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WHITE PAPER: C12D CARBONO NEUTRO DESCENTRALIZADO,

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WHITE PAPER FOR C12D DECENTRALIZED NEUTRAL CARBON,

1. Introduction: The Challenge of Decarbonization in Brazil

The system proposed by the C12d Decentralized Carbon Neutral protocol aims to facilitate and expand access to the carbon market and environmental services for small and medium-sized rural properties and other legal holders of preserved nature areas. Payment for Environmental Services (PSA) is facilitated through the carbon market, where a preserved natural area generates carbon credits, often with extra gains for other environmental services and social inclusion provided. The carbon present in native vegetation cover is considered a priority and strategic element in structuring the Brazilian carbon market, as it harbors biodiversity.

Brazil, as a signatory to the Paris Agreement, has assumed ambitious commitments to reduce greenhouse gas (GHG) emissions, aiming for a 37% net reduction by 2025 and 43% by 2030 relative to 2005 levels, and net-zero emissions by 2050. These commitments were ratified by Decree N° 9.073/17. However, environmental entities have criticized Brazil for not providing more details on how these targets will be achieved. Brazil is the fifth largest climate polluter globally, behind only China, the USA, Russia, and India, contributing about 3.2% of the total world emissions.

2. The Market Opportunity and Obstacles

Brazil's immense area of native vegetation, covering 66% of its territory, represents the largest opportunity to generate wealth based on the preservation of

biodiversity. Native vegetation removes approximately 90 billion tons of CO₂ annually nationwide, or an average of 42 tons of CO₂ per hectare per year, based on the net primary productivity (NPP) of native vegetation across 564 million hectares, according to Mapbiomas.

Despite this potential, the portion of this carbon that is certifiable as carbon credits faces significant limitations due to certain criteria. A major obstacle is the requirement for land regularization; only slightly over 50% of protected areas are officially recognized ("homologadas"), and just over 30% of private areas are regularly georeferenced in SIGEF-INCRA. Another requirement is positive additionality, meaning the proportion of native areas within the perimeter is greater than in the surrounding area. The average additionality value in Brazil is 8%.

The requirement for external certification standards, such as VERRA-AFOLU, which dominates over 80% of the Brazilian market, poses the biggest obstacle to structuring the internal decarbonization market using native vegetation. This is due to high financial costs, complex analog methods, extensive field sampling, complex project elaboration, lengthy processes, and limited accessibility for smaller areas (typically excluding areas under 30 thousand hectares). The estimated maximum area certifiable by the VERRA standard would generate a maximum credit volume of 4,968 Mt, representing only 6% of the estimated removal targets needed. As of 2024, VERRA-certified projects in Brazil have generated approximately 45.28 million tons of CO₂e. This slow evolutionary dynamic is attributed to analog inventory methods and complex risk analyses.

To meet Paris Agreement goals and avoid being taxed by mechanisms like the EU's Carbon Border Adjustment Mechanism (CBAM), Brazil needs to develop internal mechanisms to tax or "price" emissions. Structuring an internal decarbonization market based on CO₂ removals by native vegetation is seen as the path to enable the neutralization of national emissions, meet goals, and generate economic wealth. The remaining removal target needed post-Paris goals is estimated at 73,463 Mt. A conservative estimate of the certifiable volume of carbon from native vegetation is 113,140 Mt. The potential economic value of this conservative certifiable volume is estimated at over R\$ 5.6 trillion (almost two-thirds of the national GDP), assuming a value of R\$ 50.00 per ton of CO₂e. The certifiable volume in Protected Areas is 75,730

Mt (worth R\$ 3.7 trillion), and the certifiable private volume is 39,019 Mt (worth R\$ 1.9 trillion). The volume certifiable at the best vintage (up to 5 years old) is 66,800 Mt, worth approximately R\$ 3.3 trillion, close to one-third of the national GDP.

3. The C12d Protocol and Digital Certification Solution

Digital certification is presented as the solution to overcome the obstacle posed by traditional certifiers for native vegetation carbon. It provides agility, control, and security in the issuance of carbon credits, seeking to meet growing market demands by integrating major institutional partners. This digital certification, structured by the C12d Protocol, aims to reach the necessary scale with the lowest impact, efficiency, and precision across the national territory, democratizing the benefits and wealth of carbon credits. It is designed to meet the demands of federal, state, and municipal public spheres, as well as the private sector.

The C12d Protocol provides a Brazilian certification standard for GHG removal projects in native vegetation. It utilizes geotechnology to streamline the credit generation process rapidly, providing precision and standardization in parametrization and certification. The system is dedicated to objective simplification. A key simplification is that for areas certified by SIGEF (INCRA), this registration is sufficient for contract elaboration and a quantitative pilot proposal for the amount of credits to be certified and audited. The C12d system is flexible to collaborative georeferencing.

The C12d was developed based on ISO standards (ISO 14064-2:2006, ISO 14064-3:2006, and NBR ISO 14064-1:2022), relative to greenhouse gases. It maintains most principles of the VERRA VCS program, adapted for applicability within the C12d System. Principles such as Relevance, Completeness, Consistency, Accuracy, Transparency, and Conservatism, derived from ISO 14064-2:2006, are maintained.

4. How the C12d System Works

The C12d system was developed on the Google Earth Engine platform. It uses independent, free third-party spatial data sources: Mapbiomas for land use proof (using Collection VI/VII data since 1985/2021) and NASA's MODIS/Terra Net Primary Production (MOD17A3HGF) satellite data for carbon stocks (annual carbon productivity estimates).

The system accounts for effectively avoided emissions proven by satellite data annually since the year 2000. This logic counts the past time and sums the real carbon value each year, "recompensating who effectively preserved" instead of "betting on the future". A new vintage is generated each year until July, potentially allowing for indefinite future annual harvests. Due to this backward accounting method, complex analyses of Non-Permanence and Leakage risks are not required in the C12d System.

The result of each project comes from the analysis and integration of spatialized data: the annual carbon credit history (removed/avoided) from 2000 up to 2023, the land use for the same period, and the georeferenced polygon of the property's boundaries (certified by INCRA). The C12d system does not have area size limits.

The employment of innovative technologies in the Protocol C12d dispenses with field inventories, significantly reducing project costs. Similarly, the monitoring plan, which is a significant effort and cost in other standards, is eliminated because the system extract already shows the achieved result, and system maps prove the data and values attained.

The system applies a standardized method to determine annual additionality across all projects. The entire territory of Brazil uses the same code, which also solves the problem of distortions between different estimates of carbon productivity. The size of the additionality buffer can vary to achieve the best yield for each landscape. All GHG emission reductions are converted into CO₂e using GWP values from the IPCC Fifth Assessment Report (AR5).

Project requirements are primarily related to providing documentary proof of legal domain over the property generating the credits. If legal domain is proven, a project can be opened, and credits generated and certified. Another requirement is presenting positive additionality. The project property is derived from a statutory, property, or contractual right from the project start date back to the year 2000.

Each project involves defined parties in a contract:

* Project Proponents: The holder of land rights (CPF or CNPJ) over the Rural Property.

* Validation Agent: The company that elaborates the project and gathers documentation for certification, partnering with a C12d certifier. C12d GESTÃO DE ATIVOS LTDA. acts as the first Validation Agent.

* Verification Agent: An independent, non-profit certifying organization that performs verification and certification, partnering with a validation company. CERTIPASA (INSTITUTO DE VERIFICAÇÃO E CERTIFICAÇÃO DE PAGAMENTOS DE SERVIÇOS AMBIENTAIS) is a Verification Agent and controls certification in the C12d System. The COOPERATIVA DOS PRODUTORES DE CRÉDITO DE CARBONO SOCIAL E AGRICULTORES FAMILIARES DO BIOMA CAATINGA is also a Verification Agent.

* Emission Representatives: The holder of credits issued for each project.

All processes and contracts are developed in Brazil, including certification. The entire process of documentation, data processing, inventory, and certificate issuance is digital and secured by security keys for e-cpf and e-cnpj tokens. Digital signatures are permitted for contracts.

5. Advantages and Differentials of the C12d System

The C12d System presents several key differentials compared to traditional certification methods like VERRA:

* Accessibility and Inclusivity: It facilitates and expands access to the carbon market for small and medium-sized rural properties and other legal holders of preserved areas, who are often excluded by traditional certifications due to high costs and complexity. It democratizes the benefits and wealth of carbon credits.

* Comprehensive Biome Coverage: It serves all Brazilian biomes, including those with less biomass that are less favored by traditional standards.

* Fully Digital Process: The entire protocol and certification are done digitally. Documentation is generated online and in Portuguese.

* Agility and Cost Reduction: The use of geotechnology and innovative methods eliminates the need for field inventories, complex risk analyses, and monitoring plans, significantly reducing project costs and time.

* Precision and Standardization: It uses standardized methods and data sources for the entire Brazilian territory, ensuring accuracy and precision (average error < 1.5%, maximum 3%) and resolving distortions in carbon productivity estimates. Data is proven by satellite.

* Transparency and Auditability: The system is decentralized, developed in open code, and fully verifiable and auditable by all interested parties. Each project has its own applications (APPs) for conference and audit, presenting a unique project code and a history with all data and maps for interactive consultation.

* Socioenvironmental Profile: It provides extra gains for different spatial/legal configurations and environmental services. Notably, Indigenous Lands receive the highest PSA values, with an extra rate of up to 50%, highlighting its socioenvironmental profile. The system avoids unwanted contact with indigenous people in Indigenous Lands as it does not require field visits. It generates credits proportionally for those who promote greater socioenvironmental benefits.

* Developed in Brazil: All processes, contracts, and certification are developed within Brazil and are online.

6. Certification and Transparency

Credits issued for a project are certified by independent, non-profit institutions that continue to track each credit until it is extinguished or retired, when the intended emission compensation has effectively occurred. CERTIPASA acts as a Verification Agent and the Central Control for Certification in the C12d System, providing verification, certification, and control of credit transactions. CERTIPASA issues a certificate for each project. As of the documentation date, C12d had a portfolio with approximately 15 million tons of CO₂e already certified by CERTIPASA. Validation/verification bodies must maintain records for at least 20 years after the project's credit period. The body and team must meet the competence requirements defined in ISO 14065:2013.

7. Additional Environmental Services

Beyond basic carbon removal/avoidance, the C12d Protocol provides extra gains for different spatial and legal configurations, recognizing additional environmental

services. These include Protected Areas, Quilombos, areas covered by the Atlantic Forest Law, Biosphere Reserves, Semi-arid regions, and Reservoir influence zones. As mentioned, Indigenous Lands receive the highest extra value, up to 50% more. This incentivizes the preservation of areas with significant socioenvironmental value. A partnership contract with Eco Prime for restoration projects also outlines revenue sharing from credit generation, including percentages for the owner, Eco Prime, C12d, and Certipasa.

8. Crypto Asset \$C12d

In the near future, owners of certified properties will be able to receive payment for their carbon credits in the equivalent \$C12d cryptocurrency. Deposited into the project owner's own wallet (linked to the same CPF or CNPJ), this cryptocurrency will be irreversibly registered on the Blockchain network. It can be stored, traded, fractionalized, and retired, electronically fulfilling its mission of emission removal and compensation, giving back the wealth of Brazilian biodiversity. The conversion of credits into cryptocurrency is intended to provide immediate liquidity through the ease of fractional sale (this is still under development). The system aims for immediate liquidity and fractional sale of credits through the \$C12d crypto asset.

9. Legal and Regulatory Context

Brazilian law defines Carbon Credit as a "transferable intangible and incorporeal asset title". The Lei nº 15.042, of December 11, 2024 (Lei do Carbono), established the Brazilian Emissions Trading System (SBCE). This law defines key terms like "gerador de projeto de crédito de carbono" (generator) and "remoção de GEE" (GHG removal).

The law differentiates between:

1. Crédito de Carbono: A transferable asset representing 1 tCO₂e reduction or removal, obtained from public or private projects/programs, subject to national or international methodologies that adopt criteria and rules for measurement, reporting, and verification *external to the SBCE*. The law recognizes forest carbon credits from preservation or reforestation (excluding those from jurisdictional programs with certain limitations) as having the legal nature of civil fruit.

2. CRVE (Certificado de Redução ou Remoção Verificada de Emissões): A fungible, transferable asset representing 1 tCO₂e, following an accredited methodology and registered *within the SBCE*.

The C12d Protocol generates carbon credits from the preservation and restoration of native vegetation using its own methodology (based on international and national norms) external to the SBCE. Thus, it aligns with the definition of a "Crédito de Carbono" generator under the law. The C12d Project Proponent, as the land rights holder, fits the law's definition of a project generator. For credits generated by the C12d Protocol to become CRVEs and be integrated into the SBCE, their methodology would need accreditation, and the credits registered within the SBCE framework. The law specifies that conversion of a carbon credit into an SBCE asset (CRVE) will not trigger taxation.

The Lei do Carbono also addresses:

* Eligible Areas: Reaffirms that Permanent Preservation Areas (APPs), Legal Reserves, restricted use areas (under Law nº 12.651/2012), and conservation units (Law nº 9.985/2000) are eligible for carbon credit generation. Indigenous Lands, Quilombola territories, settlement projects, and other areas are also apt unless legally prohibited. The C12d system operates in preserved areas and restoration projects and includes PSA extras for these categories, including Indigenous Lands.

* Land Rights and Double Counting: The law protects the right of owners, legitimate usufructuaries, and concessionaires to request, at any time, the exclusion of their areas from jurisdictional REDD+ programs to avoid double counting. The C12d, by basing credit generation on documented legal domain and satellite-proven historical results, helps mitigate the risk of double counting with state programs.

* Indigenous Peoples and Traditional Communities: For projects in traditionally occupied areas, the law requires free, prior, and informed consent and fair benefit sharing, with a minimum of 50% of removal credits designated for compensation to these communities. The cost of consultation falls to the developer. The C12d's socioenvironmental profile, which already offers significant PSA extras (up to 50%) for Indigenous Lands, aligns with these principles.

* Financial and Capital Markets: The law states that SBCE assets (CRVEs) and carbon credits, when traded in financial and capital markets, are securities subject to the regulation of the Comissão de Valores Mobiliários (CVM). The CVM can impose specific rules for custody, registration, and information. The C12d's plan to convert credits into cryptocurrency (\$C12d) and negotiate on exchanges will likely fall under CVM scrutiny if traded in this context. The law allows for private placement outside these markets.

* Mandatory Investments: The law mandates that certain financial entities (insurers, open complementary pension entities, capitalization societies, and local reinsurers) must acquire environmental assets (like carbon credits/CRVEs) or quotas of funds investing in them, up to a minimum percentage of their technical reserves. This creates potential demand for C12d-generated assets.

* Taxation: The law provides rules for taxing gains from the sale of carbon credits and SBCE assets and allows for deduction of expenses incurred in generating these assets.

* Fiscalization and Penalties: The law outlines fiscalization and sanctions for non-compliance within the SBCE. The CVM has exclusive jurisdiction over infractions related to trading in financial/capital markets.

10. Conclusion

The C12d Decentralized Carbon Neutral Protocol offers an innovative, digital, and scalable solution to unlock the vast potential of Brazil's internal carbon market based on native vegetation preservation and restoration. By addressing the barriers of high cost, complexity, and limited scale inherent in traditional international certification methods through a digital and decentralized approach leveraging geotechnology, C12d democratizes access to the carbon market for landholders of all sizes across all Brazilian biomes.

Its unique logic of counting credits backward from past, satellite-proven results rewards effective preservation. The elimination of complex future risk analysis and constant monitoring, coupled with its strong socioenvironmental focus that recognizes and values protected areas and biomes through additional PSA gains (especially for

Indigenous Lands), aligns with the need for a dynamic internal market with a clear socioenvironmental profile.

By enabling the large-scale generation of nationally certified carbon credits, C12d can catalyze the structuring of a robust internal decarbonization market. This market has the potential not only to contribute significantly to Brazil meeting its Paris Agreement climate targets and achieving net-zero emissions by 2050 but also to generate trillions of reais in economic wealth from the preservation of its invaluable biodiversity, driving sustainable development and the social function of land. Digital certification is presented as the solution to achieve the necessary scale with efficiency and precision nationwide, democratizing the benefits and wealth derived from carbon credits. The C12d Protocol, with its technological foundation and focus on accessibility and inclusion, is well-positioned to be a relevant player in the Brazilian Internal Carbon Market, contributing to national emission reduction goals and the valorization of biodiversity, in accordance with the principles and rules established by Lei nº 15.042/2024.

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