxonomy. | 4 | 3 | 7 | High |
| 2.2.1. Develop actions for *in situ* management. | 4 | 3 | 7 | High |
| 1.2.1 Increase the surface area of natural populations of *Copiapoa* species within officially protected areas. | 4 | 3 | 7 | High |
| 1.1.2 Restrict off-road motorised activities (official and unofficial rallies, 4x4) that degrade or destroy *Copiapoa* plants and their habitat. | 3 | 3 | 7 | High |
| 1.3.4 Include environmental criteria for the protection of *Copiapoa* habitat in the design and prefeasibility phase, and construction and maintenance of roads. | 4 | 3 | 7 | High |
| 3.2.1. Develop and implement an outreach programme that includes global education, outreach and communication for cacti with a focus on *Copiapoa*, which is integrated into national curriculum-adjusted education programmes, focused on decreasing demand for illegal harvesting and trade and identity promotion. | 2 | 4 | 6 | Medium |
| 1.3.2 Prevent illegal land occupation in areas that are relevant for *Copiapoa* through intersectoral action. | 3 | 2 | 5 | Medium |

**Despite not having had a rating of more than 7 (high and very high), in plenary, it was decided to include them in the high priority lists with the justification of being linked to two of the main threats (illegal extraction and illegal occupations).*

| STRATEGY LINES | Impact | Viability | PRIORITY | |
|---|---|---|---|---|
| 1.2.2 Encourage the implementation of measures that facilitate conservation within the distribution range of *Copiapoa* species (e.g. legal measures to foster conservation on private land, biological corridors, exclusion zones, municipal bylaws, etc.). | 4 | 3 | 7 | High |
| 2.1.2 Initiate monitoring of population dynamics and threats to priority species. | 4 | 3 | 7 | High |
| 2.2.3.Develop integrated conservation strategies that promote the use of *ex situ* populations for the conservation of *in situ* populations, for the purposes of restoration, relocation, reintroduction and introduction of species. | 4 | 3 | 7 | High |
| 2.3.1 Describe and quantify the possible effects of climate change on *Copiapoa* populations. | 4 | 3 | 7 | High |
| 3.1.1. Strengthen enforcement and implementation of national and international regulations to control illegal harvesting and trade of *Copiapoa* and its parts. | 4 | 3 | 7 | High |
| 2.2.2. Develop actions for the conservation of populations through the use of *ex situ* conservation tools. | 3 | 3 | 7 | High |
| 1.1.1 Reduce or mitigate the impacts of livestock practices and free grazing on *Copiapoa* species and their habitat. | 2 | 3 | 5 | Medium |
| 1.3.3. Implement measures for the conservation of *Copiapoa* species and their habitat in areas with property subdivisions, and in rural areas. | 3 | 2 | 5 | Medium |
| 2.3.2 Develop management strategies to reduce the impacts of climate change on *Copiapoa* populations. | 3 | 2 | 5 | Medium |
| 3.1.2. Establish a network of nurseries for formal production and sale, with a national and international certification and traceability system, to promote legal trade in *Copiapoa*. | 3 | 2 | 5 | Medium |
| 3.2.2. Develop an engagement programme through citizen science initiatives and active protection of *Copiapoa* populations. | 2 | 3 | 5 | Medium |

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# GOVERNANCE AND IMPLEMENTATION

## WORKING GROUP

**Functions:**

- Consolidation of suggestions and changes to the final report, and in the complete spreadsheet.
- Participation in a biannual meeting (2023-2025) of the Working Group.
- Dissemination and liaison with the stakeholders responsible for implementation of the *Copiapoa* Action Plan.
- Provide support in sourcing resources for the implementation of the Plan.
- Provide information and updates on the implementation of actions to the Steering Group Coordinators (Barbara - *in situ*; Paul - *ex situ*).
- Systematization of updates on the implementation of actions prior to the biennial monitoring meetings.
- Proposal of adjustments to the *Copiapoa* Plan throughout its execution.
- Participation in monitoring workshops (Working Group + parties responsible for the actions), in person or virtually, to evaluate the execution of actions, with legitimacy to propose adjustments to these, including expected outputs, responsible parties, deadlines, employees, estimated costs and locations.

**Integrated by:**

Public or private bodies and individuals (e.g. researchers) with expertise on the species, who have the necessary knowledge or experience in accordance with the needs of the plan.

**Structure of the Working Group**

1. Coordination level
   - International: IUCN SSC CSSG (Barbara Goettsch - coordination of *in situ* actions); Chester Zoo (Paul Bamford - coordination of *ex situ* actions)
   - National: University of Concepción/Institute of Ecology and Biodiversity (Pablo Guerrero)
2. Operationalisation and monitoring level
   - Public sector, national: MMA (Leonora Rojas); CONAF (Maria Carolina Gazmuri, Rodrigo Herrera)
   - Public sector, regional: MMA (Beatriz Ramirez, Álvaro Parra); CONAF (Victor Muñoz, Jorge Carabantes, Moises Grimberg)
   - Research: Universidad de Concepción (Pablo Guerrero and Carol Peña); INFOR (José Hernandez)
   - *Ex Situ*: INIA (Ana Sandoval); Cactus Lagarto (Santiago Figueroa)
   - Communication and Education: CONAF (Moises Grimberg/Jorge Carabantes)
3. Implementation level
   - Communities of work to be defined and formed for each Objective by the sub-groups of the articulation and monitoring level.

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# APPENDICES

# APPENDIX I
Participant list

| Institution | Name |
|---|---|
| Biota Gestión y Consultorías Ambientales Ltda. | Luis Faundez |
| Centro de Estudios Avanzados en Zonas Áridas | Alexandra Stoll |
| Chester Zoo | Paul Bamford |
| Corporación Nacional Forestal | Jorge Carabantes |
| | Jose Luis Gutierrez |
| | Maria Carolina Gazmuri |
| | Moises Grimberg |
| | Werther Marcoleta |
| Huntington Botanical Gardens | Raquel Folgado |
| INIA INTIHUASI | Ana Sandoval |
| Instituto Forestal | José Hernández |
| | Marlene Gonzalez |
| | Marcelo Rosas |
| | Sergio Silva |
| IUCN SSC Cactus and Succulent Plants Specialist Group | Barbara Goettsch |
| Jardin Botánico Nacional | Mauricio Cisternas |
| Ministerio de Obras Publicas | Manuel Donoso |
| Ministerio del Medio Ambiente | Charif Tala |
| | Leonora Rojas |
| | Paulina Stowhas |
| | Reinaldo Aviles |
| Ministerio del Medio Ambiente - Región de Antofagasta | Beatriz Ramírez |
| Ministerio del Medio Ambiente - Región de Atacama | Álvaro Parra |
| Ministerio del Medio Ambiente - Región de Coquimbo | Claudia Accini |
| Ministerio del Medio Ambiente - SEREMI Antofagasta | Carlos Alberto Cares Medrano |

| Institution | Name |
|---|---|
| Mondocactus | Andrea Cattabriga |
| Museo Nacional de Historia Natural | Gloria Rojas |
| Royal Botanic Gardens, Kew | Paul Rees |
| Servicio Agricola y Ganadero - Región de Antofagasta | Jorge Muñoz Camadro |
| Universidad de Concepción | Pablo Guerrero |
| | Angelica Maria Villalobos Lopez |
| | Carol Peña |
| | Marcelo Rosas |
| Universidad de La Serena | Francisco Squeo |
| | Gina Arancio |
| | Luis Fernando Velarde Simonini |
| Universidad de Valparaíso | Carmen Gloria Ossa |
| University of Arizona | Michiel Pillet |
| Vivero Cactus Lagarto | Santiago Figueroa |

# APPENDIX II
Workshop agenda

| Day 1 | 31st August 2022 |
|---|---|
| Time | Activiity |
| 08:35 | Opening and welcome |
| 09:20 | Introduction to CPSG and RECOGE planning process |
| 09:45 | Levelling presentations:<br>- Natural history and ecology of the genus Copiapoa<br>- Updates in the taxonomy of Copiapoa<br>- The genus Copiapoa under climate change |
| 10:50 | Break |
| 11:10 | Levelling presentations:<br>- Assessment of extinction risk in species of the genus Copiapoa (Cactaceae).<br>- Protection and conservation of species of the genus Copiapoa: an approach from the management of the National System of State Protected Wild Areas<br>- BGCI's Global Conservation Conservation Consortia |
| 12:15 | Threats to Copiapoa |
| 12:30 | Close |
| 14:00 - 16:00 | Asynchronous activity: add detail to threats descriptions |
| **Day 2** | **1st September 2022** |
| Time | Activiity |
| 08:30 | Opening |
| 08:45 | Visioning activity |
| 09:30 | Plenary: threats |
| 10:30 | Break |
| 10:50 | Plenary: threats (cntd.) |
| 12:30 | Close |
| 14:00 -16:00 | Asynchronous activity: review of threats descriptions |
| **Day 3** | **7th September 2022** |
| Time | Activiity |
| 09:30 | Opening |
| 09:55 | Plenary: vision |
| 10:45 | Break |
| 10:55 | Plenary: scope and goal |
| 11:20 | Plenary: threats (cntd.) |
| 13:20 | Division into working groups |
| 13:30 | Close |
| **Day 4** | **8th September 2022** |
| Time | Activiity |
| 09:30 | Opening |
| 09:40 | Plenary: vision (cntd.) |
| 10:20 | Plenary: threats (cntd.) |
| 12:00 | Break |
| 12:10 | Presentation and discussion: roles of ex situ conservation |
| 13:20 | Close |

| Day 5 | 9th September 2022 |
|---|---|
| Time | Activiity |
| 09:30 | Opening |
| 10:20 | Working groups: defining objectives |
| 12:20 | Break |
| 12:40 | Plenary: objectives |
| 13:20 | Close |
| Day 6 | 14th September 2022 |
| Time | Activiity |
| 09:00 | Opening |
| 09:10 | Plenary: scope and goal |
| 10:10 | Plenary: objectives |
| 11:10 | Break |
| 11:30 | Working groups: strategy lines |
| 13:00 | Close |
| Day 7 | 15th September 2022 |
| Time | Activiity |
| 09:00 | Opening |
| 09:10 | Review of genus distribution map |
| 09:25 | Working groups: strategy lines |
| 11:10 | Break |
| 11:30 | Plenary: strategy lines |
| 13:00 | Close |
| Day 8 | 3rd October 2022 |
| Time | Activiity |
| 09:00 | Opening |
| 09:15 | Working groups: actions |
| 13:00 | Close |
| Day 9 | 5th October 2022 |
| Time | Activiity |
| 09:00 | Opening |
| 09:15 | Final validation of distribution map |
| 11:45 | Final validation of goal |
| 12:35 | Explanation of next steps |
| 13:00 | Close |

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# Planning Workshop for the Integrated Conservation of the Genus COPIAPOA

ONLINE WORKSHOP

**August - October, 2022**

**Chile**