



NATIONAL PROGRAM FOR RESEARCH CENTERS OF EXCELLENCE
(FONDAP)

CONTINUITY PLAN EVALUATION REPORT

This form is intended to facilitate your work as a referee and standardize the evaluation reports. Each topic should be evaluated with concepts ranging from “Excellent” to “Does Not Qualify”. **PLEASE INDICATE YOUR QUALIFICATION FOR EACH CRITERION IN A SCALE BETWEEN 0 TO 5 POINTS (HALF POINTS ARE ALSO ALLOWED)**. Each qualification must be properly supported with relevant comments.

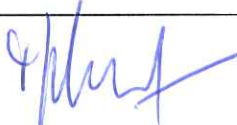

Grading scale:

0 = Does Not Qualify	The proposal fails to meet/address the criterion under analysis or cannot be evaluated due to missing or incomplete information.
1 = Poor	The proposal does not properly meet/address the aspects of the criterion or there are serious inherent deficiencies.
2 = Fair	The proposal broadly meets/addresses the aspects of the criterion, but there are important deficiencies.
3 = Good	The proposal properly meets/addresses the aspects of the criterion, although some improvements are required.
4 = Very Good	The proposal meets/addresses the aspects of the criterion very well, although some improvements are still possible.
5 = Outstanding	The proposal successfully meets/addresses all the aspects of the criterion. Any shortcomings are minor.

If the Center report does not contain information on the given topic, please indicate so in your evaluation.

Your final overall comments and recommendations are an important part of the review process.

I. PROJECT INFORMATION
CENTER'S NAME: Center for Climate Research and Resilience (CR2)
DIRECTOR: Dr Laura Gallardo

II. EVALUATION PANEL			
REFEREE NAME	ORGANIZATION/ INSTITUTION	E - MAIL	SIGNATURE
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III. PROPOSAL EVALUATION

1. Goals and objectives for the next five-year period

i. Comments

In its original proposal several years ago, the mission of the Centre was relatively generic: "... to develop Earth System Science in Chile to increase our understanding of the functioning of the climate system and look into new approaches to create resilience to climate change."

And now, after nearly five years of operation, it is very clear that the CR2 has succeeded in meeting those broad objectives. The Centre has markedly helped to increase our collective understanding of the expressions and impacts of climate change in Chile, all while keeping resilience in mind, working to improve the capacity of the country to absorb and adapt to the major changes afoot. What is particularly striking is that the CR2 has communicated its analyses and results vigorously to all levels of Chilean society, notably including the policy realm.

But times change. Priorities evolve. The Centre has been commendably proactive in recognizing from the outset that success in 'creating resilience' and 'increasing understanding' cannot be achieved via traditional disciplinary pathways. Rather a fully interdisciplinary approach--one in which researchers from disparate backgrounds bring their skills to bear on common questions--will yield optimal results. And while they practiced that in Phase 1, the CR2 team recognized that it could do even more to make its research results both accessible to and applicable for policymakers.

It was with that thinking in mind that the Phase 2 goals and objectives were built around a mission appropriately more focused than that in Phase 1: conduct fully interdisciplinary research on common questions of direct relevance to Chilean society. Necessarily, the Phase 2 approach is to put greater emphasis on the interface between physical and social scientific insights and the policy world. Governance is now a keyword.

The research program in Phase 2 is to be organized around "five complex problems framed within climate variability and change and societal resilience". Each is to be addressed by interdisciplinary research teams that will comprise natural and social scientists, including where appropriate economics, sociology, psychology, and law. While discovery and developing fundamental understanding will remain principal objectives, strategies that consider governance challenges will be developed in parallel.

Each of the five major Phase 2 concerns is timely and all are highly relevant:

- Water availability and extremes;
- Land use change;
- Cities in a changing climate;
- The coastal zone;
- Governance and policy-science interface

The first three of these were prominent in Phase 1 where they served as integrating questions and the last two are explicit additions to the Phase 2 program. We note that when considered collectively, the five themes or 'Research Lines' capture well most of the major issues that confront Chile as it faces the climate-change challenge.

But, they are also non-specific. In recognition of that, the CR2 is proposing to incorporate a sixth research objective: a suite of integrative questions, directly relevant to Chilean society, that will be tackled by early to mid-career scientists who will serve as leaders or co-leaders of interdisciplinary teams. As of this writing, those questions include wildfire regimes, urban air pollution, extreme rainfall events and droughts, and harmful algal blooms. All are to be explored in the context of climate variability and long-term change. The primary goal of this sixth line is to provide knowledge in the short term (i.e. two to two and one-half years) that can be used to help society and policymakers respond to such specific challenges. And in recognizing that the research community is capacity-constrained, these integrative questions are to be staged over the duration of the Phase 2 program. Overall, the sixth line is an innovative addition that promises to yield much value.

The anticipated outcomes of this work will be many, for example:

- With respect to hydrometeorological extremes, disentanglement of natural climatic variability and the human influence on the climate system. This work should yield 'actionable science' that will assist Chile in preparing for, and adapting to, flood events and droughts.
- Identification of mechanisms (related to climate change and variability) that affect coastal oceanographic processes, primarily biological or biogeochemical, that impact fisheries productivity, recognizing the value of both the coastal fishery and aquaculture to Chile's economy.
- Enhancement of policies that will sustain provision of ecosystem goods and services in the face of climate variability, including such concerns as forest management and the role forests play in runoff and carbon sequestration.
- Enhancement of the resilience capacities of Chilean cities in the face of extreme weather events, air pollution hazards, and provision of basic services such as cold-season heating.
- Provision of options for governance that will help Chile meet its Paris 2015 commitment of at least a 30% decline in greenhouse gas emissions by 2030, per unit of GDP.

As reviewers we are impressed with the maturity that the CR2 now exhibits: 'continuous improvement' is one phrase that we use to describe its evolution as a centre. And in that context, we foresee that the ongoing work of the centre will provide additional side benefits should Phase 2 be funded:

- Significant continued strengthening of the emerging community of Earth system scientists, both natural and social, in Chile.
- Strengthening the organizational fabric of the Centre, through establishment of formal protocols for membership and associated responsibilities.



- Strengthened assessments and development of junior research personnel (associated researchers and post-doctoral fellows, in particular).
- A strengthened focus on external fund raising.
- Reinforced networking, particularly with a growing list of international partners and affiliates. Such efforts are to be enhanced by hosting international conferences and summer schools in Chile, now scheduled for January 2019 and January 2021.

Finally, the outreach and communications efforts of the CR2 in Phase 1 were outstanding. Adjustments proposed for Phase 2 can be expected to reinforce the very high level of performance in the area of communications and knowledge mobilization that the Centre has demonstrated to this point. A second full-time journalist is to be appointed, a move that we salute. In addition, existing communications programs will be strengthened, including RedLama, a graduate-student led initiative that works with school children. We note that RedLama was discussed with enthusiasm by graduate students in the block interview with the evaluation panel. And amongst other initiatives, the Centre intends to maintain its continuing education program entitled, "Climate change and low -carbon development: an interdisciplinary challenge". That effort was mounted in Phase 1 in collaboration with the Center for Solar Energy and the Energy Center, both at the University of Chile. The importance of such societally-relevant outreach efforts is not to be underestimated, and the willingness of the CR2 to both continue and strengthen them is laudable.

In summary, the goals and objectives proposed for the next five years are timely, highly tuned to Chile's national needs, and can be expected to build directly on existing successes. They offer additional strengths, in particular the innovative inclusion of a limited set of integrative specific research questions that will be co-led by 'younger' scientists. That novel structure will reinforce the development of the next generation of climate-science researchers, to the longer-term benefit of Chile.

ii. Evaluation **Please indicate your qualification in a scale between 0 to 5 points (half points are also allowed).**

Outstanding	Very Good	Good	Regular	Poor	Not Qualify
5					



2. Expected educational impact of the center in the short and long term. Please analyze the Center strategy to influence on human resources formation (PhD students and postdoctoral fellows).

i. Comments

CR2's original vision included not just advancing science, but strengthening the community of social and physical scientists in Chile. CR2 has grown three-fold in its first phase (from 7 to 21 researchers), but remains small relative to the scale of importance and relevance of the research it is conducting. The Centre's educational goal is more than just building capacity – it is also about building a climate and Earth System Science capability that is truly interdisciplinary. That laudable intention confers uniqueness.

In our interviews, we heard from the Postdoctoral researchers that there was nowhere else in Chile that offers a multi-disciplinary research environment like CR2. They remarked how greatly they valued this rare research and training environment. We heard from the undergraduate and graduate students that in their eyes CR2 is “the only institution to look at climate in a multi-disciplinary way”. It's important to add, however, that this breadth does not seem to have come at the cost of scientific quality, in either the research or the nature of thesis topics being pursued by the students.

CR2 clearly made significant progress towards achieving this goal in Phase 1. But as noted by its Director their research cohort is still small, and so continuing to pursue this vision remains an important strategic goal for Phase 2.

The Continuity Plan identifies that in its second Phase, CR2 will grow as follows:

- a) Four new, fulltime Associate Researchers are to be appointed (this is understood to be in addition to the four requested in 2017) and will join the current team of 19. They will be appointed beginning in 2018 and beyond and each position will have a four to five year duration.
- b) Two new Adjoint researchers with PhDs in Law are to be appointed, and will join the current team of 14 Adjoint scholars.
- c) Three new Postdoctoral Fellows (PDFs) will be appointed in 2018, joining the current team of eight. The intent is to hire five new PDFs each year thereafter. CR2-funded PDF appointments are two years in duration.

These new appointees will join the current research team of six Principal Researchers, thereby enabling CR2 to grow its researcher cohort to ca. 30 FTE by 2022. This proactive strategic decision by the CR2 leadership recognizes their commitment to growing the research team to maximize the research and educational outcomes. Specifically, they plan for the PDFs to work on the four integrative questions. Given that those have been well defined, the CR2 PDF researchers will receive clear focus and direction. Moreover, the research projects associated with the quartet of integrative questions will be led by early- to mid- career researchers. That will enrich the training experience for the PDFs and enhance their opportunities for future employment.

The PDFs in particular clearly felt very positive about the Phase 2 plans. One noted that, “The transversal problem approach is very good; these are important issues for the country.” Another remarked on the mutual respect that is characteristic within the CR2



community saying, “We are treated as equals.” That comment reinforced the impression that the reviewers developed over the course of our evaluation: the CR2 has established an enviable intellectual culture in which all ideas are welcome and discussed openly. As one graduate student put it, “Our voices are heard.”

As well as growing the PDF cohort, and aiming to provide a better research and training experience, the plan in Phase 2 is to enhance the educational offering through developing an interdisciplinary, inter-institutional doctoral program and running two summer schools for PhD students. We note that the latter are already scheduled for 2019 and 2021.

Beyond building the research capacity and developing research skills for Postgraduate and PDFs, a great strength of CR2’s plan for Phase 2 is the research experience and educational impact that will be provided by the Centre’s unique and powerful commitment to high-quality science. That commitment goes beyond exploiting a single disciplinary approach and explicitly aims to be societally-relevant. This means that students and researchers are exposed to a broad range of disciplinary approaches. In addition they receive training in media skills (alongside journalist trainees in Phase 2) and are encouraged to pursue stakeholder engagement and outreach activities. We heard in our interviews that Postdocs greatly valued these opportunities to explore, and contribute to, a broader perspective – including to research outputs such as the Report to the Nation and the multidisciplinary papers on the Anthropocene that will appear in a special issue of *Elementa*. They also commented on the important value for them personally that was realized when they evolved from the relatively isolated PhD experience to the more collaborative environment offered at CR2.

CR2’s investment in research (laboratories, field and analytical equipment, high performance computing) and data infrastructure has also delivered value and experience to the student and PDF community. The open data policy, which enables unique and important data sets to be shared freely among researchers, was seen to be highly beneficial as was the commitment to publishing in the open-access literature. The PDFs we interviewed felt that this set CR2 up as a centre not just for Chile, but for all of Latin America.

In terms of areas for improvement, there was a sense amongst the students that the goals of CR2 could be enhanced by more frequent “reunions” (which we take to mean workshops or retreats involving all CR2 staff), where research ideas and experiences can be shared and the students can learn more from each other. Such meetings would also facilitate greater engagement between the senior researchers, PDFs and the students. Other issues raised included the need to ensure that the kinds of research outputs and impacts sought by CR2 will also benefit the career development of the researchers.

We also note the intent by CR2 to build a strong culture of ongoing institutional development in Phase 2. This is in response to the experience in Phase 1 that the Centre’s research explores complex, multi-faceted questions, and success lies in filling the gap between discovery (“curiosity-driven”) and applied (“solutions-focused”) research.

From its Organizational Assessment, the Centre has adopted the following approaches to enhance the training element for PDFs and graduate students, and therefore the



educational impact (these are the relevant subset of, and paraphrased from, the Continuity Plan, P. 7):

- Establish protocols for staff who are part of CR2, in terms of their roles;
- Regularly evaluate the performance of individuals and teams;
- Improve the search and selection process for hiring new staff;
- Carry out at least two plenary meetings per year for all CR2 personnel;
- Periodically document CR2's evolution in a systematic and transparent way – including monitoring results and outputs.

The CR2 Final Report (June 2017) identified concerns about the modest number of PhD theses that had been completed to date in Phase 1. When asked at interview about plans to address this concern in Phase 2, the CR2 Director was honest and pragmatic about this challenge, given CR2's modest funding and relatively non-traditional multidisciplinary emphasis.

It bears mention that the difficulty in attracting top-notch PhD students is an issue throughout the developed world; the CR2 is not alone in acknowledging that challenge. But the Centre does have an excellent product to offer: interdisciplinary research opportunities of very high and internationally-competitive intellectual quality coupled with a bonus. And the bonus is important: graduate research topics within the CR2 arena speak directly to issues of critical societal concern. That is a powerful attractant for prospective students and it warrants vigorous international promotion by the Centre. We suggest that such promotion could be facilitated via networks in which the members of the CR2 International Advisory Board are active.

ii. Evaluation **Please indicate your qualification in a scale between 0 to 5 points (half points are also allowed).**

Outstanding

Very Good

Good

Regular

Poor

Not Qualify



3. Initiatives that would be undertaken by the Center related to scientific and technological innovation and its applications to the development of the country. Please analyze the Center strategy to get involved with problems to the development of the country.

i. Comments

From its establishment, CR2 had the vision of undertaking excellent scientific research that furthers an understanding of climate change and its expression in Chile – from underpinning climate processes through to the impacts; to facilitate better policy-making through a scientific evidence base; and to strengthen Chile's Earth System and climate science researcher community. These three aspects are highly relevant for Chile's development, especially given the focus on excellent, useable *and* societally relevant knowledge. As noted in Section 1, the Centre has made significant progress towards meeting this vision and addressing these three broad objectives.

In Phase 2, we see the Centre is refining and sharpening its strategic focus to better realize this vision. This has meant re-shaping its research lines into five multi-disciplinary, solution-focused research areas, including the introduction of a new line of research focused on governance and the policy-science interface. A sixth research element integrates across all research lines to address specific questions that are highly applicable and relevant to Chile's triple bottom line (i.e. society, economy and environment) and thence development.

Beyond this restructuring of its research lines, we also see the Centre positioning itself to address key policy-relevant issues for Chile and proactively seeking stronger and more effective engagement with the private sector. For example, the addition of a research line on governance and the science-policy interface aims to assist Chile to develop better policy, focusing on climate change. Given Chile's vulnerability to climate change, this new focus on governance, institutional arrangements, and determining economically sound, low carbon pathways that enable Chile to comply with its Paris and SDG commitments is both timely and important.

In this regard, we endorse the Centre's proposed focus on the Paris Agreement, including the design of complementary adaptation and mitigation measures and the development of evaluation tools for assessing progress towards meeting Chile's commitments. This challenge of implementing, and complying with, the Paris Agreement is a significant one for any nation. That CR2 proposes this area of research, to assist the Chilean government in meeting its Paris obligations, is important nationally but also has the potential to be a significant contribution internationally as well. We note the quality and experience of the researchers who will be involved in this task of "monitoring and assessment methodologies for Chile's NDCs".

The Centre is also building stronger research and data infrastructure platforms to facilitate open access to scientific equipment by the broader research community across Chile's national innovation system, and internet-based open access to data. The most prominent example of this commitment to providing accessible and applicable information



is the Climate Explorer platform developed in Phase 1, which provides open access to a broad range of hydrometeorological data.

In Phase 2, CR2 plans to extend Climate Explorer to provide more comprehensive hydrometeorological data, as well as social data and climate simulations (the latter will also strengthen the partnership with the Chilean Ministry of the Environment). This technological innovation has great potential to transform the quality and nature of data available to a broad range of next and end users. If the Centre can provide tailored products (for specific sectors) that are built on these data then they will also be transforming the value of the information being provided.

The Centre is building the technological skill base of its researcher community through training students and researchers on the use of sophisticated simulation models (of the climate, oceans and atmosphere), and future scenario analysis.

In considering the question posed for this section, we have two additional comments:

- a) Energy provision for Chile does not appear as an issue in the five research lines – maybe others are working directly on that, such as the Solar Energy Centre and the Energy Centre at the University of Chile? If so, is there scope for collaboration with those centres in specific areas where the CR2 has strength, such as in governance and legal aspects related to energy policies that the government might develop? Moreover, given the INDC of -30% per GDP unit by 2030, Could the CR2 play a role in promoting solar development in the north and wind power in the south, or would that be considered to be outside the scope of the Centre? Certainly, playing such a role would contribute to the development of the country. Somebody needs to be making the case, and making it well.
- b) We also see great scope for new science (i.e. discovery) to result from Phase 2. This is important given CR2's goal of an ongoing emphasis on fundamental understanding and discovery, a goal that will benefit in novel ways from the multidisciplinary nature of the teams that will address the various research lines. We encourage the Centre to develop some specific, high priority, research sub-questions within the broad goals defined under each research line (these are the goals identified on pp 16 – 20 of the Continuity Plan).

ii. Evaluation: **Please indicate your qualification in a scale between 0 to 5 points (half points are also allowed).**

Outstanding

Very Good

Good

Regular

Poor

Not Qualify



4. Main goal changes since the first proposal of the Center and their effects in the plan for the following period.

i. Comments

The overarching vision for CR2 remains as clear and important as it was at the beginning: addressing the significant challenges and opportunities that climate change will bring to the Chilean economy, society, and environment, requires application of a multi-disciplinary Earth Systems Science approach. CR2 aims to advance understanding through world-class scientific research while building the capacity of the research community, so that Chile's policies and management decisions are underpinned by the best possible science. This was a unique "value proposition" at the time of CR2's launch and the Centre has learned and achieved much from its first five years of operation.

As a result of these lessons learned, and the Centre's own internal evaluations and assessments—part of its 'continuous improvement' ethos—the CR2 has refined its management structure and revised its research strategy. These changes are a clear sign of the maturity of CR2 and the strength of its leadership; the Centre can reflect on its past and work to do even better. The changes planned for Phase 2 are clearly an evolution of the original strategy, refined to be more efficient in their management and more effective in terms of achieving their outcomes. They result from an organizational assessment conducted within the Centre.

The main change in goals is the way in which research lines have been reorganized to reflect the key scientific objectives, as follows:

- a) the BGC Line has evolved into "Coastal Zones";
- b) the Climate Dynamics Line has evolved into "Water availability and Extremes";
- c) Ecosystem Services has become "Land Use Change";
- d) Human Dimensions has now been integrated into all the new research lines, and an additional line has been developed: "Governance and the policy-science interface";
- e) Modelling and Observation Systems has also been integrated into the new research lines, with the air-quality element evolving and broadening into a fifth research line entitled, "Cities and Climate Change".

It is worth noting that several of these new research lines existed as integrative questions in Phase 1; in their new form (Figure 1 in the Continuity Plan) they address the limitation that the original five lines were not optimally issue oriented.

A set of four new 'transversal' questions (focused on wildfire, air pollution, hydrometeorological extremes and harmful algal blooms) collectively comprise a sixth research focus. The questions have been designed to be fully integrative across disciplines and are thus intended to break down silos that could have inadvertently emerged as a result of the research line structure. More importantly, they provide a policy-relevant framing for the research.



The addition of an umbrella category of services, communication and outreach that supports all research lines and integrative questions is designed to facilitate knowledge exchange and uptake, and completes the organizational structure.

The new research lines clearly demonstrate CR2's unique commitment to striking a balance between curiosity-driven and solutions-focused research, a niche identified as being important for the long-term vision of the Centre.

A further change, described in detail in our comments in Section 2, is the priority accorded to investing in people, specifically four new full-time researchers with the goal of growing to 30 researchers by 2022. In so doing, the CR2 has purposely chosen to direct its FONDAP funds more toward support for research personnel. While we note that this decision will limit funding for operational, equipment, infrastructure, and support staff needs, we acknowledge and endorse the Director's view that funding to support such requirements can be appropriately sought from additional sources.

Finally, the CR2 has identified additional goals for Phase 2 around: institutional development; enhanced international engagement; policy relevance in terms of the SDGs and Paris Agreement; and two-way stakeholder engagement (in/outreach). We elaborate on each of these in sections 2, 8, 3 and 10, respectively.

ii. Evaluation **Please indicate your qualification in a scale between 0 to 5 points (half points are also allowed).**

Outstanding

Very Good

Good

Regular

Poor

Not Qualify



5. Research lines of the Center, including their feasibility and updating validity.

i. Comments

CR2 proposes an evolution from five research lines that were neither disciplinary nor solutions-focused to six new research areas that explicitly address some of the “grand challenges” confronting Chile as a result of climate change, the changing intensity and frequency of weather extremes, and its commitments to the Paris Agreement and Sustainable Development Goals (SDGs).

As described elsewhere, these new lines are:

1. Water availability and extremes;
2. Land use change;
3. Cities in a changing climate;
4. The coastal zone;
5. Governance and policy-science interface.

A sixth research line has been added to provide a set of four integrative questions, to be pursued as a sequence of projects staged across five years and led by early- to mid-career researchers.

Our view is that these new research lines are all highly applicable; but at the same time they are rather broad – notwithstanding the specific science objectives associated with each. A challenge for the Centre will therefore be to define clearly the specific sub-questions that will populate each of them and the appropriate scope of interdisciplinary expertise working on each.

The idea of a sixth research line that specifically integrates across these five areas, with an associated solutions-focus, is a powerful one in terms of addressing CR2’s goals and ‘making a difference’ to some of the serious environmental issues confronting Chile.

In this regard, these new lines are certainly valid. We believe they are also feasible as long as the research questions and scope are well defined, as noted. We feel that the feasibility is enhanced by CR2’s focus in Phase 2 to just five key research lines and four integrative questions.

As reviewers, we also offer the following comments for consideration by CR2 (these are suggestions not recommendations):

- a) Given that each of these research lines will be addressed from a range of different perspectives, and CR2’s commitment to co-production of knowledge, we think it will be important to identify the key managers, decision- and policy-makers who will receive the science and turn this into action. For example, the goal of Land Use Change is stated to be “to design resilient landscapes”, but of course it won’t be the CR2 researchers who will do this designing. Clearly identifying these next and/or end-users, and engaging with them to determine the knowledge and information they need, will help CR2 to scope and prioritize its research and to evaluate the impacts of their research.

- b) Similarly, who are the adaptation science and policy next users in Chile who might use a better understanding of climate impacts to develop appropriate adaptation plans? An example is the changes in fire risk: by combining knowledge of fire weather and land use; one could envisage an adaptation plan that combined better fire weather forecasts (from the Chilean Weather Forecasting Agency) with careful design and management of forest regions surrounding human settlements, the objective being to reduce risks and vulnerability to reduce risks and vulnerability.
- c) There are additional opportunities for further cross-line integration (and even integration/collaboration with other Centres) that go beyond the four integrative questions. For example: links between extreme rainfall, flooding and coastal zone issues and/or the combined impact of ocean biogeochemistry and physical ocean changes (circulation, waves, storm surge and sea levels) on marine ecosystem productivity and fisheries. We understand the need for focus and prioritization and applaud CR2 for doing this, and acknowledge that pursuing such additional questions may not be feasible given the existing capacity of the Centre.

ii. Evaluation **Please indicate your qualification in a scale between 0 to 5 points (half points are also allowed).**

5					
Outstanding	Very Good	Good	Regular	Poor	Not Qualify



6. When applicable, new lines of research that aroused during this period and how they were considered in the present proposal.

i. Comments

No new lines of research (i.e. beyond what was proposed in CR2's continuity plan) arose during the interview and review period.

We have provided detailed feedback on the applicability, feasibility and validity of the proposed six new research lines in our answers to sections 1, 4 and 5. Therefore we feel no need to provide a score for this section.

ii. Evaluation Please indicate your qualification in a scale between 0 to 5 points (half points are also allowed).

Outstanding

Very Good

Good

Regular

Poor

Not Qualify



7. Synergies and interactions between the members of the Center and their purpose in the Continuity Plan (not only based on publications or thesis, but also, for example, on emerging new research lines (areas) in the nearest future). Remember that the whole should be greater than the sum of work of individual researchers.

i. Comments

Synergies are a defining characteristic of the CR2. From its earliest days the Centre has vigorously promoted intellectual interactions across disciplinary boundaries. Indeed, it is appropriate to note that a capacity to practice cross-disciplinary exchange - a willingness to hear and respect the insights of scholars from different fields - is an unwritten but well understood criterion for membership in the Centre. That willingness was on full display in the block interviews that we conducted.

The benefits of the CR2 approach have been clear. One PDF remarked that, “We are working together across disciplines. We now have the opportunity to explore. I’m excited!” Another, observing that, “We are now treated as equals”, and went on to say that, “The transverse problem approach is very good, very important issues for the country.” And in her presentation, Dr Gallardo noted that building the team was one of the Centre’s significant achievements in Phase 1.

Such comments about the nature of interactions in the CR2 reinforce a basic truism: dealing constructively with the spectrum of physical, sociological, psychological, economic and legal impacts that the climate challenge presents can only be met by bringing talented minds together that span all such backgrounds. And the Centre has wisely tasked those minds to work in concert on the specific issues facing Chile that are described elsewhere in this report. The Centre made great progress with this approach in Phase 1 but was not content to sit on its laurels, and following an internal assessment, it determined that it can do even better in a Phase 2.

The Continuity Plan captures that. Every research area in Phase 2 will be populated by experts from a broad suite of disciplines. As the Plan puts it, these scholars will “converge to address short-term integrative questions.” It is important to note that this approach will not dilute research rigor. Rather, because the practitioners are so committed to the task at hand, and because they are so well led by the team of principal investigators, we aver that the integrative, transdisciplinary approach will strengthen the research findings by fostering vigorous interaction.

Finally, there is abundant empirical evidence of interactions that arose in Phase 1. Numerous journal articles were co-authored by scholars from disciplines widely separated intellectually but who shared a common interest in tackling complex issues in the climate-challenge arena. To give just three examples, a paper that appeared in the journal “Sustainability” in 2016 addressed the issue of resilience to drought in Chile. The authorship includes two sociologists, a climate dynamicist and a natural resources engineer. Another article in “Hydrological Processes”, also published in 2016, explored the issue of forest sustainability in South America in the face of climate change, management and conservation concerns and changes in the hydrological cycle. What is important about this contribution is that it reflects international in addition to multidisciplinary synergies.



The authors, including two from the CR2, hail from nine different countries (seven from South America, plus the U.S. and Australia). And finally, the outstanding “Report to the Nation” of 2015 on Chile’s megadrought was co-authored by 29 CR2 members who worked collectively (interactively!) to produce a document of very high impact with national implications for policy.

We conclude that the structure of the CR2 coupled with the intellectual quality and interdisciplinary earnestness of its members yields - and will continue to yield - research and policy-relevant results as a whole that are indeed greater than the sum of the individual research parts.

ii. Evaluation **Please indicate your qualification in a scale between 0 to 5 points (half points are also allowed).**

Outstanding

Very Good

Good

Regular

Poor

Not Qualify



8. Center organization chart including its nearest links (companies, associated institution, other units within the same institution, etc), international and national collaboration, and international advisory committee.

i. Comments

The management structure of the CR2 has evolved, reflecting the Centre's organizational review and its goal of becoming more efficient and effective.

A major change is the proposed appointment of an Executive Director whose role will be to coordinate and oversee all the operational and management functions of the Centre including administration, budgeting, accounting, data handling and computing, communications services and outreach. This appointment will free up the Director and Deputy Director to focus their time and energies more on science and Centre leadership.

We endorse this change, with one caveat: we suggest that the title "Executive Director" may be confusing to external eyes - if that title is kept, there will be three management positions, each containing the word "Director"! Suitable alternative titles could be: Operations Manager or Program Manager.

Position titles notwithstanding, the structure in Figure 2 implies that the Executive Director (ED) will report to the Deputy Director – is this to be the case? While noting that the ED role does not replace the other leadership roles, we would urge appropriate governance arrangements be put in place to ensure that the Director (in particular) does not lose touch with the research projects, academic initiatives and outreach/ stakeholder engagement. And in terms of reporting arrangements, we wonder, for example, if the ED will have an *ex-officio* role on the Academic Board? Finally, given the importance of the new ED position and the heavy workload now carried by the Director and Deputy Director, it is important that the best possible candidate be recruited and appointed in a timely manner.

We note that the 'new' structure is organized to promote the interdisciplinary nature that is at the core of the Centre's purpose and vision – this is a welcome feature! However, Figure 2 does not really illustrate how CR2 will engage with the National and International Advisory Panels, nor is it clarified by the text on pp 31 – 32 of the Continuity Plan.

We asked about this at interview, and were pleased to learn that in fact both external advisory panels have played a key role in CR2's development. Given this, and the particular role that the International Advisory Panel appears to be playing both in guiding the CR2 internally and promoting it globally, we would recommend that an additional governance figure be crafted that clearly describes both the nature of the respective roles of the two Panels and how they will fit into the organizational hierarchy.

Similarly, the organizational-structure graphic does not illustrate how the Centre engages with external stakeholders, including other FONDAP Centres, other stakeholder agencies and the broader community. A revised set of figures could usefully reflect these broader linkages.



The CR2 explicitly identifies international engagement as a key part of its strategy for Phase 2, noting that it intends to “consolidate CR2 as an internationally recognized climate and resilience research centre and as a regional hub for climate and resilience research”. We strongly endorse this intent, and especially the aim of the Centre to provide a platform for climate data—both observed and modeled—for South America.

ii. Evaluation **Please indicate your qualification in a scale between 0 to 5 points (half points are also allowed).**

Outstanding

Very Good

Good

Regular

Poor

Not Qualify



9. When applicable, the scientific quality and experience of the new researchers, experience and capacity in training advanced human resources, and ability to work in collaboration in proposals of this magnitude.

Note, the following question is not applicable to CR2 and so has not been addressed: When applicable, the new Director and/or new Deputy Director should have clear leadership and capabilities to establish networks, and articulate joint activities with national and international institutions (research projects, workshops, publications, etc.).

Six new scholars are proposed to join the CR2 as Associate Researchers. The reviewers have examined their curricula vitae and we summarise their cases as follows:

1. **Gustavo Blanco Wells** (PhD 2009, Wageningen, Netherlands), Associate Professor of Sociology, Institute of History and Social Sciences, Universidad Austral de Chile

A sociologist who works on issues of developmental, rural and environmental sociology, Dr. Blanco led from 2011-2014 a FONDECYT research program entitled, "The Sociology of Climate Change". Since 2016 he has served as the Principal Investigator on a FONDECYT program entitled, "The Social Life of Energy". He has previous research experience in Patagonian aquaculture issues, focusing on social conflicts related to aquaculture development.

Dr. Blanco has published an extensive body of research in both Spanish and English in journals, books and book chapters. Two of his most recent papers are co-authored with current CR2 scholars, including both physical and social scientists.

Currently an Adjoint Researcher at the CR2, he also serves as an Associate Researcher with IDEAL (Centro de Investigación Dinámica de Ecosistemas Marinos de Altas Latitudes) and will bring that cross-pollinating experience with him to the CR2.

2. **Rodrigo A. Arriagada** (PhD, 2008, North Carolina), Assistant Professor, Department of Agricultural Economics, Pontificia Universidad Católica de Chile

Currently an adjoint researcher at the CR2, Dr. Arriagada is an expert in natural resource economics, the economics of ecosystem services, environmental policy impact assessment and the economics of land use changes. He publishes actively, primarily in English in high-impact journals, and is an affiliated member of the Center for the Socioeconomic Impact of Environmental Policies (CESIEP).

3. **Beatriz Díez Moreno** (PhD, 2001, Barcelona), Associate Professor, School of Biological Sciences, P. Catholic University of Chile

Dr. Díez is a marine microbiologist with extensive experience working on microbial ecology in high latitude marine settings (Antarctic and Arctic) as well as in lakes, hot springs and the Chilean coastal ocean. She publishes actively in both English and Spanish and many of her papers have appeared in high-impact journals.



4. **Martín Sebastián Jacques-Coper** (PhD, 2014, Bern). PAI-FONDECYT Academic and Lecturer, Department of Geophysics, University of Concepción

Dr. Jacques-Coper is a climate physicist who works on climatic variability and dynamics in South America on different time scales, including research on Southern Hemisphere teleconnections. He also conducts research on evaluation of wind-speed regimes and predictability for wind power applications.

A young scientist, appointed to faculty earlier this year at the University of Concepcion, he already has significant publications record in top journals, focusing on such issues as ozone depletion, South American summer heat waves, and variability of winds over the Atacama Desert.

5. **Luis Cordero Vega** (PhD, Lleida, Spain), Assistant Professor, Faculty of Law, University of Chile

A highly-experienced lawyer with an extensive publication record in the area of administrative law, particularly as it pertains to environmental issues, Dr. Cordero Vega is very well known in Chile. He coordinated the creation of the Environmental Institutional Reform Law for the nation, under the auspices of the Ministry of the Environment and the Environmental Assessment Service. In addition to his professorial position in the Faculty of Law, he also serves as an advisor to the Congress in the Environmental Courts project.

Dr. Cordero is currently the Principal Investigator on a FONDECYT-funded project entitled, "Critical analysis of the procedure to create Plans for Prevention and/or Environmental Decontamination: insufficient citizen participation and absence of regulatory evaluation." [in Spanish: Análisis crítico al procedimiento de creación de Planes de Prevención y/o Descontaminación Ambiental: insuficiente participación ciudadana y ausencia de evaluación regulatoria.]

6. **Ariel Andrés Muñoz Navarro** (PhD, 2012, University Austral), Assistant Professor, Institute of Geography, Pontifical Catholic University, Valparaíso

A dendrochronologist, Dr. Muñoz uses tree-ring records to study climate variability, environmental pollution and the ecology and dynamics of forests. He is currently Principal Investigator of the FONDECYT project entitled, "Geographical impact of the megadrought (2010-2015) on water resources in river basins...for the region of Valparaíso".

Dr. Muñoz publishes actively in leading journals in his field on such topics as streamflow reconstructions, forest sensitivity to climatic variations, and the history of hydrological variability in the past century, primarily in southern South America.

In addition, the reviewers examined the record of a seventh scholar, who is listed on page 26 of the Continuity Plan as a proposed Associate Researcher:

7. **Anahi Urquiza Gomez** (PhD, 2014, Munich), Assistant Professor, Department of Anthropology, University of Chile



An early career sociologist, Dr. Gomez conducts research in the areas of vulnerability and risk, organizational systems, and environment and society. She publishes actively in book chapters and journal articles on topics that include access to clean energy, the interface between social systems, social organization, the environment and resilience, and links between environmental policies and territorial conflicts.

Without exception, all of the above have extensive experience in working with students (teaching, and supervising research at the graduate and often, senior undergraduate level). Most importantly, the review panel met some of these scholars at the block interview with affiliated researchers held on September 27 and we were impressed with the enthusiasm that they demonstrated with respect to their involvement with the CR2. It was very clear that they find the interdisciplinary work of the Centre a major intellectual attraction, and it was also clear that they relish the opportunity to practice true interdisciplinary research in service of the major challenges that a changing climate is already imposing on Chile.

Based on our evaluation of the curricula vitae of the above scholars, and our (albeit limited) exposure to some of the during the block interview, we have no qualms in suggesting that all will significantly enhance the already strong collective research capacity that the CR2 offers.

We are not sure how to score these – it would unfair to assign a single score to a group of researchers that span different backgrounds, levels of seniority, and differing cultures of scholarship. Thus, we have purposely left the evaluation score blank. We note, however, that if process requires a score, we would be comfortable with 4.5, despite our concern that a blanket score is an inappropriate yardstick to use for this section.

ii. Evaluation **Please indicate your qualification in a scale between 0 to 5 points (half points are also allowed).**

Outstanding	Very Good	Good	Regular	Poor	Not Qualify
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>





10. Outreach strategy.

i. Comments

As with other elements of the Continuity Plan, the Centre's approach to outreach has matured and evolved from Phase 1 where the priority was on building CR2's brand and developing and disseminating communication products. We applaud the Centre's nimbleness in producing in short order highest-quality communications products that describe in lay terms the nature and impacts of unanticipated climatic events. Indeed, the excellent 2015 "Report to the Nation" on the megadrought is an example of a communication product that warrants international promotion. The timeliness and quality of such products have enabled the Centre to position itself as a "trusted advisor" to the Chilean government and community.

The Phase 2 Outreach strategy promises to reinforce this broad advisory role, but now with a sharpened focus on raising awareness of climate change science, mitigation *and* adaptation. Moreover, it will focus promoting dialogue across the science-policy interface, along with a strengthened commitment to combining understanding with solutions. Thus, "services, communication, and in/outreach" is an overarching goal in Phase 2, encompassing each of the six research foci, as illustrated in Figure 2. Even the titles reflect the priorities: 'in/outreach' promises a two way dialogue between users and researchers; 'services' implies outputs with tailored content to deliver value; and 'communication' speaks to what remains a critical societal need.

We suggest that with this Phase 2 outreach strategy, the Centre should fulfil its ambition of being a "long-lasting and major player in developing proposals for climate and resilience science".

We applaud the additional investment in staff with specific skills to support this strategy, including the appointment of a sociologist or anthropologist whose training will enable mediation with stakeholders. When asked if this was a knowledge brokering role, we were advised that no, all of the scientists regard themselves as knowledge brokers; rather CR2 hopes that a social scientist with an understanding of human behaviour can help facilitate an effective two-way dialogue and engagement with the broader community. The proposed hiring of an additional journalist, continuing media training for CR2 members including graduate students and PDFs, and the intent to bring journalism trainees in to work with the outreach team in CR2 are highly positive additional examples of ways that the Centre will use to realize its outreach strategy in Phase 2.

The planned strengthening of existing communications programs, including RedLama (a graduate-student led initiative that works with school children) is strongly supported by us. We note also that RedLama was discussed enthusiastically by the graduate students in the interview with the evaluation panel.

The intention to maintain CR2's continuing education program ("Climate change and low - carbon development: an interdisciplinary challenge"), delivered in Phase 1 in collaboration with the Center for Solar Energy and the Energy Center, is similarly endorsed. It demonstrates real and societally-relevant outreach consistent with CR2's goals.



We also endorse the planned engagement with the private sector, via sectoral associations.

We offer some additional suggestions that might enhance what is already a very strong strategy:

- Explore the idea of making the “Report to the Nation” a biennial product.
- Use the International Advisory Board as an ‘international outreach’ vehicle; i.e. use the CR2 “Report(s) to the Nation” outside of Chile, to showcase the approach and give CR2 much deserved international profile.
- Complement the biennial “Report to the Nation” with more targeted (less resource-demanding) Case Studies that link some aspect of the Centre’s research to a specific problem. This is also a way to demonstrate ties with other research centres. For example, the Centre might partner with the Centre for Solar Energy to provide a Case Study on climate mitigation in Chile using solar energy. A case study could be as simple as a 1-page brochure, or it might be a video, a podcast, or a web-based tool.
- Consider holding short (1/2 to 1-day in duration) courses for specific sectors, e.g. for the mining industry that lays out the full implications of climate change for Chile, including future water availability, why the megadrought happened, future wildfire or extreme-deluge risk, etc etc. By charging for attendance, this could raise funds as well as contributing to the Centre’s outreach goals.

ii. Evaluation **Please indicate your qualification in a scale between 0 to 5 points (half points are also allowed).**

Outstanding

Very Good

Good

Regular

Poor

Not Qualify



11. Economic feasibility: coherence between needs, operational costs, new positions, major equipment, traveling and per diem, among others, and proposed activities (1US\$ ≈ 710 Chilean pesos).

i. Comments

We find it difficult to comment on the details of the budget as we do not have sufficient understanding of the cost of travel, equipment and salaries in Chile. For the purposes of our review, we understand the headline budget is:

- \$1.5M USD per year from FONDAP
- 56% of the budget will be invested in staff
- 16.5% of the budget is allocated to operating expenses
- This leaves a small allocation (ca. 3%) to capital and infrastructure (installation of Andean Observatory downwind of Santiago) and administrative staff (6.7%)

We understand that the coinvestment is as follows:

- UCH: 76 MCLP (ca. 8%) annually, covering the cost of one researcher position, part of the ED's salary, and operational and infrastructure costs.
- UACH and UDEC: 8.5 MCLP (ca. 1%) annually to fund support staff in the Land Use Change and Coastal Zones research lines.

Combined, this provides a total budget of ca \$USD10M over five years. Given the impact of the Centre's achievements, this would seem to be a modest investment that will deliver significant returns for Chile.

However, we do understand that the Centre has made some hard decisions in, for example, choosing to invest in new staff. The CR2 openly acknowledges that this will reduce significantly its operating and capital budget lines, noting that it intends to tap additional, non-FONDAP funds to meet these needs. Clearly, there is a risk here, but given the excellent track record to date of the Centre, we believe that the prospects for sourcing additional funds from external agencies are high. Thus, we support the proposed budget and its realigned allocations as described in the Continuity Plan.

Finally, we note that there is no contingency in the current budget, and we also note that there are challenges in having CR2 members located in institutions thousands of kilometres apart. We thus encourage the Centre to build in to its budgetary planning sufficient funds to support essential travel while encouraging enhanced use of collaborative internet-based platforms (including social media) to facilitate research collaboration among students and researchers.

We do not feel able to assign a score.

ii. Evaluation Please indicate your qualification in a scale between 0 to 5 points (half points are also allowed).

Outstanding	Very Good	Good	Regular	Poor	Not Qualify
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

IV. FINAL OVERALL COMMENTS AND RECOMMENDATIONS

Please provide a final overall and recommendations for the Center. Include here aspects that were not covered in the previous sections, which you consider significant for the Center.

CR2 has been on a journey since its establishment. The CR2 leaders clearly see the Centre moving from a “5-year project” to an enduring institution. Their intent is that institution will become recognized as a provider of credible scientific and social scientific knowledge and analysis that will support the nation in its efforts to meet the adaptation, resilience and mitigation imperatives that a changing climate is imposing. At the same time, the Centre freely and wisely acknowledges it cannot do everything and so, if funded, Phase 2 would see the research lines focus on a core set of questions that are critically important to Chile – now and into the future.

Having reviewed their Phase 1 Final Report and Continuity Plan and interviewed the Principal, Associate, and Adjoint researchers as well as PhDs, graduate and undergraduate students, we have no hesitation in strongly recommending that CR2 be funded for a second phase.

In making that clear recommendation, we would like to note some additional points:

1. The outstanding leadership of Dr Laura Gallardo is acknowledged. We have been impressed by the culture that she and her leadership team have built. Our interviews with the Associate Researchers, Postdocs, and students revealed a consistently collegial and positive view about CR2’s goals and achievements and the unique role it is playing in capacity building and delivering research that is of benefit to Chile. Our interview discussions revealed that everyone felt included in the Centre. Everyone, whether they be a student or an established researcher, felt that they had a voice and were encouraged to use it. Moreover, they felt that they were heard.

We came into the review knowing that Dr. Gallardo had played an important role; indeed we commented on this in our 2015 review. Our interviews and discussions reinforced this view, and that created another question: what is CR2 doing about succession planning? Fortunately, we understand that a succession plan is in place – at least for the Director.

But we also must acknowledge the excellence of the whole CR2 leadership team. They are first-rate researchers who have supported Dr. Gallardo and *together* they are achieving the vision of the Centre. This means that it will be important for CR2, early in Phase 2, to consider not just a succession plan for the Director but also for the entire senior leadership team. We note that there are a numerous energetic and committed scholars within the CR2 team who are at the early or mid-career stage. Encouraging them to take on additional leadership responsibilities will be an important aspect of the longer-term succession planning.

2. One of the greatest accomplishments of the CR2 lies in the breadth, depth and strength of its communications and outreach programs. Because we have not written



many words about this elsewhere in this report we wish to state here that the Centre's work in this area stands as a template for the world. Its use of all types of media – traditional, social, emerging – to communicate the nature of the challenge as well as potential solutions and policy options is to be celebrated. Moreover, the Centre's intent to make climate data freely available to the citizenry in Chile and elsewhere is to be applauded. Its Climate Explorer product is excellent and of direct and immediate value to the nation. The Centre wishes to expand it, and we salute that intent.

Finally, we wish to emphasize the value of the CR2 to the nation. Acting on the climate change challenge is complex, as the Centre readily acknowledged in its Continuity Plan. Indeed it is more complex than putting a human on the moon because it requires changing human behavior. It requires the support of society and understanding simultaneously the worlds of politics, social responses, *and* climate physics. In our experience, very few research institutions anywhere on this planet have been able to span this gamut of imperatives. This is the vision of the Centre, which we applaud. We believe that in that context, Chile and FONDAP, should celebrate what has been achieved to date.

ii. Evaluation **Please indicate your qualification in a scale between 0 to 5 points (half points are also allowed).**

Outstanding

Very Good

Good

Regular

Poor

Not Qualify

V. RECOMMENDATION

<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
APPROVED	APPROVED WITH MINOR OBSERVATIONS	PENDING	REJECTED

EVALUATION CONCEPTS

Approved: The objectives and goals are fully accomplished and all the relevant issues are properly covered in the report.

Approved with minor observations: The objectives and goals are accomplished, however, some comments and suggestions need to be addressed.

Pending: Additional information is required to fully evaluate the report.

Rejected: The objectives and goals have not been accomplished and/or the outcomes are deficient.