Technical Cooperation Document

I. Basic Information for TC

▪ Country/Region:	BOLIVIA
▪ TC Name:	Evaluating the Effect of Bolivia's Environmental Rural Cadaster on Deforestation
▪ TC Number:	BO-T1452
▪ Team Leader/Members:	Blackman, Allen (CSD/CSD) Team Leader; Mattos Vazualdo, Juan De Dios Roger (CSD/RND) Alternate Team Leader; Mendoza Benavente, Horacio (LEG/SGO); Arguello, Marlene Zoraida (VPC/FMP); Schling, Maja (CSD/RND); Aleman, Marco Andres (VPC/FMP); Chavez, Elizabeth (CSD/RND); Gomez, Juan Carlos (CSD/CCS)
▪ Taxonomy:	Operational Support
▪ Operation Supported by the TC:	BO-L1234BO-L1234
▪ Date of TC Abstract authorization:	09 Oct 2024.
▪ Beneficiary:	National Agrarian Reform Institute (INRA)
▪ Executing Agency and contact name:	Inter-American Development Bank
▪ Donors providing funding:	OC SDP Window 2 - Sustainability(W2A)
▪ IDB Funding Requested:	US$200,000.00
▪ Local counterpart funding, if any:	US$100,000.00 (In-Kind)
▪ Disbursement period (Execution period):	36 months
▪ Required start date:	January, 2025
▪ Types of consultants:	Firms and individual consultants
▪ Prepared by Unit:	CSD-Climate Change and Sustainable Development Sector
▪ Unit of Disbursement Responsibility:	CSD/CSD-Climate Change and Sustainable Development Sector
▪ TC included in Country Strategy:	Yes
▪ TC included in CPD:	No
▪ Alignment to the Update to the Institutional Strategy 2024-2030:	Environmental sustainability; Institutional capacity and rule of law; Social inclusion and equality

II. Description of the Associated Loan/Guarantee

2.1 The operation associated with the proposed study is BO-L1234, the Bolivian Land Management Program for Sustainable Rural Development, a US$47 million loan approved in April 2024. Its broad objectives are to: (i) consolidate the legal security of rural property; (ii) promote sustainable land use; (iii) reduce deforestation and land use change; and (iv) increase the efficiency and coverage of the rural cadastral system. The operation will be executed by Bolivia's National Institute for Agrarian Reform (INRA). It has three components and an administration module.

2.2 Component 1 (US $16.7 million) focuses on regularizing tenure on the last 13.3 million hectares of Bolivia's rural lands (13 percent of the country's total area) where formal legal titles have not yet been assigned.

2.3 Component 2 (US $16.8 million) focuses on implementing Bolivia's land management system so as to reduce deforestation and land-use change. It has six parts: (i) estimating and mapping rural land values; (ii) building a land management platform that incorporates satellite data on land use and land cover; (iii) creating an

Environmental Rural Cadaster (ERC) that incorporates environmental information into the existing cadaster, including land uses and easements (regulatory land use restrictions) inside property boundaries; (iv) supporting staff and equipment required for the prioritized *municipios* to use the land management platform; (v) verification and monitoring of sustainable land use by Bolivian institutions, specifically, INRA, the Agroenvironmental and Productive Observatory (OAP), the Forest and Land Enforcement and Social Oversight Authority (ABT), and the National Protected Areas Service (SERNAP); and (vi) developing land management tools for Indigenous, Native, and Campesino Territories and lowland communities.

2.4 Component 3 (US $8.9 million) entails increasing the efficiency and coverage of the land management system. It has five parts: (i) updating of the legal and regulatory framework for the national land management system; (ii) modernizing the information systems of INRA, ABT, and the Real Property Rights Registry via the purchase of hardware and software; (iii) digitalization of INRA's records and files; (iv) modernizing service delivery infrastructure, including the design, construction, and renovation of 11 INRA offices; and (v) design and implementation of the INRA institutional policy on gender and diversity.

2.5 The Administration Component (US $4.5 million) will finance program administration, annual audits, midterm and final evaluations, an impact assessment (focused only on socioeconomic outcomes, not environmental ones), and monitoring of activities and indicators.

III. Objectives and Justification of the TC

A. Motivation and Background

3.1 Over the past several decades, IDB has provided hundreds of millions of dollars for rural land titling interventions, including large-scale operations in Brazil, Ecuador, Peru, and Guatemala. The principal aim has been to boost investment, productivity, food security, and other socioeconomic outcomes. As a result, impact evaluations have focused on these outcomes.

3.2 Less attention has been devoted to environmental outcomes, in particular deforestation, which is an urgent problem facing the region (Blackman et al. 2021). Unfortunately, both theory and empirical evidence indicate that in some contexts, land titling can exacerbate deforestation. Theory suggests that titling can increase landholders' access to credit, which in turn, boosts returns to agriculture relative to forest (Farzin 1984). And counterfactual evidence indicates that in some contexts, land tenure interventions lead to forest loss (Liscow 2013; Tseng et al. 2019).

3.3 These issues have recently come to the fore in Bolivia. The country's 51 million ha of forests are increasingly threatened. Since 2000, Bolivia has ranked among the world's 10 countries with the most net forest loss, almost all of which has occurred in the Bolivian lowlands (FAO 2010, 2020). During this same period, IDB has provided financial and technical support for increasingly ambitious land titling and land tenure regularization efforts starting with a $2 million project in Santa Cruz in 2002 (1099/SF-BO), then a $22 million project also focused on Santa Cruz in 2003 (BO-0221), then a $60 million national project in 2016 (3722/BL-BO), and most recently, a $47 million national project in 2024 (5865/OC-BO).

3.4 To address concerns about potential adverse effects of land titling on deforestation, the most recent IDB operation (5865/OC-BO) features an innovative intervention, pioneered in Brazil over the past 15 years, but to our knowledge not used elsewhere:

an environmental rural cadaster (ERC). Whereas conventional rural cadasters simply demarcate property boundaries, an ERC also maps the land uses (forest, agriculture, pasture, etc.) at baseline along with all applicable regulatory restrictions on land use and land cover on the property. The ERC is used to monitor and compel compliance with these restrictions. Brazil's ERC has mainly been used to ensure compliance with the country's 2012 Forest Code's 'Legal Reserve' provisions that require a minimum percentage of all private parcels be forested, ranging from 20 percent in the Atlantic Forest region to 80 percent in the Amazon region. Similarly, Bolivia's ERC will mainly be used to ensure compliance with the country's national Economic and Social Function (*Función Económica y Social*, FES) laws that require private parcels to have at least 50 percent forest cover. In addition, the ERC will be used to boost compliance with property-specific easements that, for example, require riparian areas (i.e., lands that border rivers and wetlands) to be protected. Enrollment in the ERC will be mandatory for all private properties. In principle, the ERC can reduce deforestation via three causal mechanisms: (i) enhancing formal regulatory pressure exerted by state institutions, (ii) strengthening informal regulatory pressure exerted by communities, capital markets and consumers; and (iii) bolstering landholders' management capacity. If this approach proves effective, it could be used in other LAC countries.

B. Objectives

3.5 The broad objective of this TC is to evaluate the efficacy of Bolivia ERC, and to distill the implications for forest conservation policy and land tenure policy both in Bolivia and throughout Latin America and the Caribbean.

3.6 The specific objective of the TC is to answer three related research questions. First, what is the effect of the ERC on deforestation in the Bolivian lowlands, where the vast majority of the countries forest loss has occurred? Second, how are these effects moderated by the geophysical, socioeconomic, and institutional characteristics of rural properties? And finally, what are the implications of the answers to the first two research questions for the design and implementation of Bolivia's ERC and more broadly, for forest conservation and land regularization interventions in Latin American and the Caribbean?

3.7 None of these research questions will be addressed by the impact evaluation already planned for and financed by 5865/OC-BO. As noted above, that impact evaluation will focus solely on socioeconomic outcomes, specifically on household investment and credit activities. Moreover, it will focus on the Bolivian highlands, where forest cover is sparse.

C. Methods and Data

3.8 **Identification strategy, principal outcome, and intervention.** Our identification strategy is an RCT. The principal outcome will be deforestation on participating properties. The intervention will be enrollment in the ERC

3.9 **Experimental design.** Juan de Dios Fernández, Director of Planning and Evaluation, at INRA, the executing agency for the associated operation (BO-L1234), will be a member of the study team and has confirmed that INRA will randomize the rollout intervention.

3.10 **Sample.** The rural properties participating in the RCT will be the universe of large-scale (500-5,000 ha) private properties in the Amazon region of Bolivia, which number roughly 8,000 according to INRA. The vast majority of these properties are located in two departments: Santa Cruz and Beni. Roughly half are owned by large corporations. These 8,000 properties will be the only ones enrolled in the ERC in the first four years

after it is launched. Smaller properties will be enrolled subsequently. INRA has decided to enroll large properties first because they contain the vast majority of forests on private properties, and therefore, the transactions costs of enrollment per hectare of forest are relatively low. As noted above, enrollment in the ERC is mandatory for all private properties.

3.11 **Timeline and randomization.** The BO-L1234 results matrix calls for enrolling these roughly 8,000 large-scale properties in the ERC over a four-year period spanning 2026–2029. Specifically, it calls for enrolling 2,000 large-scale properties during each of these four years, after which 100 percent of the properties will have been enrolled. INRA plans to randomize the order in which the 8,000 properties are enrolled. That is, each year of the of the project, a randomly selected group of 2,000 large-scale properties will be enrolled. Randomization will be at the level of individual properties. INRA has opted for a randomized rollout not only to facilitate an RCT, but also to allay potential concerns about political motivations for the timing of enrollment. Our study would evaluate the efficacy of the first two years of the rollout of the ERC: 2026 and 2027.

3.12 **Treatment arms.** Our RCT will have two treatment arms: a treated group of properties that has been enrolled and a control group of properties that have yet to be enrolled. We will identify the effect of the ERC by comparing average outcomes for treated properties with average outcomes for control properties.

3.13 **Administrative and survey data on property characteristics and heterogeneity analysis.** We will collect and compile data on geophysical, socioeconomic, and institutional property characteristics such as property size, biome, baseline land use and land cover, ownership structure, and market integration. These data will be culled from two sources: (i) INRA and other government agencies; and (ii) an original baseline survey administered to owners and managers of participating properties. These data will be used both to control for any residual imbalance between treatment and control groups after randomization and to explore treatment effect heterogeneity.

3.14 **Estimations.** We will estimate treatment effects using ordinary least squares to fit regressions of the form:

$$y_{it} = \sum_{0}^{n} \beta_{t-n} erc_{it} + \beta_2 y_{i0} + \beta_3 x_{i0} + \epsilon \qquad (n = 1,2 \ldots z) \text{ (n=1,2…z)(1)}$$

where *i* is a property index, *t* is a year index, and *n* is an index of temporal lags; *y* is the percentage of the property with forest cover; *erc* is a binary indicator of whether the property was enrolled in the ERC; *x* is a vector of property characteristics at baseline; β is a parameter or vector of parameters; and ϵ is an error term. Our treatment effects are given by the vector of parameters $\beta\_(t\text{-}n)$. We will use interaction between the treatment dummies and elements of the vector *x* to explore treatment effect heterogeneity.

3.15 **Our impact evaluation will rely on three main data sets**.

3.16 **ERC data created by the operation (5865/OC-BO)**. These geographic information system data will map the boundaries of participating properties along with the land uses, land cover, and regulatory restrictions within those boundaries. It will be provided by INRA.

3.17 **High spatial resolution annual land use and land cover maps from 2026 to 2029**. These data will be derived from satellite images. A number of freely available high spatial resolution annual data sets for Bolivia can be used. Three have a spatial resolution of 30m×30m: Hansen et al. (2013 and updates), Vancutsem (2021 and

updates), and the MapBiomas Bolivia project (2024 and updates). A fourth data set, Zanaga et al. (2022 and updates), has spatial resolution of 10m×10m. We will assess the strengths and weaknesses of each data set for our study area. We will select one to be our preferred data set and will use the others to conduct robustness checks.

3.18 **Administrative and survey data property characteristics.** As noted above, we will collect and compile secondary administrative data and primary survey data on property characteristics. The administrative data will be provided by INRA and other government agencies. The baseline survey data will be collected in 2025.

3.19 **These data sets map to the variables in Equation (1) as follows**. The first data set will be used to generate our treatment variables, erc_{it} ,a dichotomous dummy indicating whether the property was enrolled in the ERC in year *t*. These data, along with the second data set will be used to generate our outcome variable, y_{it}, the percentage of the property with forest cover in year *t*. And the third data set will be used to generate x_i, the vector of property characteristics at baseline.

D. Alignment

3.20 This TC is consistent with the *IDB Group Institutional Strategy: Transformation for Greater Scale and Impact* (CA-631). The operation is aligned with its objective of "*adressing climate change*" and its area of operational focus of "*biodiversity, natural capital and climate action*", because it will rigorously evaluate a promising new policy intervention (Bolivia's ERC) that aims to reduce deforestation, which in turn, will cut emissions of greenhouse gases, and conserve biodiversity and natural capital

3.21 This TC will contribute to the IDB Group Impact Framework 2024-2030 (GN-3195-8). The Results Matrix indicators (IADB publications and dissemination workshops) will help to advance the CRF Country Development results level 1 indicators of government effectiveness (15), voice and accountability (18); the level 2 indicators of emissions avoided (19); and the level 3 indicators of projects supporting climate change mitigation and/or adaptation (6), projects supporting institutional capacity and rule of law (9), and average downloads of IDBG publications (22).

3.22 The operation is also aligned with: (i) the IDB Integrated Strategy for Climate Change Adaptation and Mitigation, and Sustainable and Renewable Energy (GN-2609-1); (ii) the Climate Change Sector Framework Document (GN-2835-13); (iii) the Environment and Biodiversity Sector Framework Document (GN-2827-8); (iv) the Climate Change Action Plan 2021-2025; and (v) the IDB Group Natural Capital and Biodiversity Mainstreaming Action Plan 2024-2025 (GN-3216-1)

3.23 Additionally, this operation is aligned with the objectives and pillars of the Ordinary Capital Strategic Development Program for Sustainability (OC-SDP for Sustainability) (GN-2819-14), in particular with the objectives of expanding the knowledge base on climate change mitigation, adaptation, and sustainable energy geared towards leveraging climate investment; and with the foci of strengthening the climate knowledge base; strengthening institutional capacities, including those focused on environmental sustainability, disaster prevention, and disaster response; and supporting technological innovations, reforms, and market access initiatives.

3.24 Finally, this operation complements the IDB's ongoing work through more than 20 operations focused on climate change, disasters and natural resource degradation. These include for example, ATN/FR-17302-AR, 4363/OC-BH, BK-C1118, 4403/BL-BO,4403, ATN/FC-19789-BR, ATN/OC-17504-CH, ATN/PI-19369-CO, ATN/OC-18148-CRhttps://convergence.iadb.org/Operation/CR-

T1218, ATN/OC-18843-DRhttps://convergence.iadb.org/Operation/DR-T1219, ATN/FC-20456-EC, 5191/MS-GU, ATN/OC-19242-GY, GRT/GN-17771-HO, ATN/ME-18064-JA,
ATN/SX-18950-PE, ATN/JF-16701-PN, https://convergence.iadb.org/Operation/RG-E1577ATN/CN-18968-TT, and
GRC/ME-19656-UR. It opens lines of communication and promotes a regional dialogue between the community of experts—including team leaders of these funded operations—the scientific community, and policy makers, to leverage the lessons learned to address knowledge gaps.

IV. Description of Activities/Components and Budget

4.1 **Component 1**. **Design and data compilation (US$70,000).** The objective of this component is to design the impact evaluation and baseline survey, identify and compile administrative data, and set up systems needed to manage these data. It will have the following elements: (i) Randomization. We will obtain and verify a database of the universe of approximately 8,000 large-scale private properties in Bolivia's Amazon region that will be enrolled in the ERC and working with INRA, will randomly select 2,000 to be enrolled during each year of our RCT; (ii) Land use and land cover data selection. We will download and assess the strengths and weaknesses of the four-land use and land cover data sets described above (and any others that may become available in the next year) and we will select one to be our preferred data set; (iii) Administrative data acquisition. We will acquire and compile administrative data on property characteristics from INRA, ABT, SERNAP, and any other government agencies that have such data; (iv) Baseline survey design. We will design the baseline survey and hire a survey research firm to administer it; and (v) Data management system. We will develop a system for compiling and cleaning the ERC data and merging it with the other data used in the project, specifically, land use and land cover data, and administrative and survey data on property characteristics. Component 1 will be completed by the end of 2025. The output and deliverable for this component will be a supervision report detailing progress on elements (i) through (v) described above.

4.2 **Component 2**. **RCT implementation (US$65,000).** The objective of this component is to support the implementation of the RCT, specifically administering the baseline survey and compiling the cadastral and outcome data needed to evaluate the effect of the ERC. It will entail the following elements: (i) Baseline survey administration. We will administer the baseline survey following design developed in Component 1; (ii) Data compilation. Using the data management system developed in Component 1, we will compile the ERC data as it becomes available and merge it with administrative and survey data on property characteristics. Component 2 will be conducted in 2026–2027. The baseline survey will be completed by the end of 2026. Data compilation will occur during each of the first two years of ERC enrollment 2026–2027. The outputs and deliverables for this component will be: (a) a completed baseline survey and (b) a new data base.

4.3 **Component 3**. **Data analysis (US$45,000).** The objective of this component is to conduct the statistical analysis needed to evaluate the effect of the ERC. Using the empirical strategy described above, we will estimate treatment effects and explore effect heterogeneity. We will conduct this analysis at end of 2027. The output and deliverable for this component will be a supervision report detailing the progress of the data analysis.

4.4 **Component 4. Dissemination (US$20,000).** The objective of this component is to disseminate the results of the impact evaluation. It will finance write-up and dissemination of our results via the reports, workshops, and meetings described below. Component 4 will be completed by the end of 2027. The outputs and deliverables for this component will be: (a) an IDB Working Paper summarizing the data collected and data analysis; (b) an IDB Policy Brief focused on lessons of the study for policy; and (c) a dissemination workshop.

4.5 The expected results of this TC include: (i) a rigorous objective assessment of the efficacy of Bolivia's ERC and how it depends on property characteristics; (ii) an improved design and implementation of Bolivia's ERC; and (iii) an understanding of the opportunities and challenges of using ERCs as a conservation tool in LAC.

4.6 The estimated total cost of this operation is US$300,000, of which US$200,000 will be financed with resources from Window 2 (W2A – Sustainability) of the Ordinary Capital Strategic Development Program (OC SDP), and US$100,000 will be provided as in-kind local counterpart.

Indicative Budget (US$)

Activity/Component Description	IDB Funding	Counterpart Funding	Total
Component 1. Design and data compilation	70,000	0	70,000
Component 2. RCT implementation	65,000	100,000	165,000
Component 3. Data analysis	45,000	0	45,000
Component 4. Dissemination	20,000	0	20,000
Total	**200,000**	**100,000**	**300,000**

V. Executing Agency and Execution Structure

5.1 This operation will be executed by the IDB in light of synergies and complementarities with Bank operations and research. The Climate Change and Sustainable Development sector's (CSD) Front Office will be responsible for the preparation, execution, and supervision of Components 1-3 and the administration module following the policies established by the Bank. The Team Leader, will be responsible for the execution and monitoring of the operation. They will directly supervise the submission of deliverables and track that these products are delivered according to the project's planned timeline. They will be supported by the alternate team leader and team members. The non-objection from the MPD is in process and activities will not start until the letter is received.

5.2 The principal reason for this execution structure is that the IDB, and the research team in particular, have the technical expertise to conduct the research described above. They have considerable experience conducting rigorous impact evaluations, including experimental ones, to evaluate the efficacy of forest conservation policies. In addition, the IDB and the project team have considerable experience implementing and analyzing IDB land tenure interventions. A second reason is that the Bank has the capacity to identify and fill knowledge gaps at the regional scale. A final reason has to do with dissemination: the policy implications from the proposed studies will be informative for other countries.

5.3 All activities to be executed under this TC have been included in the Procurement Plan (Annex III) and will be executed in accordance with the Bank's established procurement methods, namely: (i) hiring of individual consultants, as established in the Complementary Workforce Document (AM-650); and (ii) contracting of services in accordance with the Institutional Procurement Policy (GN-2303-33) and its associated guidelines.

5.4 The knowledge products generated within this technical cooperation will be the property of the Bank and may be made available to the public under a creative commons license. However, at the request of a beneficiary, in accordance with the provisions of AM-331, the intellectual property of said products may also be licensed to one or more beneficiaries through specific contractual commitments that shall be prepared with the advice of the Legal Department.

VI. Important Risks

6.1 The main risk to successful and timely execution of the project is that the implementation of the ERC under BO-L1234 is delayed. This risk and the measures taken to mitigate them are discussed in the BO-L1234 loan documents. A second risk is that implementation of ERC related activities will not adhere to the treatment assignment (randomization). This risk is mitigated by the fact that the research team is coordinating closely with the executing unit of the loan which has confirmed its willingness to randomize treatment assignment in part because it will allay potential concerns that it is driven by political considerations. The research team will continue to coordinate all research activities with the executing unit to ensure proper implementation of the evaluation. A third risk is that the intervention in question, Bolivia's ERC, will not be sustained. This risk is mitigated by the fact that it is a supported by a $47 million six-year IDB loan. This operation provides both incentives and resources needed to address factors that might endanger sustainability.

VII. Exceptions to Bank policy

7.1 This operation does not include any exceptions to Bank policy.

VIII. Environmental and Social Aspects

8.1 This Technical Cooperation is not intended to finance pre-feasibility or feasibility studies of specific investment projects or environmental and social studies associated with them; therefore, this TC does not have applicable requirements of the Bank's Environmental and Social Policy Framework (ESPF).

Required Annexes

Request from the Client_11104.pdf

Results Matrix_40908.pdf

Terms of Reference_27207.pdf

Procurement Plan_67809.pdf

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