Technical paper

Testing of the Belém Adaptation Indicators in the Province of Chaco, Argentina. Lessons Learned from a Multi-Scale Exercise

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[1.5]
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1 | Introduction

The establishment of the Global Goal on Adaptation (GGA)—aimed at enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change within the context of the temperature goal and sustainable development—marked a critical milestone under the Paris Agreement. Nevertheless, its operationalization spans several years, and a comprehensive assessment of its progress could not be fully realized under the first Global Stocktake (GST).

To bridge this gap, COP28 witnessed the landmark adoption of the United Arab Emirates Framework for Global Climate Resilience (UAE-FGCR), designed to achieve the goal and track collective progress across both action and support. The framework establishes 11 targets structured around the four dimensions of the iterative adaptation cycle (impact, vulnerability, and risk assessment; planning; implementation; and monitoring, evaluation, and learning systems) and seven themes or sectors (water, health, food and agriculture, cultural heritage, poverty and livelihoods, infrastructure and human settlements, and ecosystems and biodiversity), alongside several cross-cutting considerations. Additionally, parties established a two-year work programme concluding at COP30 in Belém to develop the specific indicators needed to measure these targets.

After this process, 59 Belém Adaptation Indicators (BAI) were adopted and are now part of a testing exercise by parties and other stakeholders in order to understand its usefulness, and to adjust what is necessary, making use of the Belém-Addis Vision (BAV) also launched at COP30 which, among other aspects, requires the development of methodological work associated with the indicators.

Argentina 1.5 and Gran Chaco Foundations have embarked on a joint journey to contribute to the testing of BAI from a multi-scalar and multi-level perspective of adaptation. This policy report summarizes the progress made in recent months, which has involved joint capacity building and an effort to understand the extent to which BAI are applicable to the realities of the Chaco province in Argentina, and in particular, to the livestock production chain. To this end, the UAE-FGCR, along with the National Adaptation Plan (NAP) submitted by Argentina to the UNFCCC and the draft Response Plan of the Chaco province under Law 27.520, have been considered as key inputs for the exercise.

In addition to the methodological exercise, we seek to inform the work that will take place at the UNFCCC until COP32 in Addis Ababa, by demonstrating the relevance of considering other levels of application, such as the subnational and community levels, when testing indicators and generating recommendations.

2 | Methodological approach

Between March and June 2026, the Argentina 1.5 and Gran Chaco Foundations established a collaborative process to build joint capacities regarding the UAE-FGCR and the development of a strategic roadmap for testing the Belém Adaptation Indicators (BAI) in the Chaco province.

This exercise required a series of critical methodological decisions that underscore the systemic challenges of multilevel adaptation governance and indicator application. A primary decision was to narrow the thematic scope of the exercise to the livestock sector within Chaco province in Argentina. Concurrently, six specific measures were prioritized and goals for the livestock sector drawn from Chaco's draft Provincial Response Plan, to which the Gran Chaco Foundation had previously contributed.

Both the selected measures and their corresponding goals are directly informed by a risk, impact, and vulnerability assessment of the Gran Chaco region. This assessment was integrated into the analysis to ensure that subnational planning remains strictly evidence-based, and in full compliance with the targets of the UAE-FGCR.

The subnational planning under Chaco's draft Response Plan was structured around the methodological architecture of Argentina's NAP. The NAP relied on a participatory process that engaged provincial governments, the Autonomous City of Buenos Aires (CABA), national authorities, Indigenous Peoples, and civil society representatives. It also built climate risk chains mapped across five distinct geographical regions across the country. Under this classification, Chaco province is situated within the Northeast (NEA) region.

The primary climate risks identified in the NAP across all regions include: ecosystem degradation driven by the increased scale, occurrence, and spread of wildfires; diminished access to safe drinking water caused by prolonged droughts; disruptions to hydroelectric power generation due to reduced water availability (specifically exacerbated by the extreme low water levels of the Paraná River in the NEA); and severe threats to the livelihoods of smallholder, family, peasant, and indigenous producers resulting from fires, desertification, and flooding. In the NEA region, artisanal fishers are identified as a frontline group exposed to these vulnerabilities.

Furthermore, the NEA region faces an acute risk of displacement and loss of adequate housing due to flooding along the Uruguay River. These recurrent floods threaten the physical safety, public health, and psychological well-being of riverside and island populations through physical trauma and the proliferation of waterborne infections.

Additionally, flooding regularly compromises physical connectivity, disrupting the transit of populations and the logistical transport of essential supplies and services due to severe infrastructure damage to roads and paths. Within this fragile ecosystem, extreme river fluctuations —both high and low water levels—directly erode riverbanks and undermine the livelihoods of the communities dependent on them.

Furthermore, the NEA region is experiencing systemic warming trends, evidenced by rising average, minimum, and maximum temperatures, alongside an increasing frequency of heat waves and tropical nights, and a corresponding decline in frost days. This warming trend drives up potential evapotranspiration, which alters native vegetation dynamics, degrades critical wetlands, and severely diminishes the capacity of these ecosystems to buffer against thermal extremes. Ultimately, elevated evapotranspiration, coupled with shifting seasonal precipitation patterns, creates conditions that favor the accumulation of dry biomass, compounding regional wildfire risks.

As a result of the risk assessment, the NAP establishes 250 measures, 4 cross-cutting approaches (gender and diversity; integrated risk management; health and just labor transition), 4 instrumental lines (action for climate empowerment; financing for the transition; institutional strengthening; and research, development, and innovation), and 6 strategic lines (conservation of biodiversity and common goods; sustainable management of food systems and forests; sustainable mobility; sustainable and resilient territories; energy transition and productive transition).

With the 6 prioritized measures and goals for the livestock sector in Chaco, alignment was carried out with the measures of the NAP, as well as with the targets of the UAE-FGCR and the BAI. As a result, 9 BAIs were selected according to 5 targets, 4 thematic: food and agriculture (3 BAIs), ecosystems and biodiversity (2 BAIs), water (2 BAIs), poverty and livelihoods (1 BAI), and one dimensional: risk, impact, and vulnerability assessment (1 BAIs).

The assessment also involves a number of observations related to the BAIs:

- Dialogue with the indicators identified by the experts in their September 2025 report, insofar as it offered an initial identification of data and metadata availability.
- Relevant conceptual considerations for a better understanding of the application of the BAI, particularly in the national and regional context.
- Considerations about proposed methodological approaches to testing indicators currently used in other contexts.

During the 2026 NAP Expo, a group of countries participated in workshops to begin testing the practical application of the BAI. The workshop dynamic, while not an official UNFCCC-approved methodology, offered an illustrative approach demonstrating one possible way to structure the voluntary testing and operationalization of the indicators using existing data sources and methodological frameworks. Its purpose was to support practical experimentation, learning, and methodological refinement, rather than to prescribe a standardized reporting approach or establish comparability across countries.

The methodology applied the indicators through a structured multidimensional framework in which each indicator was operationalized through three components: a quantitative core measure (M), a description of relevant adaptation actions (A), and the climate hazard context (H). The process began by calculating the core metric using established methodologies and existing data sources where possible, such as SDG, Sendai, or other sector-specific indicator frameworks, and then complementing this with contextual information on adaptation actions implemented, including their scale, timing, and expected influence, as well as the relevant hazard conditions affecting the reporting period, such as hazard type, intensity, frequency, and exposure. Rather than attempting strict attribution between adaptation actions and observed outcomes, or collapsing all dimensions into a single composite score, the methodology assessed these components in parallel to provide a structured interpretation of adaptation progress, while documenting assumptions, methodological choices, limitations, and data gaps to support transparency and future refinement through country-led testing.

The assessment of the applicability of the BAI conducted includes the identification of the information required for applying the selected indicators to the livestock value chain in Chaco, an analysis of available information sources, as well as limitations and information gaps.

Finally, it involved identifying cross-cutting approaches or considerations in accordance with Decision 12/CMA.7 of Belém. The decision involves two possible approaches. On the one hand, paragraph 10 amplifies cross-cutting considerations of previous GGA decisions (paragraph 10(c) Decision 3/CMA.4, paragraph 13 Decision 2/CMA.5 and paragraph 21 Decision 3/CMA.6) by recognizing the contributions of children, youth, people with disabilities, Indigenous Peoples and local communities, people of African descent and migrants to adaptation, and the importance of considering gender, human rights, intergenerational equity and social justice, and participatory and fully transparent approaches.

On the other hand, the decision's annex refers to the contextual specificity of adaptation and, therefore, the parties are invited to determine the categories and the degree of disaggregation of categories according to their circumstances and national contexts, including: social categories, such as demographic and socioeconomic characteristics like vulnerability, gender, age, disability, race, socioeconomic status, indigenous peoples status, migrant status, as well as children and young people.

For this exercise, a gender and intersectional approach was chosen, involving youth and Indigenous Peoples. This decision stems from the available information for the territory and the production chain analyzed.

3 | Presentation of the case study: adaptation in Chaco

The draft Climate Change Response Plan (CCRP) developed by the province of Chaco is firmly institutionalized and aligned with existing national and provincial legal and public policy frameworks, ensuring complementarity. In particular, with National Law No. 27.520 (Minimum Standards for Adaptation and Mitigation of Global Climate Change) that establishes the binding legal framework requiring provincial jurisdictions to design and implement their respective CCRPs. This law also establishes the National Climate Change Adaptation and Mitigation Plan, which includes the NAP. The actions outlined for Chaco are aligned with the priority objectives of Argentina's NAP, contributing explicitly to the targets established under the country's Second Nationally Determined Contribution (NDC). These targets are aimed at enhancing the resilience of agri-food systems and promoting sustainable productive diversification.

The Provincial CCRP is coordinated through the Provincial Climate Change Cabinet and the Provincial Environmental Council. It also comprises a sectoral livestock plan closely linked to the Native Forests Law (National Law No. 26.331) through the guidelines for Integrated

Forest-Livestock Management also known as Integrated Crop-Livestock-Forestry (ICLF), which promote sustainable livestock production while conserving native forest ecosystems.

The geographic and operational scope of this Plan encompasses the entire livestock-producing territory of Chaco Province, with particular attention to the critical semi-arid zones (such as the El Impenetrable region) and to wetland and savanna areas prone to extreme drought and flood cycles (the Central-Eastern region). The plan focuses on transforming the traditional livestock production system by promoting sustainable production models that mitigate soil degradation, protect native forests, and ensure the food and economic security of local communities. A fundamental pillar of this scope is the prioritization of family farming, peasant and Indigenous agriculture, and small- and medium-scale livestock producers. These socioeconomic actors constitute the foundation of rural livelihoods and territorial permanence in the province, yet they are particularly vulnerable to the impacts of climate change due to longstanding constraints in infrastructure, capitalization, and access to adaptive technologies. The plan seeks to integrate these traditional systems with cutting-edge technical and scientific approaches in order to consolidate a carbon-neutral, resilient, and climate-smart livestock production model.

The development of a robust response plan requires a rigorous assessment of the climate risks facing the provincial livestock sector, structured according to the conceptual framework of hazards, exposure, and vulnerability.

Climate projections for the Gran Chaco region indicate a sustained increase in average temperatures of between 0.5°C and 1.0°C in the near term, accompanied by an intensification in the frequency, duration, and severity of extreme heat waves, as well as a significant increase in the number of tropical nights. These thermal conditions exacerbate the Temperature-Humidity Index (THI), pushing cattle into recurrent situations of severe heat stress, which directly affects reproductive performance, milk production, and average daily weight gain.

With regard to precipitation patterns, the principal challenge is not limited to the total annual rainfall volume, but rather to its temporal and spatial distribution. A substantial increase in the number of consecutive dry days (CDD) is projected, extending both seasonal and interannual drought periods. At the same time, rainfall is expected to become increasingly concentrated in short-duration severe storm events, heightening the risks of water erosion, destructive surface runoff, and flash flooding that inundates grazing lands and disrupts transportation infrastructure.

The provincial livestock herd is highly exposed to these physical hazards. The lack of tree cover in degraded grasslands leaves livestock directly exposed to extreme solar radiation. In addition, existing water infrastructure (shallow reservoirs and shallow wells) is vulnerable to high evaporation rates during heat waves, resulting in critical water shortages precisely when livestock experience their highest biological water demand.

The sector's intrinsic vulnerability can be divided into socioeconomic and biophysical dimensions. From a biophysical perspective, decades of overgrazing and unplanned deforestation have reduced the water-retention capacity of soils, accelerating desertification processes. From a social perspective, insecure land tenure, gender disparities (where rural women are often responsible for day-to-day water management despite lacking formal land ownership), and limited income diversification amplify the impacts of any climatic anomaly.

Historical records indicate that the province has suffered cumulative losses exceeding USD 994 million due to climate-related emergencies over the past two decades. These losses have directly affected the productive assets of rural households and weakened local value chains.

The design of the plan breaks away from traditional static planning frameworks by adopting state-of-the-art approaches specifically developed to address high levels of uncertainty and foster genuine multicultural participation.

To address the variability and uncertainty inherent in long-term climate change projections, the Dynamic Adaptive Policy Pathways (DAPP) methodology was applied. This methodological approach enables the development of alternative adaptation pathways over time, while accurately identifying tipping points at which a particular adaptation measure ceases to be effective and requires either the activation of a complementary action or a strategic shift in direction.

Through the DAPP approach, the province was analytically divided into three functional macro-regions with distinct dynamics (the Agricultural Southwest, the Central Eastern Wetlands Region, and the Dry Northwestern Region), allowing each territory to adjust its investments according to the critical precipitation and temperature thresholds observed over time. This framework enables adaptation decisions to be triggered by real-world climatic conditions rather than by fixed timelines.

The planning process involved the direct participation of Criollos and Indigenous communities belonging to the Wichí, Qom, and Moqoit people, as well as civil society organizations such as the Gran Chaco Foundation and agricultural cooperatives. Through participatory social mapping workshops and processes of free, prior, and informed consultation, traditional knowledge related to water and forest management was integrated with meteorological forecasting models, ensuring territorial legitimacy and community ownership of each adopted measure.

For Nature-based Solutions (NbS) and ecosystem-based approaches to be effective and sustainable over time, it is imperative to integrate them with Community-based solutions. In the Gran Chaco region, this methodological approach is built upon three interdependent pillars. First, it recognizes the leading role and gender perspective of Indigenous women, who are at the forefront of territorial adaptation and mitigation efforts. Second, it relies on the preservation and application of ancestral knowledge regarding forest and ecosystem management. Third, it requires the assimilation and adoption of this biocultural knowledge by criollos farming communities.

If any one of these three dimensions fails—female leadership, Indigenous knowledge, or its integration with the rural criollos communities—the structural viability of ecosystem-based solutions collapses. This underscores the fact that ecological resilience in the Gran Chaco is inseparable from social resilience.

The measures proposed under the plan are structured through an integrated approach that combines physical infrastructure, biological management practices, and institutional reforms, all guided by cross-cutting principles of gender equality, Indigenous rights, and intergenerational equity.

ICLF constitutes the plan's core strategy for reconciling livestock production with forest ecosystem conservation. This approach prohibits clear-cutting and promotes the use of the forest understory through shade-tolerant warm-season forage species, while maintaining the upper tree canopy intact. As a result, it creates a buffered microclimate that can reduce livestock heat stress by as much as 4°C compared to open pasture systems. At the same time, it diversifies household income through the sustainable use of non-timber forest products, such as carob flour and wild forest honey.

To strengthen the sector's resilience against severe droughts, the plan calls for the large-scale deployment of rainwater harvesting systems. These include rooftop catchment systems connected to ferrocement cisterns for domestic water supply, as well as the construction of deep community reservoirs (including lined and covered water reserves) equipped with solar-powered pumping systems and piped distribution networks to livestock watering points. This design prevents animals from accessing water sources directly, thereby reducing contamination and improving water quality management.

Recognizing that land tenure insecurity constitutes a critical barrier to investment in adaptation, the plan incorporates an ambitious land titling and tenure regularization program. This component adopts a gender-responsive approach by actively promoting joint land ownership for rural women. It also supports the implementation of technologies that reduce women's "time poverty" —given that women have historically spent several hours each day manually transporting water—thereby enabling their greater participation in formal agricultural decision-making and governance processes.

To ensure transparency, accountability, and the continuous improvement of the Response Plan, a Monitoring, Reporting, and Verification (MRV) system has been proposed, tailored to the territorial capacities and institutional context of the province. The system combines high-technology methodologies—such as satellite monitoring of forest cover and grassland vegetation indices through Sentinel and MODIS imagery—with citizen science and participatory community-based monitoring schemes. Producer organizations, following appropriate training, will report monthly on water levels in collective reservoirs, cattle herd dynamics, local price fluctuations, and pest-related impacts.

The MRV system's key indicators are organized into three main operational categories:

1. Climate impact Indicators:
   - Trends in the livestock population exposed to climate hazards.
   - Percentage of livestock losses resulting from extreme weather events.
   - Net carbon balance of farms operating under integrated livestock management systems.
2. Socioeconomic Adaptation Indicators:
   - Provincial average weaning rate (target increase from 50% to 70%).
   - Household income diversification.
   - Number of rural women formally participating in water management committees.
3. Institutional Management Indicators:
   - Percentage of budget execution for funds transferred to the territory under Law No. 27.520.
   - Number of early warning alerts successfully issued.
   - Number of provincial technical staff trained in the Dynamic Adaptive Policy Pathways (DAPP) methodology.

The aim is that once the plan is approved, the information consolidated through the MRV system be publicly accessible through a provincial digital platform, serving as a critical technical input for the biennial reviews of the Response Plan and for reporting.

The presence of multilevel planning instruments provides a platform for testing the usefulness and applicability of the Belém Adaptation Indicators (BAI). By comparing adaptation dynamics generated at the farm level and within community governance structures against the requirements of international reporting frameworks, this exercise makes it possible to identify both methodological gaps in data availability and aggregation across different scales, as well as strategic opportunities for measuring adaptation in a multidimensional manner. In doing so, it helps ensure that local resilience efforts effectively inform and strengthen global adaptation assessment frameworks.

4 | Testing of the Belém Adaptation indicators

The application of the Belém Adaptation Indicators (BAI) in Chaco Province requires a multilevel approach that connects the territory's biophysical and socioeconomic dynamics with global reporting frameworks. This section examines the interrelationship between local adaptation measures for the livestock sector and the UAE-FGCR, presenting them in an integrated manner to better understand territorial synergies.

Climate actions at the subnational level do not operate in isolation; their structural effectiveness depends on their ability to address local vulnerabilities while simultaneously contributing to national and international commitments. The measures prioritized for Chaco's livestock sector demonstrate substantial alignment with these existing frameworks.

The six measures prioritized are: 1. Integrated Forest-Livestock Management or Integrated Crop-Livestock-Forestry (ICLF); 2. Sustainable

Grassland Management; 3. rainwater harvesting reservoirs; 4. participatory monitoring and early warning system of key hazards; 5. land tenure regularization and ownership; and 6. jurisdictional REDD+ EC02 program at the provincial level.

Both ICLF and Sustainable Grassland Management directly contribute to the UAE-FGCR targets related to agriculture, climate-resilient food production, and terrestrial ecosystems, by supporting strategic action areas focused on the sustainable management of food systems and forests, reducing the risks of desertification and the degradation of livelihoods among family-scale livestock producers.

In parallel, the development of climate-resilient water infrastructure, including rainwater harvesting and storage systems, contributes to the UAE-FGCR target focused on reducing the impacts associated with water scarcity. It also represents a direct response under the NAP to the climate threat of reduced access to safe water resulting from prolonged droughts.

Likewise, land tenure regularization and secure land ownership function as cross-cutting enabling conditions linked to the UAE-FGCR objective of poverty eradication. These measures are essential for promoting sustainable and resilient territories while reducing the risk of displacement. They are complemented by the creation of green jobs and support for productive transition pathways, helping to strengthen territorial permanence through the financing mechanisms established under the NAP.

The implementation of a participatory monitoring and early warning system contributes directly to the UAE-FGCR target on impacts, risk and vulnerability assessments. At the same time, it aligns with the NAP's comprehensive risk management approach, reducing vulnerability to extreme events such as floods.

The last measure involves implementing a provincial jurisdictional REDD+ program to reduce emissions from deforestation and forest degradation through forest conservation, sustainable forest management, and the enhancement of forest carbon stocks, based on baseline emissions and carbon sequestration assessments. It helps mitigate climate change, protect forest ecosystems, and create enabling conditions through incentives for the long-term conservation and sustainable management of forest resources.

Below are six tables corresponding to the measures, and following each table is a summary of the conceptual and methodological variables described.

Subnational measure: Expand the area under Integrated Forest Management with Livestock Farming or Integrated Crop-Livestock-Forestry (ICLF) to improve drought and flood prevention and soil quality.

Subnational target: By 2030, 500,000 hectares are under ICLF, creating 4,000 new jobs (1,000 women, 1,000 indigenous people, 1,000 young people).

Main hazards (H) at the subnational level: Drought and flood regulation as ecosystem services.

UAE-FGCR target 9.b. Food and agriculture. Attaining climate-resilient food and agricultural production and supply and distribution of food, as well as increasing sustainable and regenerative production and equitable access to adequate food and nutrition for all;

BAI 9.b.a. Proportion of area under management for food and agricultural production utilizing practices and technologies relevant to climate change adaptation;

BAI 9.b.c. Level of degraded areas that are under management for food and agricultural production, including as an outcome of adaptation actions where applicable;

BAI 9.b.d. Level of food and agricultural yield in areas that are under management for food and agricultural production, including as an outcome of adaptation actions where applicable;

It is proposed to examine the indicators for the ICLF measure as a whole, noting their differences but also how they feed into one another.

Although 9.b.a has not changed since it was identified by the experts (9.b.01), at the conceptual level, this indicator requires a precise definition of which practices in Chaco technically qualify as adaptation technologies. In the words of the experts, this indicator measures the extent of uptake of measures to help the food and agriculture sector respond to climate shocks, such as soil and water conservation, sustainable irrigation, and agrobiodiversity diversification. As such, it tracks the implementation of context-specific adaptation measures in response to key climate hazards.

As for the approach to the indicator 9.b.d., it may involve different perspectives, given that it refers to food and agricultural productivity in productive areas. In vulnerable contexts, the loss of productivity in food production can be conceptualized in economic terms, but perhaps more importantly, as a threat to food security and local nutritional sovereignty. In Argentina, the decline in food and agricultural yields amid extreme climate variability has reignited debates regarding the effective implementation of the Family Farming Act (Law 27,118), particularly concerning access to land, rural settlement, and the strengthening of small-scale production systems.

In terms of 9.b.c. there is no single indicator of land degradation, as also identified by experts in their September report; rather, different indicators are used depending on the context and the factors driving degradation. This makes it difficult to aggregate data directly from the subnational to the national or international scale.

This indicator represents a shift in focus compared to the analogue presented by the experts: since it moves from environmental damage to adaptation intervention. While incorporating the results of adaptation measures facilitates a better understanding of actions to reduce degradation, it creates the challenge of quantifying the effects of climate change on existing degradation processes in order to establish an adequate baseline. For these measures, and at the national level, there is no quantitative data on land degradation projections considering future climate scenarios, which hinders the definition of a baseline. This necessitates the consideration of qualitative analyses that can provide greater flexibility for reporting.

Regarding the availability of information to measure land degradation in Chaco, the National Observatory on Land Degradation and Desertification adopts and implements methodologies aligned with the United Nations Convention to Combat Desertification (UNCCD) to assess land degradation neutrality across the national territory. However, the indicators adopted to measure degradation vary depending on the ecosystem—those used for forests differ from those for grasslands and wetlands—adding another layer of complexity to reporting. At the same time, the frequency of monitoring those indicators at the national and subnational levels does not necessarily align [1].

A quantitative measure of the level of land degradation (M), which could be associated with SDG 15.3.1. reported by Argentina to the UNCCD. The main indicator used by Argentina is the proportion of degraded land relative to the total land area (SDG 15.3.1.). This proportion has been reduced from 326,954 km^2 -11.68% as the proportion of degraded land relative to total land area- in 2000-2015 as baseline, to 154,333 km^2 -5.52% as the proportion of degraded land). These values are obtained from two sub-indicators: land cover trend and land productivity dynamics. Additionally, in 2020 Argentina presented six voluntary targets to the UNCCD, including the implementation of ICLF on 140,000 hectares by 2030. Further information is expected in the next report.

[1] - The last report submitted by Argentina is from 2022 https://www.unccd.int/our-work-impact/country-profiles/argentina

According to Gaitán et al. (2015), monitoring of land degradation in Argentina could be based on satellite data and should be supplemented with indicators measured in the field. This does not mean that the effects of measures to reduce degradation should be monitored on a property-by-property basis, but rather that a sample of properties should be selected.

The main indicator of degradation of native forest in Chaco used by the National Observatory on Land Degradation and Desertification, is the Land Cover Change Indicator (deforestation). This indicator measures how many hectares of stable native ecosystems (forests, wetlands) are irreversibly converted into agricultural or urban land. The consolidated agricultural area covers nearly 1,500,000 hectares of the province's territory that have been completely converted from forest to cropland. According to annual satellite monitoring, last year alone saw 16,872 hectares of native forest lost in the province due to land clearing (both authorized and illegal) and wildfires.

Another indicator monitored by the Observatory is Standing Forest Degradation which measures forest that has not been cleared but is losing its ecological quality and its ability to provide environmental services due to overgrazing and uncontrolled selective logging. The National Institute of Agricultural Technology (INTA) and global networks such as MapBiomas estimate that approximately 8% of the remaining native forest in the Chaco shows severe signs of structural degradation. This means there are about 376,000 ha of degraded standing forest that require urgent restoration plans or conversion to ICLF. The Physical Degradation and Soil Salinization indicator monitors the loss of soil productivity due to poor practices, compaction from heavy machinery, and water imbalances. Considering the 3,400,000 ha used for livestock in the Dry Chaco (West), prolonged periods of drought leave the soil bare, causing the wind to carry away the most fertile layers of the earth.

In terms of adaptation measures proposed (A), a National Plan for ICLF was adopted in 2022, including targets such as expanding the area under ICLF by an additional 300,000 hectares by 2027. Various indicators are being monitored, including soil erosion, soil organic matter, and forest regeneration, as well as production indicators such as livestock productivity and livestock production efficiency, and socioeconomic indicators such as the annual gross margin of the production system or the direct labor employed annually in this production system. However, the plan, its measures, and indicators do not directly relate to adaptation measures. This brings us back to the first difficulty mentioned regarding the change of the indicator in Belém, namely, the challenge of isolating the adaptation action of adaptation attribution (FVSA, 2023).

The province of Chaco has a total forest area of approximately 4.82 million hectares. This means that the goal of bringing 500,000 hectares under ICLF represents 10.5% of the total area of native forests in the Chaco. In the province of Chaco, the ICLF Plan is being implemented gradually through individual and community land-use plans. There is no single publicly available figure for the total number of active hectares, but according to the Chaco Government's Annual Management Report, the province selected and validated 14 new strategic sites between 2025 and 2026.

The provincial target of 4,000 new jobs was calculated based on the management of 500,000 hectares. According to studies conducted at the UNSE by the "Forest Utilization" Department, for every 100 hectares of ICLF, an average of one job is estimated to be created for annual work involving pruning, harvesting, maintenance, and thinning. The 4,000 jobs are divided into 1,000 women, 1,000 indigenous people, and 1,000 young people. Although in the semi-arid Chaco, traditional "open-range" livestock farming is very labor-efficient, requiring just one worker per 2,500 to 3,000 hectares, ICLF breaks this pattern, requiring subdivision of plots, rigorous rotational grazing, maintenance of watering holes, and management of the tree layer. Under this model, staffing needs not only increase but also requires more professionalization, taking to an average of one direct job per approximately 600 hectares [2].

Subnational measure: Improve the management of natural grasslands and wetlands to increase their capacity to store water and improve soil quality, as ecosystem services.

Subnational target: By 2030, 2,000,000 heads of cattle raised on pasture, 300,000 hectares of managed pastureland, and 3,500 new jobs (1,000 women, 3,000 indigenous people, 1,000 young people).

Main hazards (H) at the subnational level: Drought and flood regulation as ecosystem services.

UAE-FGCR target 9.b. Food and agriculture. Attaining climate-resilient food and agricultural production and supply and distribution of food, as well as increasing sustainable and regenerative production and equitable access to adequate food and nutrition for all.

BAI 9.b.a. Proportion of area under management for food and agricultural production utilizing practices and technologies relevant to climate change adaptation.

BAI 9.b.c. Level of degraded areas that are under management for food and agricultural production, including as an outcome of adaptation actions where applicable.

BAI 9.b.d. Level of food and agricultural yield in areas that are under management for food and agricultural production, including as an outcome of adaptation actions where applicable.

UAE-FGCR target 9.d. Ecosystems and biodiversity. Reducing climate impacts on ecosystems and biodiversity, and accelerating the use of ecosystem-based adaptation and nature-based solutions, including through their management, enhancement, restoration and conservation and the protection of terrestrial, inland water, mountain, marine and coastal ecosystems.

BAI 9.d.b. Proportion of ecosystem areas with adaptation actions implemented towards enhanced resilience and services.

[2] - This section is based on the following sources ONDTyI, 2024; FVSA, 2021; INTA, 2020.

Insofar as three indicators (9.b.a-c) overlap with the ICLF measure, some of the points considered, such as the conceptual debate, are taken as given.

To apply the quantitative approach (M) that allows for measuring the actual impact of the measure regarding hectares of natural pastures in accordance with 9.b.a., it is important to note that the territory of Chaco covers approximately 10,000,000 hectares, of which 9,963,000 ha are available land. Of this latter figure, 4,700,000 ha consist of native forest, and 1,500,000 ha of established agricultural land with crops. This leaves a gross remaining area of 3,763,000 ha, from which urban areas and natural infrastructure must be subtracted. This calculation yields a figure of between 2,500,000 and 2,800,000 hectares of natural grasslands, savannas, ravines, and wetlands. Of this natural forage area, it is estimated that between 2,200,000 and 2,500,000 hectares could be fully dedicated to planned rotational management.

These areas are located between the Eastern or Humid Chaco and the Submeridional Lowlands. They consist of wetlands, marshes, and pastures of espartillo or canutillo grass, historically managed through traditional extensive livestock grazing and controlled burning. In this case, rotational grazing is ideal for restoring the soil without the need to plant exotic pastures. Another area of interest is the paleochannels and “abras” of the Dry Chaco, in the western part of the province, with natural xerophytic (dry-climate) grasslands that are optimal for highly efficient rotational grazing systems.

The ICLF measure does not apply, as these are areas without forests. The rotational grazing management practice (A) aims to eliminate fire as a clearing tool, divide the land into small paddocks, encourage animals to graze evenly, and give the natural grass (and wetlands) time to recover and sequester carbon in their roots. Applying this practice to all available land could double the province’s livestock population in the area.

With regard to 9.b.c., the National Observatory on Land Degradation and Desertification provides access to data (M), although it is not updated regularly. In some areas, specific measurements are taken that demonstrate a reduction in degradation, such as changes in vegetation cover. However, it is worth asking whether a proven adaptation solution requires monitoring of its impacts across the entire scope of its implementation or whether it requires impact monitoring.

Grasslands play a key role in regulating floods, sequestering carbon, and sustaining livestock production, but they are undergoing severe deterioration. The main drivers of this deterioration in the study area are: chronic, continuous overgrazing; systematic burning; water-related alterations such as canalization; and the expansion of the agricultural frontier, which has pushed traditional livestock farming into marginal areas of ravines and wetlands.

The evidence of land degradation includes scrub encroachment—the process by which native grasses disappear and the soil is colonized by invasive, thorny woody plants, hindering livestock movement and displacing palatable species. Other signs include soil compaction caused by the continuous passage of heavy livestock on clay soils and the loss of endemic fauna, which alters the structure of the grassland and impacts critically endangered species.

In addition to (M), the Country Report of the National Observatory on Land Degradation and Incentives adopts methodologies aligned with the UNCCD to assess land degradation neutrality in Chaco, and uses three indicators: change in land cover, land productivity dynamics, and soil organic carbon stock. There are other complementary indicators that serve as proxies for wetlands, such as hydrological cycle dynamics and the frequency and intensity of fires.

Regarding productivity in 9.b.d., while measurements of forage intake are taken as an indirect indicator of yield—assuming that more forage leads to higher yields—and of income per activity, it is worth asking how the impact of adaptation measure (A) is being monitored. In this regard, the proposed measure generates a transformative productive impact on the province's agricultural economy. This can be measured through its impact on stocking rates, weaning rates, as well as macroeconomic indicators. In terms of production, it may lead to an increase in calving efficiency. A potential increase of 725,650 calves per year is estimated for provincial production, doubling the current meat supply in Chaco without clearing land (Gándara, 2003; Pardo, 2023; INTA Chaco Formosa, 2024; Sauer et al., 2025).

The proposed measure increases staffing requirements compared to traditional livestock farming. According to labor coefficients applied by INTA and regenerative livestock associations, an average need of 1 direct job per 500 hectares is estimated. This involves direct field personnel, which could increase 3,800 positions. Additionally, technical and management staff are required, which could bring the requirement to 1 professional or technical operator per 10,000 hectares, estimated at 230 professionals and technicians. Furthermore, infrastructure and service personnel would be needed, thereby boosting local service companies, creating approximately 3,500 new jobs.

Regarding indicator 9.d.b. on the proportion of ecosystem areas (M) with adaptation actions implemented towards enhanced resilience and services (A), the indicator is different to the one proposed in September by the experts. The latter (9.d.02. extent and capacity of regulating ecosystem services that reduce exposure and vulnerability to climate risks/impacts) aimed to capture both the spatial coverage of ecosystems and their capacity to sustain ecosystem services by reducing risk (outcome/impact). It was based on the IUCN indicator "services provided by ecosystems" (GBF Indicator B-1) and leverages the System of Environmental-Economic Accounting (SEEA) Ecosystem Accounting framework. While the available metadata required adjustments, the experts highlighted that ecosystem service models such as InVEST and ARIES would provide biophysical quantification to complement national data.

The BAI is an indicator that could be considered a process or output indicator insofar as it evaluates institutional measures related to management, i.e. (M) proportion of ecosystem areas). At the same time, this could potentially make it easier to collect information. This does not mean, however, that when applying it, there is an equal or greater focus on the second part, which is (A) the adaptation measures implemented to strengthen services and resilience.

The approach in Chaco focuses on the transformation and active management of 2,300,000 hectares of grasslands and wetlands. To put into perspective the proportion of ecosystem areas subject to adaptation measures, this land area represents a critical fraction of the province's productive ecosystems and a substantial contribution to the country's resilience goals. The central measure (A) implemented to improve ecosystem services across this territory is the transition from traditional extensive livestock farming to an intensive rotational grazing model. This shift requires constant monitoring of pasture growth of native species, such as espartillar or canutillar.

The effectiveness of this measure is linked to the restructuring of the rural labor market mentioned earlier, as rotational grazing is labor-intensive, requiring on average one direct job for every 500 hectares. The project sets the creation of 3,500 new jobs as a minimum condition for its viability.

Subnational measure: Implement rainwater harvesting reservoirs.

Subnational target: By 2030, develop a water harvesting system to meet the safe water needs of 2,250,000 people (26.9 million cubic meters), ensuring the equitable participation of women, youth, and indigenous peoples.

Main hazards (H) at the subnational level: Drought and flood regulation as ecosystem services.

UAE-FGCR target 9.a. Water. Significantly reducing climate-induced water scarcity and enhancing climate resilience to water-related hazards towards a climate-resilient water supply, climate-resilient sanitation and access to safe and affordable potable water for all.

BAI 9.a.a. Level of water stress, including as an outcome of adaptation actions where applicable, accounting for relevant climate hazard intensity and/or frequency.

BAI 9.a.b. Level of water-use efficiency, including as an outcome of adaptation actions where applicable.

A critical assessment of the indicators proposed for the rainwater harvesting measure reveals the complexity of translating global water security metrics to highly vulnerable, off-grid territories. Both indicators require significant localization to accurately reflect the reality of the Gran Chaco region.

At the conceptual level, BAI 9.a.a. (Level of water stress) represents a shift from the September expert list of indicators (9.a.01: Change in water stress levels over time). The experts' version was built upon the methodology for SDG 6.4.2, which the FAO applies at the national level by calculating the ratio of conventional water resources withdrawn by municipalities, industry, and agriculture to the total renewable conventional water resources available. As observed in Argentina´s 2023 reporting to FAO´s Aquastat, which registered a national water stress level of 10,46% [3], applying this metric at the country level often yields an aggregated average that dilutes the extreme, localized water deficits of the Gran Chaco. Crucially, this traditional metric excludes rainwater. Relying solely on the SDG 6.4.2 framework would therefore invisibilize the reality of the Gran Chaco, where harvesting non-conventional water (rainwater) is the primary survival and productive strategy for off-grid communities.

The modified wording adopted in the BAIs bridges the gap between macro-hydrological data and territorial reality. It allows the indicator to function not just as a macro-level diagnostic, but as a context-driven measurement that integrates both qualitative assessments of local resilience (for example, reduced dependency on emergency water trucks) and concrete quantitative outputs.

At the same time, the change in the indicator aims, as in other BAI, to give greater weight to the outcome resulting from adaptation actions (A), in comparison with the more general environmental measures referred to in SDG 6.4.2. In contrast, maintaining the SDG ensures the availability of data and metadata, which will require significant adjustments in light of this change.

Similarly, BAI 9.a.b. (Level of water-use efficiency) new wording shifts the focus from measuring a "change over time" (as proposed by experts in September under 9.a.02) to assessing a specific "level". At the same time, the BAI also focuses on the outcome of an adaptation action (A). The indicator proposed by experts in September (9.a.02) builds upon SDG 6.4.1, which measures efficiency as a macroeconomic ratio: the dollar value added per volume of water used, relying on aggregated data from national line ministries and statistical offices. As stated in 9.a.a., there is a trade-off between placing greater emphasis on the outcome resulting from the adaptation measure and the direct availability of the database

[3] - AQUASTAT Dissemination System https://data.apps.fao.org/aquastat/?lang=en for the SDG.

For the rainwater harvesting measures in the Gran Chaco, however, evaluating efficiency through a purely profitability-driven or macroeconomic lens is inadequate and/or insufficient. In these highly vulnerable territories, water-use efficiency should be conceptualized in terms of socio-environmental resilience. True efficiency here does not mean necessarily, maximizing financial return per drop of water; rather, it could also mean optimizing captured rainwater to guarantee equitable community access, support food sovereignty through the diversification of low-water-demand crops, and safeguard essential ecosystem functions during extended droughts.

Furthermore, relying on the standard national methodology for SDG 6.4.1 poses significant data challenges. At the national level, calculating the gross value added per sector (agriculture, industry, services) overlooks the informal and subsistence-based of family farming and indigenous communities in the Chaco.

Since national datasets do not adequately capture decentralized rainwater harvesting systems, tracking this BAI at the subnational level will require localized monitoring mechanisms that measure efficiency based on social and adaptive outcomes—such as the number of families secured with safe water per cubic meter harvested—rather than traditional economic output.

Establishing a baseline for these measures presents significant technical challenges. In Argentina, centralized water data usually focuses on urban water networks and major river basins, for example through the National Water Institute, or provincial water authorities like the Water Provincial Authority in Chaco. However, quantitative data on water stress for dispersed rural populations relying on informal or precarious sources (such as shallow wells with high arsenic content or seasonal ponds) is fragmented.

To assess water stress, the quantitative approach (M) may be insufficient, requiring qualitative analyses. The baseline for many of these rural and indigenous communities is characterized by a high dependency on emergency water distribution (water trucks) provided by municipalities during prolonged droughts. Therefore, the metric for success is not only the volume of water captured, but also the reduction in dependency on these emergency, unsustainable supply chains.

As captured in the table, the primary hazard (H) is the increasing frequency of extreme, prolonged dry spells, which have reached critical maximum thresholds of 60, 100, and up to 150 consecutive days without rain. This precipitation deficit is compounded by extreme thermal stress. The proposed adaptation measure (A) to address the main hazard, and its corresponding target, is the development of a water harvesting system to supply 26.9 million cubic meters of safe water to 2,250,000 people across the region by 2030. Reaching this target requires executing precise on-farm hydro-engineering to structurally shield local livelihoods. Based on technical coefficients validated by INTA, SENASA, and the provincial Ministry of Production, this intervention entails three core infrastructural pillars: moving sufficient earth to create deep strategic reserves (excavated to a minimum depth of 4 to 5 meters to counteract the extreme evaporation rates); the construction or reconversion of 4,260 watering systems designed under anti-evaporation parameters; and deploying extensive buried pipe networks to safely transport water across the highly dispersed rural herds and settlements of the Western Chaco and El Impenetrable.

Regarding cross-cutting considerations, the analysis focuses on the equitable participation of women, youth, and indigenous peoples in relation to the measure. From a gender perspective, there is a sexual division of labor in the rural Chaco. While men typically manage large-scale cattle, women are historically responsible for small livestock (goats and sheep), domestic water supply, and gardens. Implementing localized reservoirs drastically reduces the "time poverty" and severe physical exertion associated with fetching water. Securing water for their flocks during dry seasons protects women's independent income and the baseline of family food sovereignty, fostering economic autonomy. However, a structural barrier persists, the lack of formal land titles of women.

Regarding generational impact, the lack of resilient infrastructure is a driver of the youth rural exodus. Installing modern water harvesting systems demonstrates that climate-adapted livelihoods are viable and secure, seeking to curb migration to urban peripheries. However, the lack of formal land ownership by youth acts as an obstacle to developing infrastructure projects.

Finally, for indigenous communities (such as the Qom, Wichí, and Moqoit), water is central to health, worldview, and territorial survival. Unlike private parcels, associative reservoirs in these territories demand and strengthen collective governance, protecting the subsistence economies that act as the primary safety net against malnutrition during extreme droughts. Nevertheless, development agencies and climate funds require secure land tenure to finance permanent infrastructure. The incomplete implementation of the Indigenous Territorial Emergency Law (Law 26.160 [4]) disqualifies many communities from receiving official support. Additionally, an intersectional barrier operates within these communities, as women and youth are often rendered invisible and excluded from land governance structures traditionally led by adult men.

[4] - Indigenous Territorial Emergency Law 26.160. https://servicios.infoleg.gob.ar/infolegInternet/anexos/120000-124999/122499/norma.htm

Subnational measure: Install participatory monitoring and early warning systems for disaster prevention.

Subnational target: By 2030, establish a reliable, effective, and real-time participatory monitoring and early warning system for the watersheds of all rivers that flow through or around the province, with a specific consultation, monitoring, and warning system for each watershed.

Main hazards (H) at the subnational level: Downspouts, flooding, and runoff along the slopes of watersheds, with unforeseen effects and externalities in areas where no extreme rainfall events occurred.

UAE-FGCR Target 10.a. Impact, vulnerability and risk assessment. By 2030 all Parties have conducted up-to-date assessments of climate hazards, climate change impacts and exposure to risks and vulnerabilities and have used the outcomes of these assessments to inform their formulation of national adaptation plans, policy instruments, and planning processes and/or strategies, and by 2027 all Parties have established multi-hazard early warning systems, climate information services for risk reduction and systematic observation to support improved climate-related data, information and services;

BAI 10.a.a. Level of establishment of multi-hazard early warning systems.

The BAIs linked to multi-hazard early warning systems (MHEWS) in general, are similar to the ones recommended by the experts in September 2026 but with some conceptual differences relevant to adaptation monitoring.

The indicators recommended by the experts are based on the methodology for monitoring and reporting progress on Target G of the Sendai Framework, regarding "Availability of and Access to Multi-Hazard Early Warning System" (UNDRR, 2017a). This methodology defines specific indicators for each one of the four key interrelated elements of effective Early Warning System (EWS), defined by the Open-ended

Intergovernmental Expert Working Group on Indicators and Terminology (OIEWG): (1) Disaster risk knowledge, (2) Detection, observations, monitoring, analysis and forecasting of hazards, (3) warning dissemination and communication and (4) Preparedness and response capabilities (UNDRR, 2017b). It also establishes a compound indicator [5] to report on overall progress regarding the availability of and access to MHEWS, which is computed based on the indicators previously mentioned. Similarly, BAI 10.a.b. to 10.a.g. are also based on the key elements of effective EWS, respectively.

BAI 10.a.a. is analogous to the compound indicator 10.a.01 used by experts (number of Parties that have established multi-hazard early warning systems), but instead of referring to number of countries or parties it relates to "level of establishment". This may give rise to multiple interpretations. Other BAIs under the same target, such as 10.a.b. or 10.a.c. contain the same vague definition as 10.a.a., as they refer to the "level of implementation" or "level of establishment", respectively.

The indicators identified by the experts involved aggregating data from the national to the global level. With the current definition of the indicator, on the one hand, aggregation is more difficult due to the heterogeneity of possible measurements, but it may allow for the inclusion of MHEWS at the local level.

Regarding information availability, Argentina has reported EWS status and progress to the Sendai Framework since 2016. This data and information

[5] - Other examples of BAI that reflect the compound nature of 10.a.a are:
(b) Level of conduct of assessments of climate hazards, climate change impacts, and exposure to risks and vulnerabilities based on different global warming scenarios, as appropriate for regions and contexts; (c) Level of establishment of multi-hazard monitoring and impact-based forecasting systems, including monitoring stations; (d) Number of people per 100,000 that are covered by early warning information through local governments or through national dissemination mechanisms; (e) Percentage of the population in a country exposed to or at risk from climate related disasters protected through pre-emptive evacuation measures following early warning; (f) Level of establishment of climate information services for risk reduction and systematic observation to support improved climate-related data, information and services; (g) Extent of usage of climate risk information and comprehensive risk assessment based on different global warming scenarios, as appropriate for regions and contexts, to inform formulation of national adaptation plans, policy instruments, and planning processes and/or strategies.

from the WMO Monitoring System are collected in the dashboard of the Early Warnings for All Initiative, led by WMO, UNDRR, ITU and IFRC. The information reported refers to an indicator analogous to BAI 10.a.a., with a self-assed monitoring coverage score for overall capacity of MHEWS of 0.2/1 (limited) and of 0.8/1 (comprehensive) regarding early warning information dissemination. Also, Argentina has published its midterm evaluation of the implementation of the Sendai Framework [6], which refers to the strengthening of EWS implementation at the local level. It also mentions the existence of the National Emergency Warning and Monitoring System, which continuously monitors various types of events and provides provincial governments and national agencies with early warning information, as well as risk analyses and dynamic maps.

The Government of Chaco does not have information on the adoption of alerts in line with the measure's objective. However, there are currently local initiatives led by civil society in coordination with national and sub-national government areas, such as the Pilcomayo River Participatory Early Warning System, which are operational and whose scope, adoption and operation are measured and disaggregated by ethnicity, age and gender. In the case of the Pilcomayo, rural, indigenous and farming communities, as well as women and young people, play a leading role in the EWS through the Nanum digital connectivity community centres, using various communication channels such as WhatsApp, Telegram and local radio stations.

The possible quantitative measures (M) of the level of establishment of MHEWS evidence the compound nature of BAI 10.a.a, insofar as the capacity and physical coverage of MHEWS could be determined by the monitoring and forecasting systems (10.a.c.) such as the number of meteorological stations, radars or sensors, by the number of people covered by the EWS and information (10.a.d), by those who receive climate information services and information (10.a.f), and by the types of

[6] - https://sendaiframework-mtr.undrr.org/media/84352/download?startDownload=20260601 use of such information (10.a.g), among other factors.

There are a number of indicators applied in the Pilcomayo River that could be scaled for its use at the provincial level, such as “subscription rate” (number of farmers formally integrated to the EWS), “active monitoring nodes” (number of meteorological stations, sensors and human observers) and “diversification of broadcast channels” (number of operational channels available for disseminating the alerts). This last indicator is extremely relevant in isolated areas where internet connection may be weak, and other channels may be more effective such as local radio stations (AM/FM), SMS messages and VHF repeater networks.

There are also warning indicators such as the “broadcast effectiveness rate” (proportion of warnings issued at least 72 hours in advance of event occurrence) and “confirmed reach rate” (proportion of producers that receive and read the warning). Regarding the fourth key element for effective EWS, despite the limitations in terms of scale and type of response associated with indicator 10.a.e., indicator 10.a.a. could be informed using the indicator “rate of action taken” (proportion of producers who took preventive action based on early warnings received).

In terms of adaptation measures proposed (A), the provincial plan specifies the participatory and locally-based feature of the MHEWS, focusing on how technical climate information is translated into accessible local formats and how farmers’ traditional knowledge is integrated to ensure that territorial monitoring is truly participatory and effective. Furthermore, as some of the variables to be monitored extend beyond the province’s borders, inter-jurisdictional coordination is essential, as in the case of the Bermejo, Bermejito, Paraná and Paraguay rivers.

This measure is also aligned with the National Disaster Risk Reduction Plan 2025–2029, which includes the objective of strengthening the hydrometeorological hazards early warning system, as well as capacity-building activities addressed to national, provincial, and local civil protection units to enhance coordination and risk knowledge.

The hazards (H) addressed are based on a local climate risk assessment which includes the use of impact chains and takes into account future climate change scenarios for risk screening and analysis, in line with the latest IPCC's definitions. The assessment identifies periods of excessive rainfall that cause flooding in both urban and rural areas, resulting in low production levels and economic losses. Due to climate change, the return period for a flood event causing 5% losses has fallen from 2 years to 1 year.

The subnational target is to have 11,000 producers integrated into the EWS; however, since it is not specified what it means to be integrated, the above points may be considered features of that integration.

This figure breaks down into 15% women and 11% young people (INDEC, 2018). Of the 10,705 agricultural holdings registered in the name of individuals in Chaco, 1,653 (exactly 15%) are managed directly by women. At the national level, the census confirms that 50% of farms led by women have cattle farming as their main activity.

Age structure tables for producers and partners in family farms in the NEA region show that only 11% are under 40, according to the National Agricultural Census. The rest of the working-age population is heavily concentrated in the 40–64 age group and among those aged 65 and over, reflecting the structural problem of generational renewal in rural areas.

Subnational measure: Promote secure land tenure.

Subnational target: By 2030, establish the Land Management Institute by updating existing regulations and incorporating gender-disaggregated data (by age and ethnicity), thereby achieving land title regularization and access to ownership of 4,000 rural properties with gender equality (30% women, 30% youth).

Main hazards (H) at the subnational level: severe droughts and flooding events.

UAE-FGCR Target 9.f Poverty eradication and livelihoods. Substantially reducing the adverse effects of climate change on poverty eradication and livelihoods, in particular by promoting the use of adaptive social protection measures for all;

BAI 9.f.c. Level of social protection systems that consider climate risk management aspects and can respond to climate change impacts.

The thematic or sectoral target on poverty eradication and livelihoods was particularly scaled back in Decision 12/CMA.7, leaving only three BAI, which do not adequately represent the components of that target.

One could argue that land tenure regularization serves as a measure for adapting to climate change, as well as its connection to the goal of poverty eradication and livelihood improvement. From the perspective of this exercise, it is important to understand land tenure regularization not as an administrative formality, but as an enabling measure and a fundamental form of social protection designed to safeguard people's livelihoods in the context of climate change.

Argentina's land governance has historically been shaped by different forces, including its territorial expansion and the political desire to populate its vast surface, as reflected in the 1994 reform of the National Constitution. In recent decades, prolonged economic instability, high inflation, investment policies and technological innovations have paved the way for agricultural expansion, making Argentina a primary destination for large-scale land acquisitions. The agro-export model has heavily consolidated rural property, with private ownership accounting for 96% of the land according to the 2018 Agricultural Census (INDEC, 2018), accelerating deforestation, triggering extensive environmental degradation and severe flooding.

The rapid expansion of corporate industrial agriculture has significantly squeezed smallholders, family farmers, and indigenous populations, many of whom occupy ancestral or state lands without formal property titles. This lack of legal formalization leaves vulnerable communities highly exposed to forced evictions by new landowners.

According to the indicators identified by the experts in September, there were no indicators that fully aligned with this measure either. Indicator 9.f.09 from September (level of social protection system preparedness/adaptiveness to respond to climate change impacts) differs somewhat from BAI 9.f.c. In the former, the focus was on the preparedness/adaptiveness of the social protection system, whereas in the BAI, the focus is on the social protection system and its management of climate risk.

According to the experts, adapting social protection systems to climate risks allows them to be more resilient and responsive in the face of climate shocks, ensuring that financial assistance reaches all those affected in a timely manner. It also allows them to better support livelihood transitions, diversification, and adaptation by linking social protection schemes with green livelihood and employment programs.

The intersection of severe hydroclimatic hazards (H) and land tenure insecurity in the Chaco province creates a profound vulnerability loop for smallholders, family farmers, and indigenous families who lack formal titles to their ancestral or state-owned lands. When intense droughts or sudden, catastrophic floods destroy livestock pasture and small-scale crops, these frontline populations are structurally disqualified from accessing state-subsidized emergency credit, climate insurance, or agricultural recovery funds, all of which strictly require legal proof of land ownership. Consequently, climate hazards act as a catalyst for land dispossession.

The quantitative value of the indicator (M) would be determined by the number of rural properties with pending title regularization, since the proposed target refers to the titling of 4,000 rural properties with pending regularization, representing 40% of all properties in the province of Chaco (10,705 establishments) according to the Chaco Province Institute of Colonization. Of the total 10,705 agricultural establishments, only 1,653 are managed by women, representing 15%. Fifty-five percent of the agricultural land managed by these women is used for oilseeds (primary and secondary crops) and supports a considerable livestock population of more than 163,000 head of cattle and 25,000 goats.

Only 11% of all agricultural producers in the country are under 40 years of age (INDEC, 2018). Applying these official percentages to the total number of landowners in Chaco: 264 young women producers (16% of the 1,653 female landowners in the Chaco), and 913 young men producers (calculated to account for the 11% of the overall youth population among men). If the variable of "secure tenure" (operating on plots with defined boundaries, whether through ownership or a formal contract) is applied to this group of young people, the conclusions are clear: The countryside is adult and male-dominated: Nearly 8,100 farms in Chaco are managed by men aged 40 or older. Generational turnover is practically nonexistent in land ownership. As a result, the number of women in Chaco under the age of 40 who have some form of land tenure does not exceed 250 across the entire province.

In the case of indigenous communities, these are communal properties with a different form of tenure. Indigenous communities do not typically operate under the legal concept of "natural person" (individual ownership), but rather under the right to communal property, where women do not usually have the same rights and participation in decision-making as men.

Since 2006, Argentina passed a National Law No. 26,160, which prohibits evictions and mandates that the State survey and demarcate the lands traditionally occupied by the communities. However, of the more than 110 indigenous communities identified in the province of Chaco, less than 20% have managed to complete their technical dossier with the formal demarcation of their territories. The vast majority of indigenous people in Chaco live and farm on lands that lack definitive legal security from the State, leaving them vulnerable to the expansion of the agricultural frontier (deforestation) and territorial conflicts with private producers.

At the national level, the 2018 Agricultural Census revealed a troubling disparity: while a handful of corporate farms control millions of hectares, indigenous communities and small-scale subsistence farmers operate on the geographical margins, facing the worst infrastructure conditions (lack of access to water, roads, and agricultural technology).

For women and those under 40, ethnic identity makes exclusion an almost universal reality. Young indigenous women are the driving force behind the subsistence economy, gathering, gardening, and raising small livestock (such as goats). However, their work is considered domestic labor, and they are rarely recognized as producers by the state. Consequently, they face not only marginalization by the state, which fails to demarcate their lands, but also, within many communities, representative and decision-making structures (chiefs, delegates) that remain strongly male-dominated and adult-centric.

Subnational measure: Implement a jurisdictional REDD+ EC02 program at the provincial level.

Subnational target: By 2030, 2.5 million hectares are certified under REDD and, 500 new jobs have been created (50% women, 50% indigenous people, 30% young people).

Main hazards (H) at the subnational level: Drought and flood regulation.

UAE-FGCR Target 9.d. Ecosystems and biodiversity. Reducing climate impacts on ecosystems and biodiversity, and accelerating the use of ecosystem-based adaptation and nature-based solutions, including through their management, enhancement, restoration and conservation and the protection of terrestrial, inland water, mountain, marine and coastal ecosystems;

BAI 9.d.a. Proportion of climate-resilient ecosystems that are providing services to populations that depend on them;

BAI 9.d.a. is similar to indicator 9.d.02 proposed by the experts. However, the former focuses on the proportion (percentage) of climate-resilient ecosystems, which raises at least two questions: which ecosystems it refers to and what it means to be resilient—a definition that varies from context to context. The second part of the BAI defines these ecosystems as those that provide ecosystem services to the population. The September indicator referred to the extent (area, distribution) and capacity (biophysical ability) of ecosystems to provide ecosystem services.

In the case of the proposed REDD+ measure, the concept of ecosystem applies to forests. National Law No. 26,331 on Native Forests defines native forests as natural forest ecosystems composed predominantly of mature native tree species, with diverse associated flora and fauna, together with the surrounding environment —soil, subsoil, atmosphere, climate, water resources—forming an interdependent network with unique characteristics and multiple functions, which in their natural state provide the system with a state of dynamic equilibrium and offer various environmental services to society, in addition to diverse natural resources with potential for economic use. The definition includes both primary native forests, where there has been no human intervention, and secondary forests formed after clearing, as well as those resulting from voluntary reforestation or restoration.

According to the IPCC (2022) the resilience of a system is based on its capacity to cope with a hazardous event, trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure. Thus, it could be said that a climate-resilient forest in the Chaco region should maintain its biodiversity structural integrity, as well as its ability to provide ecosystem services such as carbon sequestration and water regulation, and its capacity to absorb climate shocks. The main hazards (H) identified are severe droughts and floods as described in previous measures.

In the national context, the NAP operationalizes ecosystem resilience around the concept of protecting natural infrastructure to safeguard vulnerable human communities. Thus, a resilient ecosystem in Argentine policy is defined by its ability to maintain ecological connectivity and prevent irreversible land degradation or desertification under future warming scenarios.

The quantitative measure (M) refers to the percentage of hectares, while the adaptation action (A) is REDD+ certification, with a target of 2.5 million hectares. This figure is derived from the calculation of the forest area that could be affected by this measure, based on an analysis of the National Forest Inventory and MAP Biomas. This measure can be classified as both mitigation and adaptation, as it helps mitigate climate change, protect forest ecosystems, and create incentives for the long-term conservation and sustainable management of forest resources.

The Argentine Carbon Council has prepared a report (MAC, 2023) identifying the growth potential of certified projects in Argentina's voluntary carbon market, taking into account land-use emissions at the international and national levels, as well as the growing interest among companies in investing in these types of markets and initiatives to offset their emissions.

At the same time, the measure covers the maximum possible area of the province, protecting 100% of the remaining forest cover in the Chaco. The subnational target also involves the creation of 500 jobs, which is based on an analysis of unemployment indicators in the province of Chaco (INDEC) and the measure's capacity to generate employment according to estimates of the monitoring needs of the REDD system (based on participatory workshops and inter-institutional agreements). The job profile includes provincial forest rangers, wildfire brigade members, GIS technicians (satellite monitoring), field auditors, and community coordinators.

The Response Plan's target of having 50% of new employees be women is aligned with SDG 5 and the goal of gender parity, in line with the population's composition. The target that 50% of employees belong to indigenous peoples and that 30% are young people are linked to a positive measure that harnesses the knowledge of indigenous communities regarding native ecosystems. Youth in Chaco face high levels of vulnerability associated with school dropout rates, unemployment, and limited access to healthcare, among other issues.

5 | Lesson learned and recommendations

5.1. Learning from the subnational case

The province possesses a *hybrid information architecture* that combines highly rigorous technical metrics with significant operational gaps. On the one hand, there is a solid body of research and satellite-derived data generated by the National Institute of Agricultural Technology (INTA) and the National Observatory for Land Degradation and Desertification, which assess the performance of ICLF and sustainable grassland management systems. This technology-based information is complemented by in situ community-level metrics collected regularly through citizen science initiatives led by local organizations.

However, the challenge of bridging multiple scales of action and reporting remains profound. Local actions typically emerge from the immediate identification of territorial problems and do not always align with the formal architecture of government planning frameworks. As a result, substantial territorial heterogeneity exists: while some pilot sites benefit from comprehensive monitoring systems and detailed measurements, other areas still lack even the most basic data collection capacities.

Within the Chaco territory, adaptation is not understood as an isolated or reactive intervention, but rather as a comprehensive process aimed at optimizing the systemic functions of the biome. Based on this perspective, the territorial analysis establishes a clear distinction between preparedness and institutional-enabling measures and those interventions that generate structural adaptation co-benefits.

Measures such as the Early Warning System and Secure Land Tenure, while fundamental pillars of resilience, do not directly generate adaptation co-benefits. The former primarily serves as a preparedness mechanism for imminent climate-related emergencies, while the latter constitutes a foundational enabling condition for adaptation investments and long-term territorial stability.

In contrast, four key interventions substantially enhance the resilience capacity of the system: the Jurisdictional REDD+ Program; ICLF; sustainable grassland management and water harvesting and water resources management. These four interventions reduce climate-related threats by restoring and strengthening the ecosystem's regulatory functions.

The adaptation co-benefits of the 4 measures operate across three interdependent levels: biophysical regulation and buffering of climate extremes; prevention of damage at a global scale; and social equity and economic valorization.

- *Biophysical regulation and buffering of climate extremes.* The forests and grasslands of Chaco function as critical thermal and hydrological regulators. At the microclimatic level, areas that maintain forest cover can experience ground-level temperatures that are 6–7°C lower than those recorded in deforested landscapes. From a hydrological perspective, native forests act as a natural "pumping system," extracting groundwater and regulating water balances. When this vegetation cover is removed, infiltration capacity collapses and groundwater tables rise. The loss of this ecosystem regulatory service was one of the primary drivers of the 2019 flooding event in Chaco, during which approximately 500,000 hectares were inundated. Likewise, from an infrastructure perspective, the network of community water reservoirs not only secures water availability for livestock during drought periods but also functions as a hydrological buffer during intense rainfall events, capturing surface runoff and reducing the risk of flash flooding.

- *Prevention of damage at a global scale.* Local adaptation solutions generate co-benefits that extend far beyond the boundaries of the Gran Chaco region. The loss of vegetation cover and the washing away of soils during extreme rainfall events can trigger severe erosion processes, transporting sediments and nutrients into downstream watersheds. By reducing erosion through ICLF and Sustainable Grassland Management, Chaco contributes to mitigating these broader environmental impacts and supports the maintenance of ecosystem services with regional and global significance.

- *Social equity and economic valorization.* The Chaco intervention model is distinguished by an equity-centered approach designed from the outset. The incorporation of a gender perspective, the creation of rural employment opportunities, and the active participation of Indigenous communities are not supplementary measures or last-minute adjustments introduced to satisfy external requirements. Rather, the policy framework is intrinsically structured around these populations through Community-Based Adaptation (CBA) approach. This design recognizes that long-term climate resilience depends not only on ecological restoration and productive transformation, but also on social inclusion, local ownership, and the equitable distribution of adaptation benefits. As a result, the model strengthens both environmental sustainability and the social foundations required to access and sustain participation in high-integrity climate and sustainability markets.

5.2. The conceptual and methodological exercise

The empirical testing of the Belém Adaptation Indicators (BAI) within the livestock and ecosystem governance framework of Chaco has generated a series of unavoidable methodological and policy lessons that reshape the way climate action is reported and assessed.

Overall, the exercise reveals a clear methodological tension between indicators designed for aggregated national reporting and the highly granular reality of territorial adaptation. Establishing a unified and rigidly standardized monitoring framework is not feasible when the drivers of degradation vary substantially across ecosystems. As a result, **global reporting systems require a degree of qualitative flexibility to adequately capture context-specific adaptation processes.**

To address this challenge of over-homogenization, **the methodology used during the NAP Expo 2026—which separates reporting into three components: hazard, action and metric —proved to be an adaptable approach**. By structuring reporting around three complementary elements—a core quantitative measure, a qualitative narrative description linked to adaptation action, and the contextual characterization of the climate hazard (or risk)—it allows progress to be justified and communicated without reducing complex adaptation processes to a single composite score. It also allows adaptation outcomes to be contextualized without sacrificing comparability, while preserving the specific characteristics of each territory.

At the same time, **the current formulation of indicators places particular emphasis on the adaptation action, which sometimes raises issues of attribution**, adding an additional layer of uncertainty to the implementation process. Certain metrics—such as the "level of establishment" of Early Warning Systems—remain ambiguous and open to multiple jurisdictional interpretations, creating challenges for consistency and comparability.

This exercise is also an invitation to avoid narrowing the approach to measuring environmental damage, seeking for **more interaction between territorial vulnerability and response capacity**. When populations receive timely information through effective early warning systems and possess the knowledge and resources needed to respond appropriately, economic losses, threats to human life, and secondary environmental impacts can be reduced substantially.

From the perspective of **cross-cutting considerations**, the metrics confirm the indivisibility of Chaco's resilience model, consolidating what could be described as the "**adaptation triad**". Ecological resilience, or Ecosystem-based Adaptation (EbA), is entirely unviable without strong social organization through Community-based Adaptation (CbA), and the latter, in turn, is structurally unsustainable without a genuine gender and diversity perspective.

In the context of the climate emergency, women's leadership extends far beyond questions of equity in productive income and becomes a matter of territorial survival. Recent experiences in communities such as Vaca Perdida demonstrate that, in the face of climate-related crises, it is often Indigenous and rural women who design, organize, and implement evacuation strategies, logistical responses, and livelihood protection measures. **Excluding gender-disaggregated data risks obscuring the true operational drivers of resilience on the front lines of climate adaptation**.

This social framework is itself sustained by ancestral biocultural knowledge. The understanding that rural criollos communities possess regarding the dynamics of the Chaco forest has historically been shaped by the knowledge systems, classifications, and worldviews of Indigenous Peoples. Consequently, the transfer and preservation of this knowledge constitute an indispensable foundation for any effective adaptation strategy.

Regarding information gaps and systemic requirements, the analysis identifies a structural deficiency in subnational monitoring systems grounded in a rigorous Theory of Change and results framework. **Existing datasets remain disproportionately focused on process and output indicators, such as the number of hectares managed or the number of beneficiaries reached**. To apply the BAI framework with integrity, there is an urgent need to shift toward measuring direct adaptation outcomes and impacts, while simultaneously developing subnational climate modeling capacities capable of generating robust future baselines.

In this context, one of the most important policy lessons emerging from the exercise **is the need for institutional agility influencing and**

shaping formal reporting frameworks from bottom-up perspectives. To ensure that rights-based approaches, place-based knowledge, and intersectional perspectives are organically incorporated into the official narrative of global adaptation, territories must generate robust empirical evidence and report it rapidly and effectively. Being among the first to document, test, and operationalize these methodologies establishes a strategic precedent that compels national and international reporting frameworks to engage with local realities, preventing territories from becoming passive recipients of globally designed bureaucratic processes.

5.3. Political Alignment

A definitive consensus has yet to emerge regarding the operationalization of the political alignment of the Belém Adaptation Indicators (BAIs) in the context of the Belém-Addis Vision (BAV) (Decision 12/CMA.7). This piloting exercise demonstrates that conceptualizing political alignment as a direct, top-down assimilation of a global framework is neither methodologically feasible nor institutionally desirable. Conversely, we argue that the political and technical architecture of the BAV is fundamentally enriched by subnational and national testing. Such exercises allow for a critical examination of diverse conceptual and methodological approaches when applying the 59 BAIs across heterogeneous territorial contexts and different scales.

In this regard, policy alignment should be understood as an iterative outcome derived from bottom-up testing—a process that uncovers localized lessons, structural data gaps, and concrete capacity needs across countries, states, cities, and frontline communities, backed by key stakeholders.

Crucially, securing buy-in from national governments remains paramount; they must perceive testing not as a new reporting burden, but as a strategic opportunity to strengthen their monitoring, evaluation, and learning (MEL) systems. However, for this transformation to materialize, the international community must actively incentivize these pilots through sustained financial mechanisms, targeted capacity-building for technical staff, and dedicated support for developing and maintaining robust databases.

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