



Technical report on the technical analysis of the technical annex to the third biennial update report of Chile submitted in accordance with decision 14/CP.19, paragraph 7, on 3 December 2018

Summary

This technical report covers the technical analysis of the technical annex submitted on a voluntary basis, in the context of results-based payments, by Chile on 3 December 2018 through its third biennial update report in accordance with decision 14/CP.19. The technical annex provides data and information on the activities reducing emissions from deforestation, reducing emissions from forest degradation, conservation of forest carbon stocks and enhancement of forest carbon stocks included in decision 1/CP.16, paragraph 70, and covers the same subnational territorial forest area as the assessed forest reference emission levels/forest reference levels proposed by Chile in its modified submission of 31 August 2016.

Chile reported the results of the implementation of these activities for the periods 2014–2016 (for activities resulting in a land-use change) and 2011–2015 (for activities occurring in forests remaining forests), which amount to a total reduction of emissions of 6,136,475 t CO₂ eq per year and were measured against the assessed forest reference emission levels/forest reference levels for the activities during the corresponding reference periods: 2001–2013 when there is a land-use change, and 2001–2010 when there is no land-use change.

The data and information provided in the technical annex are in overall accordance with the guidelines contained in the annex to decision 14/CP.19. The technical analysis concluded that the data and information provided by Chile in the technical annex are transparent and, to the extent possible, consistent with the assessed forest reference emission levels/forest reference levels established in accordance with decision 1/CP.16, paragraph 71(b), and decision 12/CP.17, section II. This report contains the findings from the technical analysis and a few areas identified for capacity-building and future technical improvement in accordance with decision 14/CP.19, paragraph 14.

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Abbreviations and acronyms

| | |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AD | activity data |
| BUR | biennial update report |
| CH ₄ | methane |
| CO ₂ | carbon dioxide |
| CO ₂ eq | carbon dioxide equivalent |
| DOM | dead organic matter |
| EF | emission factor |
| FREL | forest reference emission level |
| FRL | forest reference level |
| GHG | greenhouse gas |
| IPCC | Intergovernmental Panel on Climate Change |
| LULUCF | land use, land-use change and forestry |
| MRV | measurement, reporting and verification |
| NFI | national forest inventory |
| NFMS | national forest monitoring system |
| NIR | national inventory report |
| N ₂ O | nitrous oxide |
| REDD+ | reducing emissions from deforestation; reducing emissions from forest degradation; conservation of forest carbon stocks; sustainable management of forests; and enhancement of forest carbon stocks (decision 1/CP.16, para. 70) |
| SOC | soil organic carbon |
| TA | technical analysis |
| TTE | team of technical experts |
| 2006 IPCC Guidelines | <i>2006 IPCC Guidelines for National Greenhouse Gas Inventories</i> |

I. Introduction

A. Introduction

1. This technical report covers the TA of the technical annex provided by Chile on 3 December 2018 in accordance with decision 14/CP.19, paragraph 7, included in the third BUR of Chile, which was submitted in accordance with decision 2/CP.17, paragraph 41(a), and annex III, paragraph 19.¹ In the technical annex, Chile provided the data and information used for estimating its anthropogenic forest-related emissions by sources and removals by sinks, forest carbon stocks, and forest carbon stock and forest area changes resulting from the implementation of REDD+ activities. The submission of the technical annex is voluntary and in the context of results-based payments in accordance with decision 14/CP.19, paragraph 8. The TA was coordinated by Jenny Wong (secretariat).

2. The TA of the technical annex is part of the international consultation and analysis of BURs referred to in decision 2/CP.17, annex IV, paragraph 4, the objective of which is to increase the transparency of mitigation actions and their effects through analysis by the TTE in consultation with the Party and through a facilitative sharing of views, resulting in a separate summary report.²

3. Chile made its FREL/FRL submission,³ in accordance with decision 12/CP.17, on 4 January 2016, which was subject to a technical assessment following the guidance provided in decision 13/CP.19 and its annex. The assessed FRELs/FRLs were included as elements of the technical annex to its third BUR in accordance with the guidelines contained in the annex to decision 14/CP.19. The findings from the technical assessment of the FRELs/FRLs are included in a separate report.⁴

B. Process overview

4. The TA of the third BUR of Chile took place from 27 to 31 May 2019 in Bonn and was undertaken by the following TTE drawn from the UNFCCC roster of experts on the basis of the criteria defined in decision 20/CP.19, annex, paragraphs 2–6: Laura Aranguren (Colombia), Liviu Gheorghe (Romania), Thelma Krug (Brazil), Maria José Lopez (Belgium), Juan Luis Martín Ortega (El Salvador), Rosa María Rivas Palma (New Zealand), Mauro Meirelles de Oliveira Santos (Brazil), Koen Smekens (Belgium), Alexander Valencia (Colombia) and Brian Zutta (Peru). Ms. Lopez and Mr. Martín Ortega were the co-leads. Ms. Rivas Palma and Mr. Zutta were the LULUCF experts who undertook the TA of the technical annex in accordance with decision 14/CP.19, paragraphs 10–13.

5. The TA of the technical annex provided by Chile was undertaken in accordance with the procedures contained in decisions 2/CP.17, 14/CP.19 and 20/CP.19. This technical report on the TA was prepared by the LULUCF experts in the TTE in accordance with decision 14/CP.19, paragraph 14.

6. During the TA and subsequent exchanges, the LULUCF experts and Chile engaged in technical discussions, and Chile provided clarifications in response to the questions raised by the LULUCF experts, in order to reach a common understanding on the identification of potential capacity-building needs of the Party and areas for technical improvement. The LULUCF experts noted several technical inconsistencies and editorial errors in the original technical annex. In response, Chile provided a revised technical annex⁵ on 9 August 2019 in which these elements had been corrected (e.g. consistent EFs applied and without changes to methodologies), thus enhancing the transparency and, to the extent possible, the consistency

¹ Available at <https://unfccc.int/BURs>.

² FCCC/SBI/ICA/2019/TASR.3/CHL. At the time of the preparation of this report, the summary report was still under preparation.

³ Available at <https://redd.unfccc.int/submissions.html?country=chl>.

⁴ FCCC/TAR/2016/CHL.

⁵ As footnote 1 above.

of the submission. This technical report was prepared on the basis of the TA of the revised technical annex.

7. Following the TA of the technical annex, the LULUCF experts prepared and shared the draft technical report with Chile for its review and comments. The LULUCF experts responded to the Party's comments and incorporated them into and finalized this technical report in consultation with Chile.

C. Summary of results

8. In decision 1/CP.16, paragraph 70, the Conference of the Parties encouraged developing country Parties to contribute to mitigation actions in the forest sector by undertaking a number of activities, as deemed appropriate by each Party in accordance with its respective capabilities and national circumstances. In the context of results-based payments and in line with decision 12/CP.17, Chile, on a voluntary basis, proposed subnational FRELs and FRLs covering the activities reducing emissions from deforestation, reducing emissions from forest degradation, conservation of forest carbon stocks and enhancement of forest carbon stocks for the purpose of a technical assessment in accordance with decision 13/CP.19 and its annex. The activities are being implemented in five administrative regions in Chile (Biobío, La Araucanía, Los Lagos, Los Ríos and Maule), which cover an area of 165,220.77 km², comprising 22 per cent of the national territory and 41 per cent (5,853,387 ha) of the country's total native forest land. The assessed FRELs and FRLs of Chile were constructed on the basis of available data and information from the national cadastre, satellite images and the NFI and using the methodologies provided in the 2006 IPCC Guidelines for estimating annual changes in forest carbon stock and associated emissions and removals as well as non-CO₂ emissions.

9. The Party's FRELs and FRLs are based on its annual average historical CO₂ emissions and removals, amounting to 159,826 t CO₂ eq/year, and are for two reference periods, one for activities involving land-use change (2001–2013) or and one for no change in land use (i.e. forest remaining forest) (2001–2010). The FRELs and FRLs are as follows:

(a) Emissions of 3,452,885 t CO₂ eq/year associated with deforestation for the historical reference period 2001–2013;

(b) Emissions of 9,149,392 t CO₂ eq/year associated with forest degradation from two subactivities:

(i) Substitution,⁶ with emissions of 4,076,040 t CO₂ eq/year for the reference period 2001–2013;

(ii) Degradation of permanent native forest, with emissions of 5,073,351 t CO₂ eq/year, including emissions from forest fires, for the historical reference period 2001–2010;

(c) Removals of 2,430,438 t CO₂ eq/year associated with the conservation of forest carbon stocks for the reference period 2001–2010;

(d) Removals of 10,012,012 t CO₂ eq/year associated with the enhancement of forest carbon stocks from two subactivities:

(i) Conversion of other land uses to forest lands, including restitution,⁷ resulting in an increase in native forest area and removals of 890,773 t CO₂ eq/year for the reference period 2001–2013;

(ii) Recovery of degraded forests, resulting in an increase in forest carbon stocks and removals of 9,121,239 t CO₂ eq/year for the reference period 2001–2010.

⁶ Substitution is the change from native forest to exotic species plantations and is a subactivity of reducing emissions from forest degradation.

⁷ Restitution is the change from exotic species plantations to native forest and is a subactivity of enhancement of forest carbon stocks.

10. Chile reported the results of the implementation of its four REDD+ activities calculated against its FRELs and FRLs, which amount to emission reductions of 6,136,475 t CO₂ eq/year, derived from the following:

- (a) A reduction in emissions of 148,513 t CO₂ eq/year for deforestation for the period 2014–2016;
- (b) An increase in emissions due to forest degradation amounting to 4,530,732 t CO₂ eq/year, resulting from:
 - (i) A reduction in emissions of 3,854,177 t CO₂ eq/year from the substitution of native forest with exotic species plantations for the period 2014–2016;
 - (ii) An increase in emissions of 8,384,909 t CO₂ eq/year from the degradation of permanent forests, including forest fires, for the period 2011–2015;⁸
- (c) An increase in removals of 1,519,769 t CO₂ eq/year from the conservation of forest carbon stocks for the period 2011–2015;
- (d) An increase in removals of 8,998,925 t CO₂ eq/year from the enhancement of forest carbon stocks, including:
 - (i) Removals of 128,868 t CO₂ eq/year from the increase in forest carbon stocks due to an increase in native forest area resulting from the conversion of other land uses to forest lands, including restitution, for the period 2014–2016;
 - (ii) Emission reductions of 8,870,057 t CO₂ eq/year from the recovery of degraded forests resulting in increased forest carbon stocks for the period 2011–2015.

11. In its technical annex, Chile provided a summary table (table 35) with the aggregated results of the implementation of its REDD+ activities covering two periods: 2014–2016 for activities resulting in land-use change and 2011–2015 for activities occurring in forest remaining forest. The aggregated results (net emissions/removals) for the periods 2014–2016 and 2011–2015 are 4,131,558 t CO₂ eq/year and 2,004,917 t CO₂ eq/year, respectively.

II. Technical analysis of the information reported in the technical annex to the third biennial update report

A. Technical annex

12. For the technical annex to the third BUR submitted by Chile, see annex I.⁹

B. Technical analysis

13. The scope of the TA is outlined in decision 14/CP.19, paragraph 11, according to which the TTE shall analyse the extent to which:

- (a) There is consistency in the methodologies, definitions, comprehensiveness and information provided between the assessed FREL/FRL and the results of the implementation of REDD+ activities;
- (b) The data and information provided in the technical annex are transparent, consistent, complete and accurate;
- (c) The data and information provided in the technical annex are consistent with the guidelines referred to in decision 14/CP.19, paragraph 9;
- (d) The results are accurate, to the extent possible.

⁸ According to Chile, although monitoring showed a reduction in degradation of permanent forests, emissions increased during this period compared with the reference period because of an increase in forest areas affected by fires associated with an extended drought period that started in 2010.

⁹ In accordance with decision 14/CP.19, para. 14(a).

14. The remainder of this chapter presents the results of the TA of the technical annex to the BUR according to the scope outlined in paragraph 13 above.

1. Consistency in the methodologies, definitions, comprehensiveness and information provided between the assessed reference levels and the results in the technical annex

15. In accordance with decision 14/CP.19, paragraph 3, the data and information used by Parties for estimating anthropogenic forest-related emissions by sources and removals by sinks, forest carbon stocks, and forest carbon stock and forest area changes related to REDD+ activities undertaken by them should be transparent and consistent over time and with their established FRELs/FRLs in accordance with decision 1/CP.16, paragraph 71(b) and (c), and decision 12/CP.17, section II.

16. The LULUCF experts noted that Chile ensured overall consistency between its assessed FRELs/FRLs and its estimation of the results of the implementation of its REDD+ activities by:

(a) Including the same carbon pools: above-ground biomass, below-ground biomass and DOM were included for the activities reducing emissions from deforestation, reducing emissions from forest degradation and conservation of forest carbon stocks. For the activity enhancement of forest carbon stocks, only the above-ground biomass and below-ground biomass carbon pools were included;

(b) Including the same gases: CO₂ was included for all the activities, and non-CO₂ emissions (CH₄ and N₂O) from forest fires were included for the activity reducing emissions from forest degradation;

(c) Covering the same area: five administrative regions were covered (Biobío, La Araucanía, Los Lagos, Los Ríos and Maule);

(d) Using the same forest definition as that used in constructing the FRELs/FRLs, which is defined in Chilean legislation (Law No. 20.283);¹⁰

(e) Using consistent methodologies to estimate carbon stocks for each of the activities, including IPCC tier 2 and 3 approaches for estimating annual changes in carbon stock. Chile applied the gain–loss method for activities that result in land-use change and the stock change approach for activities that do not result in land-use change (i.e. forest remaining forest);

(f) Using consistently a tier 3 method to determine degradation based on carbon stock changes in relation to a baseline defined for the Roble-Rauli-Coihue forest type (*Nothofagus oblique*, *Nothofagus alpine*, *Nothofagus dombeyii*), which is one of the most common forest types in Chile. The methodology was developed by Bahamóndez et al. (2009) and assesses the relative stocking and basal area in the inventory plots over two time periods. In addition, Chile used the extrapolation methodology described in Tomppo (1991) and Landsat data to define the degraded areas within the boundaries of permanent forests using imagery for two years, namely 2010 and 2015, for the monitoring of results;

(g) Using consistent EFs, derived from data from the first cycle of the NFI, for above- and below-ground biomass for deforestation and forest degradation by substitution.

17. The LULUCF experts noted from the information provided in the technical annex that there are some observed differences between Chile's assessed FRELs/FRLs and the results reported in the technical annex, namely from:

(a) The methodology used to generate some of the AD for activities that involve land-use change (deforestation, degradation by substitution, enhancement of forest carbon stocks). The methodology used for generating the land-use change maps for constructing the FRELs/FRLs was based on data contained in the cadastre and evaluation of vegetation resources in Chile (hereinafter referred to as the cadastre) while for estimating the results, the land-use change maps were based on spectral classification, application of the Random Forest

¹⁰ See http://www.conaf.cl/cms/editorweb/transparencia/potestades/Lev-20283_bn.pdf.

algorithm for classification (Breiman, 2001) and analysis of changes in Landsat 8 imagery (see para. 20 below);

(b) The minimum mapping unit used (resulting from the different methodology for estimating AD noted above): 0.5 ha was used for the FRELs and FRLs and 0.27 ha was used for the monitoring of results, which is equivalent to three pixels in the Landsat 8 imagery.

18. In view of the above, the LULUCF experts concluded that the results presented of the implementation of the selected REDD+ activities in the five administrative regions of Chile are consistent, to the extent possible and according to its current national capacities and capabilities, with the assessed FRELs/FRLs. This is considering that Chile used a different method for monitoring AD in the present submission (see para. 17(a) above) and that the Party identified areas of future technical improvement for future FREL/FRL submissions. The LULUCF experts commend Chile for its efforts to ensure consistency between the data and methodologies described in the FREL/FRL submission and the technical annex (see para. 16 above). They also commend Chile for the methodological improvements made in the monitoring of activities since the FREL/FRL submission, and the efforts made to improve the NFI data and EFs. They noted that Chile may wish to continue to ensure the consistency of the elements referred to in paragraph 17 above as an area of future technical improvement in future submissions of proposed FRELs/FRLs and results in accordance with decision 14/CP.19, paragraphs 3 and 5.

2. Transparency, consistency, completeness and accuracy of the data and information provided in the technical annex

19. The LULUCF experts noted that, as part of the TA process, Chile provided additional information, in particular, the calculation worksheets for the uncertainty analysis, the regional-scale forest fire statistics worksheets, the NFI data worksheets, and cadastre maps and land-use change maps.¹¹ In addition, the technical annex includes weblinks to Excel spreadsheets with details of the calculation of the results of the activities, thus increasing the transparency of the methods and AD used. The LULUCF experts commend Chile for its efforts to increase the transparency and ensure the completeness¹² of the data and information provided, allowing for the reconstruction of the results.

20. Different methodologies were used to construct some of the AD associated with activities that involve land-use change (deforestation and degradation by substitution) for the FRELs/FRLs and the technical annex. The AD used for the construction of the FRELs/FRLs for deforestation and degradation by substitution were based on cadastre maps updated for each region at different time periods and developed through visual interpretation of high-resolution satellite imagery, and the results were validated by ground-truthing. For its FRELs/FRLs, Chile complemented the detection of forest degradation with Landsat satellite images. For the technical annex, the AD were based on land-use change maps derived from spectral classification, application of the Random Forest algorithm and analysis of changes in Landsat 8 imagery. In the technical annex, Chile used the classified polygons from the cadastre maps as the baseline maps against which land-use change was determined. Chile applied an adapted multi-index integrated change analysis to detect land-use change from mosaics prepared using Landsat 8 imagery for the start and end of the results periods for all the REDD+ activities. Chile established empirical thresholds of change for each index using different variation ranges on a statistical and scientific basis. The start and end dates of the set of AD encompass the dry period between November and March of each year. Table 7 of the technical annex presents the range of dates (used to define the initial and final year of the mosaics) applied for imagery collection and used for the preparation of the mosaics. Chile noted that the collection of imagery for the cadastre and land-use change maps is also consistent during these dry period months. Chile explained that, for the FRELs/FRLs, ground-truthing was undertaken for all areas identified as experiencing a land-use change. On the other hand, the validation of the land-use change maps for the technical annex was

¹¹ The maps are available at <https://sit.conaf.cl/>.

¹² "Complete" here means the provision of the information necessary for the reconstruction of the results.

performed using high-resolution satellite imagery only. Chile explained that this approach was used for the technical annex as it was not possible for the country to generate AD biennially through the cadastre maps (i.e. the approach used for the construction of the FRELs/FRLs).

21. The EFs for the activities that involve land-use change (deforestation, degradation by substitution, enhancement of forest stocks) applied for the FRELs/FRLs and the technical annex were derived from the NFI. The data used to develop the EFs for the FRELs/FRLs were from the first cycle of the NFI, which was conducted between 2001 and 2010. Chile explained that a second cycle of the NFI had been conducted between 2010 and 2015 in the Araucanía, Los Ríos and Los Lagos regions. EFs based on the latest NFI cycle were used in the original technical annex. After discussion with the LULUCF experts, Chile, in its revised technical annex, used EFs based on the first cycle of the NFI to ensure consistency with the FRELs/FRLs. The LULUCF experts acknowledge the progress made by Chile in its efforts to improve the data from its NFI and, as called for in the stepwise approach, to take into account new methodologies and newly available data in the development of future FRELs/FRLs and results, in accordance with decision 12/CP.17, paragraph 10, and decision 14/CP.19, paragraph 5.

22. According to decision 12/CP.17, paragraph 8, the FREL/FRL shall be established taking into account decision 4/CP.15, paragraph 7, and maintaining consistency with the anthropogenic forest-related GHG emissions by sources and removals by sinks reported in the Party's GHG inventory. Further, in accordance with decision 14/CP.19, paragraph 3, the data and information used by a Party to estimate its REDD+ results should be transparent and consistent over time with the established FREL/FRL, in accordance with decision 1/CP.16, paragraph 71(b) and (c), and section II of decision 12/CP.17. The LULUCF experts noted that Chile's technical annex does not include sufficient information to allow an assessment of consistency with the data used in the latest GHG inventory (2016)¹³ submitted with the third BUR. The LULUCF experts commend Chile for its efforts to ensure consistency among the emissions and removals that will be reported in its future submissions of its GHG inventory, its FRELs/FRLs and results and to use updated methodologies and data for all three processes as part of the stepwise approach and as noted in the report on the technical assessment of the proposed FREL of Chile submitted in 2016.¹⁴

23. In response to a question from the LULUCF experts, Chile clarified that all data (images and annual maps) are publicly available,¹⁵ which enables relevant stakeholders to reconstruct annual increments of forest stocks. Chile is currently executing an NFI, which is expected to provide data that will help to improve the accuracy of its estimates. The LULUCF experts commend Chile for providing transparent information and continuing to improve the accuracy of its estimates by using nationally generated data.

24. Chile followed the methodology of Bahamóndez et al. (2009) for estimating CO₂ emissions from degradation in permanent forests and the recovery of degraded forests, using a stock chart for a single forest type (Roble-Rauli-Coihue) across all forest types. In the technical annex, Chile notes that at the time of preparation of the FRELs/FRLs, this stock chart was the only one that had been published and validated. Hence, to maintain consistency between the FRELs/FRLs and results, the Party opted to apply this stock chart to all forest types. The LULUCF experts noted that doing so might have resulted in the underestimation or overestimation (depending on a region's forest type) of emissions and removals. In the technical annex, Chile outlined the schedule for developing stock charts that will be specific to forest types for approximately 96 per cent of the native forest area in the country. The LULUCF experts commend Chile for its efforts to map different forest types, which will improve the accuracy of the data in the future.

¹³ Available at <https://unfccc.int/documents/193971>.

¹⁴ FCCC/TAR/2016/CHL, para. 19.

¹⁵ During the TA, Chile shared the following links with the LULUCF experts: cadastre maps are available at <https://sit.conaf.cl/>; land-use change maps are available at https://www.encrcvchile.cl/images/REDD/Base_de_datos/CUT.zip; and the carbon stocks map is available at https://www.encrcvchile.cl/images/REDD/Base_de_datos/ContenidoCO2.zip.

25. The LULUCF experts concluded that Chile provided the necessary information to allow for the reconstruction of the results of the implementation of the selected REDD+ activities. The data and information provided in the technical annex are considered transparent, complete and accurate to the extent possible.¹⁶ The LULUCF experts noted that Chile may wish to continue to improve the accuracy and ensure the consistency of the elements referred to in paragraphs 17 and 20 above as areas for future technical improvement in future submissions of proposed FRELs/FRLs and results in accordance with decision 14/CP.19, paragraphs 3 and 5.

3. Consistency with the guidelines on elements to be included in the technical annex

26. Chile provided data and information on all the required elements in accordance with the guidelines contained in the annex to decision 14/CP.19, namely summary information from the final report containing the assessed FRELs/FRLs; results in t CO₂ eq per year, consistent with the assessed FRELs/FRLs; a demonstration that the methodologies used to produce the results are consistent with those used to establish the assessed FRELs/FRLs (as outlined in chapter II.B.1 above); a description of forest monitoring systems and the institutional roles and responsibilities in the MRV of the results; the information necessary for the reconstruction of the results (as outlined in chapter II.B.2 above); and a description of how the elements contained in decision 4/CP.15, paragraph 1(c) and (d), have been taken into account.

27. The LULUCF experts noted that Chile provided a description of its NFMS and a summary of the institutional roles and responsibilities for the MRV of the results in the technical annex, together with a weblink¹⁷ for accessing further information. The roles and responsibilities of the agencies and institutions involved in MRV were transparently explained. In its technical annex, Chile explained that the National Forest Corporation of Chile is the country's REDD+ focal point and is responsible for coordinating the NFMS and the preparation of the Party's FRELs/FRLs and technical annex for REDD+ results. REDD+ activities are the responsibility of the Climate Change and Environmental Services Unit and the Office of Forestry Development and Promotion of the National Forest Corporation of Chile. The Forestry Institute, under the Ministry of Agriculture, is mandated to undertake NFIs. The LULUCF experts commend Chile for sharing this information.

28. Chile's NFMS covers most of the forest areas in the country. The official information from the cadastre and data from the NFI are the main inputs to the NFMS. According to decision 11/CP.19, paragraph 4(b), the NFMS should enable the assessment of different types of forest in the country, including natural forest. During the consultation process, Chile explained that all the native forest and forest plantation areas in the five administrative regions included in the construction of the FRELs/FRLs and the technical annex are monitored, and the largest areas of native forest in the country are located in these regions. The LULUCF experts noted that, although Chile clarified that commercial plantations are not included in the estimation of the FRELs/FRLs or the estimation of the results of REDD+ activities, the fact that commercial plantations are not included in the monitoring of areas under the NFMS was not explicitly mentioned in the technical annex. The Party explained during the consultation process that commercial plantations are monitored through the cadastre and the NFI, which have national coverage and which are key data sources for the NFMS. In line with current Chilean legislation, areas of arborescent matorral are no longer included in the native forest classification. Chile clarified that using the cadastre as part of the NFMS, which was used for constructing the FRELs/FRLs, enables it to distinguish forest types. However, the remote sensing methodology used for the estimation of the results (see para. 20 above) does not distinguish between native forest types and arborescent matorral, nor does it disaggregate this non-forest type from native forest in the case of either the FRELs/FRLs or the results.

29. According to decision 1/CP.16, paragraph 71(c) and its footnote 7, subnational monitoring and reporting should include monitoring and reporting emission displacement at

¹⁶ In accordance with decision 4/CP.15, para. 1(d)(ii).

¹⁷ https://redd.unfccc.int/files/smm_pc.pdf.

the national level, if appropriate, and reporting on how the displacement of emissions is being addressed and on the means to integrate subnational monitoring systems into a national monitoring system. During the consultation process, Chile explained that the goal of the NFMS is to facilitate the preparation of biennial reports on land-use change for all forested regions. Currently, the five regions covered by the Party's FRELs/FRLs are monitored, and Chile is researching methodologies for monitoring other forested regions with the aim of developing a national FREL/FRL. Chile commented that there is currently no evidence of emission displacement, and the LULUCF experts agreed. The LULUCF experts commend Chile for its efforts to address this issue and, building upon the NFMS, to monitor emission displacement at the national level and enable the development of a national FREL/FRL.

30. Chile provided a description of how IPCC guidance and guidelines were taken into account in accordance with decision 4/CP.15, paragraph 1(c). For the estimation of emission reductions and removals in the subnational territory, Chile used the methodology provided in the 2006 IPCC Guidelines for estimating changes in carbon stock in forest land converted to other land uses and forest remaining forest (see para. 16(e) above). Accordingly, the emissions from the activities involving land-use change were estimated for 2014–2016 by combining AD (i.e. areas of annual deforestation) with the appropriate EF (i.e. emissions associated with the corresponding forest type). Emissions from forest degradation, conservation of forest carbon stocks and enhancement of forest carbon stocks, which do not involve land-use change, were estimated for 2011–2015 by combining AD (i.e. areas of detected annual forest degradation and conservation and enhancement of forest carbon stocks) with the appropriate EF (i.e. emissions associated with the corresponding forest type).

31. Chile included in its FRELs/FRLs and estimation of results the most significant pools and non-CO₂ GHGs. Overall, the exclusion of the SOC pool for all activities and the DOM pool for the activity enhancement of forest carbon stocks was adequately justified. Chile justified the exclusion of SOC for all four activities as being due to the lack of national data. The LULUCF experts commend Chile for its efforts to obtain better information on SOC and DOM with the aim of including these carbon pools in future FREL/FRL submissions and estimates of results as part of the stepwise approach. The LULUCF experts noted that this was an area for future technical improvement identified in relation to the Party's FREL/FRL.

4. Accuracy of the results proposed in the technical annex

32. The LULUCF experts noted that the Party's estimation of the results of the implementation of its REDD+ activities for its five subnational territories was undertaken using a transparent approach and ensuring, to the extent possible, consistency. The LULUCF experts commend Chile for its significant long-term efforts to build up a robust NFMS that is capable of providing transparent estimates of emissions and removals from deforestation, forest degradation, conservation of forest carbon stocks and enhancement of forest carbon stocks.

33. Both the established FRELs/FRLs and the results obtained for the period 2014–2016 for activities that involve land-use change and for the period 2011–2015 for activities that occur in forest remaining forest are based on the assumptions that deforestation takes place in areas of native forest; forest degradation includes the change from native forest to plantation forest; and forest enhancement includes the change from other land uses and plantation forest to native forest. In addition, it is assumed that immediate oxidation occurs for above-ground biomass, below-ground biomass, deadwood and litter when carbon stocks are lost as a result of deforestation and forest degradation.

34. Regarding the clarification of the methodologies applied for estimating AD referred to in paragraph 20 above, Chile provided some information on the estimation of the uncertainty of the AD. Although Chile had reported the time frame of the accuracy assessment of the land-use change as 2013–2017, it clarified that this time period was selected to coincide with the dry season but is linked to the 2014 and 2016 calendar years. Therefore, the satellite mosaics in the land-use change classification and accuracy assessment analysis may fall within the dry period from November to March.

35. In response to a question from the LULUCF experts, Chile clarified the development of the AD used for the calculation of the FRELs/FRLs and the results. The AD applied for

the FRELS/FRLs were developed using cadastre maps with different initial years for different regions of the country, whereas the results were estimated using land-use change maps with similar start and end dates for different regions. Both sets of AD use the same land-use and land-use change categories, with a minor adjustment in the application of the forest definition pertaining to arborescent matorral (see para. 28 above). The land-use change maps are based on the cadastre maps. The LULUCF experts are of the view that Chile may be underestimating AD by using coarser-resolution satellite data (i.e. 30 m Landsat images) and pixel-based land-use change classifications for the results period while using higher-resolution data (i.e. 5 m RapidEye and Spot images) with visual interpretation to estimate emissions for the FRELS/FRLs. The coarser pixels used for the results period may register a land-use change (e.g. forest to non-forest) depending on the thresholds chosen for the spectral indices and may indicate fewer areas compared with the high-resolution images.

C. Areas identified for technical improvement

36. The LULUCF experts concluded that the following areas for technical improvement identified in the report on the technical assessment of Chile's FRELS/FRLs also apply to the provision of information on the results of the implementation of its REDD+ activities:

- (a) Expanding the number of carbon pools included, namely, including SOC for all activities and DOM for enhancement of forest carbon stocks;
- (b) Extending the FRELS/FRLs to cover other biomes as part of the effort to move towards a national FREL/FRL;
- (c) Exploring the use of the same reference period for all activities in the selected regions by using the same methodology to estimate AD;
- (d) Exploring the use of a more consistent time series by using the same satellite data sources (e.g. Landsat or RapidEye) for the entire period of the AD.

37. Furthermore, the LULUCF experts noted that Chile may wish to consider recalculating the entire set of AD using satellite imagery with the same classification approach, spatial resolution and time frame for all subnational areas or for national coverage (see paras. 20 and 35 above), with the aim of enhancing the consistency and accuracy of the estimates in future submissions.

38. In its technical annex, Chile described several activities it has identified to address the gaps in data and information required for the construction of the FRELS/FRLs and the reporting of results (see section 3.3 of the technical annex). The LULUCF experts commend Chile for undertaking these activities, as part of the stepwise approach, to enhance the transparency, consistency and accuracy of its future FRELS/FRLs and results.

D. Comments and responses of the Party

39. During the consultation process, Chile noted a number of capacity-building needs. Addressing those needs could potentially enable Chile to improve its data and methodologies, move from subnational to national coverage, include additional carbon pools for selected activities, and include spatially explicit estimates of non-CO₂ gases from forest fires in future FREL/FRL submissions and subsequent estimations of results. After exchanges with the LULUCF experts, Chile identified the following technical support and capacity-building needs for the further improvement of its estimation of AD and EFs:

- (a) Enhancing the accuracy of identifying land-use change from non-forest to native forest;
- (b) Developing methodologies for monitoring activities in high cloud cover regions;
- (c) Strengthening the technical capacity to monitor other regions and forest types under the NFMS;

- (d) Including the activity sustainable management of forests and the associated changes in carbon stocks;
- (e) Including the SOC pool in national-level estimates;
- (f) Applying the Monte Carlo approach for the uncertainty analysis of estimates.

III. Conclusions

40. The LULUCF experts conclude that Chile reported the results of the implementation of four REDD+ activities: reducing emissions from deforestation, reducing emissions from forest degradation, conservation of forest carbon stocks and enhancement of forest carbon stocks. The technical annex covers the same five administrative regions of Chile as the FRELS/FRLs (i.e. Biobío, La Araucanía, Los Lagos, Los Ríos and Maule), accounting for 41 per cent of the national forest area. Chile used the same definitions for defining native forest and the selected activities in its estimation of results as those applied in the construction of its FRELS/FRLs. The results include estimates of CO₂ emissions from three carbon pools: above-ground biomass, below-ground biomass and deadwood for the period 2014–2016 for activities that involve land-use change and for 2011–2015 for activities that occur in forest remaining forest. The results cover the same carbon pools and gases as the FRELS/FRLs. Consistent EFs were used for the construction of the FRELS/FRLs and results but different methodologies were used for estimating the AD.

41. The LULUCF experts consider the data and information provided in the technical annex to be transparent, complete, accurate and, to the extent possible, given current national capacities and capabilities, consistent (based on the assumptions and information used), and to be in accordance with the guidelines referred to in decision 14/CP.19, paragraph 11.

42. The LULUCF experts noted that Chile is implementing an NFMS that is capable of being used to assess possible displacement of emissions.

43. In conclusion, the LULUCF experts commend Chile for showing a strong commitment to the continuous improvement of the data and information used for calculating the results, in line with the stepwise approach, which are consistent with those used to establish its assessed FRELS/FRLs. Some areas for future technical improvement and capacity-building needs identified by Chile have been identified in this report. At the same time, the LULUCF experts acknowledge that such improvements are subject to national capabilities and circumstances, and note the importance of adequate and predictable support.¹⁸ The LULUCF experts also acknowledge that the TA process was an opportunity for a facilitative and constructive technical exchange of views and information with Chile.¹⁹

¹⁸ In accordance with decision 2/CP.17, para. 57.

¹⁹ In accordance with decision 14/CP.19, paras. 12 and 13.

Annex I

Technical annex to the biennial update report

Owing to the complexity and length of the submitted technical annex, and of the revised technical annex, to the BUR, and in order to maintain the original formatting, the technical annexes are not reproduced here. It is available on the UNFCCC website at <https://unfccc.int/BURs>.

Annex II

Summary of the main features of the proposed results of the implementation of the activities referred to in decision 1/CP.16, paragraph 70, based on information provided by Chile

| | <i>Key elements</i> | <i>Remarks</i> |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Results reported (t CO ₂ eq/year) | 148 513 (reduction in emissions from deforestation) 4 530 732 (increase in emissions from forest degradation) -1 519 769 (conservation of forest carbon stocks) -8 998 925 (enhancement of forest carbon stocks) | Results presented in paragraph 10 of this document (and in table 35 of the technical annex) For the activity reducing emissions from forest degradation, CH ₄ and N ₂ O from forest fires are included; an increase in emissions due to increase in forest areas affected by fires (see paras. 10(b) and 16(b) of this document) |
| Results period | 2014–2016 for activities that involve land-use change 2011–2015 for activities that occur in forest remaining forest | See paragraph 10 of this document |
| Assessed FREL/FRL (t CO ₂ eq/year) | 3 452 885 (deforestation) 9 149 392 (forest degradation) -2 430 438 (conservation) -10 012 012 (enhancement) | The subnational FRELS/FRLs include CO ₂ emissions and removals; for the activity reducing emissions from forest degradation, CH ₄ and N ₂ O from forest fires are included See document FCCC/TAR/2016/CHL and paragraph 9 of this document |
| Reference period | FREL/FRL = annual average change in carbon stocks 2001–2013 for activities that involve land-use change 2001–2010 for activities that occur in forest remaining forest | See paragraph 9 of this document |
| National/subnational | Subnational | For five administrative regions, covering 41 per cent of the national native forest area (see para. 8 of this document) |
| Activities included | Reducing emissions from deforestation Reducing emissions from forest degradation Conservation of forest carbon stocks Enhancement of forest carbon stocks | See paragraphs 8–10 of this document |
| Pools included | Above- and below-ground biomass for all activities | Chile justified the exclusion of SOC for all four activities as being due to a lack of |

| | <i>Key elements</i> | <i>Remarks</i> |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | DOM is included for the activities deforestation, forest degradation and conservation of forest carbon stocks | national information (see para. 31 of this document) |
| Gases included | CO ₂ , CH ₄ and N ₂ O | Non-CO ₂ gases were included in the estimation of emissions from forest fires under the activity reducing emissions from forest degradation (see para. 31 of this document) |
| Consistency between assessed FREL/FRL and the results | Methods, definitions and information used for the estimation of the results are consistent to the extent possible with those used for the construction of the assessed FRELs/FRLs | The definition of forest has operationally remained the same, and the definition of activities has remained the same; the same EFs were used, but the methodology for estimating AD have changed (see paras. 20 and 21 of this document) |
| Description of NFMS and institutional roles | Included | See paragraphs 27–29 of this document |
| Identification of future technical improvements | Included | Several areas for future technical improvements were identified by the LULUCF experts and the Party (see paras. 36–37 and 39 of this document) |

Annex III

Documents and information used during the technical analysis

Reference documents

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