American Carbon Registry
AT WINROCK INTERNATIONAL

PUBLIC COMMENT

TOOL FOR

REVERSAL RISK ANALYSIS AND BUFFER POOL CONTRIBUTION DETERMINATION

VERSION 2.0

February 2023

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American Carbon Registry®

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ABOUT AMERICAN CARBON REGISTRY® (ACR)

A leading carbon offset program founded in 1996 as the first private voluntary GHG registry in the world, ACR operates in the voluntary and regulated carbon markets. ACR has unparalleled experience in the development of environmentally rigorous, science-based offset methodologies as well as operational experience in the oversight of offset project verification, registration, offset issuance and retirement reporting through its online registry system.

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We thank the staff of the United States Forest Service who published the original datasets used in the wildfire and biotic risk sections and who answered so many questions regarding how to use them. We also thank the staff of the Federal Emergency Management Agency for their work developing and maintaining the National Flood Hazard Layer which informs the hydrologic risk section.

ACR looks forward to continued collaboration and future improvements to risk estimation with all our partners.

ACRONYMS AND DEFINITIONS

ACR	American Carbon Registry
AFOLU	Agriculture, Forestry, and Other Land Use
Aggregate	The grouping of multiple project instances, fields, producers, or facilities into a single project registered on ACR. An Aggregate must be coordinated by a Project Proponent (public or private entity) serving as the aggregator. The GHG Project Plan will define the overall project boundary and baseline conditions encompassing all project instances, fields, producers, or facilities. An Aggregate will have a single Start Date and Crediting Period.
Agricultural Land	Any ecosystem modified or created specifically to grow or raise biological products for human consumption or use. This includes cropland, pasture, rangeland, orchards, groves, vineyards, nurseries, ornamental horticultural areas, and confined feeding areas. It is generally synonymous with farmland.
Buffer Contribution	The number of offsets contributed to the Buffer Pool for AFOLU projects with a risk of reversal.
Buffer Pool	An account managed by ACR as a reversal risk mitigation mechanism for AFOLU projects into which Project Proponents contribute a determined quantify of ERTs to replace unforeseen losses in carbon stocks. The Buffer Contribution is a percentage of the project's reported offsets, the Minimum Buffer Percentage, determined through a project-specific assessment of the risk of reversal. The buffer contribution may be made in ERTs of any type and vintage meeting the requirements laid out in the *ACR Buffer Pool Terms and Conditions*.
Cohort	A group of sites sharing the same validation and verification schedule within a Programmatic Development Approach (PDA) project.
ERT	Emission Reduction Ton
FEMA	Federal Emergency Management Agency
Forest	Forest projects shall use a nationally approved "forest" definition for the country where the activity occurs. For projects in the United States, Project Proponents shall use the USA definition in Appendix A of the *ACR Standard*, which is based on the U.S. Forest Service Forest Inventory & Analysis Program definition. For projects outside of the United States, Project Proponents may use the Kyoto Protocol definition in Appendix A of the *ACR Standard*, with the relevant Designated National Authority (DNA) selections for minimum land area, crown cover, and tree height. If

	the project is in a country that no longer has a designated DNA or whose DNA has not made these selections, the Project Proponent may propose another nationally approved forest definition. The definition of forest shall apply in each eligible forest project category. For example, afforestation/ reforestation activities must target the eventual establishment of a forest; IFM activities must be implemented in a forest remaining as forest; and Avoided Conversion activities must be implemented in a forest and prevent its conversion to non-forest or its degradation remaining forest.
Geologic Sequestration	The process of capturing carbon dioxide from a stationary source and injecting it deep underground through a well, with or without enhanced oil recovery. Also called carbon capture and storage.
Greenhouse Gas (GHG)	Gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation emitted by the Earth's surface, the atmosphere itself, and by clouds, causing the greenhouse effect. The primary GHGs regulated under the Kyoto Protocol are carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4), HFCs, perfluorocarbons (PFCs), and sulfur hexafluoride (SF6). The IPCC lists and periodically updates GHGs in its assessment reports.
GHG Project Plan	A document that describes the Project Activity, satisfies eligibility requirements, identifies sources and sinks of GHG emissions, establishes project boundaries, describes the baseline scenario, defines how GHG quantification will be done and what methodologies, assumptions, and data will be used, and provides details on the project's monitoring, reporting, and verification procedures. ACR requires every project to submit GHG Project Plan using an ACR-approved methodology.
GIS	Geographic information system
Grassland and Shrubland	A land-use category on which the plant cover is composed principally of grasses, grass-like plants (e.g., sedges and rushes), forbs, or shrubs. Savannas, some wetlands, deserts, and tundra are considered grassland; they are often suitable for grazing and browsing, and include pastures and native rangelands. Practices such as clearing, burning, chaining, and/or chemicals may be applied to maintain the grass vegetation. Woody plant communities of low forbs and shrubs (e.g., mesquite, chaparral, mountain shrub, and pinyon-juniper) are also classified as grassland and shrubland if they do not meet the criteria for forest land. Grassland includes land managed with agroforestry practices such as silvopasture and windbreaks, assuming the stand or woodlot does not meet the criteria for forest land.
ILAT	Forest Trends Global Illegal Logging and Associated Trade

Implementation Date	The site-specific date corresponding to the start of project activities (as they are defined by the relevant methodology) on a single site within a project implementing an Aggregate or Programmatic Design Approach.
Intentional Reversal	In the context of terrestrial sequestration, the decrease of average carbon stocks within a project area below levels associated with previously issued ERTs as a result of intentional, willful activity (e.g., harvesting, forest conversion, willful withdrawal of a parcel/parcels) on the part of the Project Proponent or project owner(s). When carbon stocks decline in this way (i.e., negative stocks, relative to previous reporting), it is assumed that the carbon is released back into the atmosphere and must be compensated per the provisions in the Project Proponent's Risk Mitigation Agreement with ACR. In the context of geologic sequestration, atmospheric leakage of injected CO2 from the storage volume that is not remediated and is the collateral effect of any planned activity affecting the storage volume.
Minimum Buffer Percentage	An overall reversal risk rating for an AFOLU project based on the ACR Tool for Reversal Risk Analysis and Buffer Pool Contribution Determination, which translates into the number of offsets that will be deposited in the ACR Buffer Pool at each issuance to mitigate the risk of reversals.
Minimum Project Term	The minimum period for which an AFOLU Project Proponent commits to project continuance, monitoring, and verification.
Monitoring Report	The report detailing a Project's activity, GHG calculations, and monitored eligibility criteria and parameters for each reporting period. A Project Proponent is required to submit a new Monitoring Report to the VVB during to each verification, and a finalized version to ACR upon completion of each verification. Project Proponent must also submit attestations regarding the continuance, regulatory compliance, ownership, and community and environmental/social impacts of a project in each Monitoring Report.
NFHL	National Flood Hazard Layer
NIDRM	National Insect & Disease Risk Map
NWPL	National Wetland Plant List
Professional Forester	An individual engaged in the profession of forestry. If a project is in a jurisdiction that has professional forester licensing laws, the individual must be credentialed in that jurisdiction. Otherwise, the individual must be certified by the Society of American Foresters or Association of Consulting Foresters.

Programmatic Development Approach (PDA)	A project in which successive cohorts of sites are added incrementally to a project over time. A PDA must be coordinated by a Project Proponent (public or private entity) that must use an approved baseline and monitoring methodology that defines the appropriate boundary, avoids double counting, accounts for leakage, and ensures that the emission reductions are real, measurable, verifiable, and additional to any that would occur in the absence of the project.
Project Proponent	An entity that undertakes, develops, and/or owns a project. This may include the project investor, designer, and/or owner of the lands/facilities on which project activities are conducted. The Project Proponent and landowner/facility owner may be different entities. The Project Proponent is the ACR account holder.
Reporting Period	The period of time covering a GHG assertion that is submitted for a single verification and subsequent request for ERT issuance. Unless otherwise noted in a methodology, there is no minimum length and the maximum length is 5 years.
Reversal	An intentional or unintentional event that results in the emissions into the atmosphere of stored or sequestered CO2e for which carbon offsets (ERTs) were issued to AFOLU or geologic sequestration projects.
Site	A physical location at which GHG emissions are generated and/or GHG emissions reductions are achieved. Project sites may consist of forest, fields, parcels of land, or industrial facilities located within the project boundary.
Substantiating Source	Documentation supporting the application of this tool, including one of the following options: ◆ Attestation from a regional professional forester, a country-level equivalent (for projects located outside of the USA), or other ACR-approved relevant expert; ◆ Attestion from a local governmental agency involved in natural resource management; ◆ Peer-reviewed journal article; or ◆ Another relevant dataset or publication of professional quality.
Terrestrial Sequestration	The process of increasing the carbon stock of terrestrial carbon pools by changing the management of forests, rangelands, agricultural lands, and wetlands, resulting in increased removals of CO2 from the atmosphere and sequestration of carbon through biological processes.
Unintentional Reversal	In the context of terrestrial sequestration, the decrease of average carbon stocks within a project area below levels associated with previously

	issued ERTs as a result of natural disturbances. Examples include fire, disease, and insect infestations. In the context of geologic sequestration, the unplanned release of CO2 from the storage volume.
USA	United States of America
Wetlands	Areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support (and that under normal circumstances do support) a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.
WGI	Worldwide Governance Indicators
WHP	Wildfire Hazard Potential dataset

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TABLES

EQUATIONS

1 INTRODUCTION

1.1 SUMMARY

The *ACR Tool for Reversal Risk Analysis and Buffer Pool Contribution Determination* provides quantification guidelines for Greenhouse Gas (GHG) terrestrial sequestration project types associated with risk of reversal. This document establishes a framework for assessing specific categories of risk as they apply to individual projects. Categorical risk assessments are then combined to produce a minimum buffer percentage, which represents a project-specific assessment of the risk that a project's issued Emission Reduction Tons (ERTs) could be reversed (i.e., released back into the atmosphere) due to unforeseen or otherwise unmitigated events prior to the end of the project term.

The ACR buffer pool only compensates for unintentional reversals and thus, only unintentional types of risks are assessed in this tool. This tool operates in conjunction with the *Agriculture, Forestry, and Other Land Use (AFOLU) Carbon Project Reversal Risk Mitigation Agreement*, which contractually obligates each Project Proponent to mitigate intentional reversals.

Projects have several options for mitigating reversal risk (section 1.3). If the project opts to utilize the ACR buffer pool to mitigate risk and compensate for carbon stock losses associated with unintentional reversals, minimum buffer percentage is multiplied by gross ERTs at each issuance (Equation 2) to calculate the required buffer contribution at each issuance.

If a project experiences an unintentional reversal, an amount of ERTs equivalent to the unintentional reversal loss amount are subsequently retired from the buffer pool on behalf of the project by ACR. Please refer to the *ACR Buffer Pool Terms and Conditions* for details on this process.

1.2 APPLICABILITY

ACR project types that derive crediting from terrestrial sequestration are subject to unintentional reversal risk and must employ a risk mitigation option (section 1.3). This includes projects that account for carbon sequestration in forests, wetlands, grasslands, shrublands, or agricultural lands (i.e., AFOLU projects). Other project types may be applicable. Per Chapter 5 of the *ACR Standard*, geologic sequestration projects mitigate reversal risk via other mechanisms and do not apply a risk mitigation option from section 1.3.

1.3 RISK MITIGATION OPTIONS

All projects subject to unintentional reversal risk and applicable per Section 1.2 must mitigate risk using one of three mechanisms:

Option 1 Contributing ERTs deducted from project issuances to the ACR buffer pool;

Option 2 Contributing ERTs of another type or vintage[1] to the ACR buffer pool; or

Option 3 Using an alternative ACR-approved risk mitigation mechanism[2].

Projects which opt to contribute to the buffer pool (Options 1 or 2) must utilize this tool to determine their project-specific risk rating, or minimum buffer percentage (equation 1), and buffer contribution (equation 2).

1.4 RISK ASSESSMENT INTERVAL

In accordance with the *ACR Standard* and the *ACR Buffer Pool Terms and Conditions*, projects are required to re-assess risk at minimum every five years, coincident with each full verification including a field visit to the project site. An updated risk assessment is also required in the event of an unintentional reversal.

For programmatic development approach (PDA) projects, an updated risk assessment is required in conjuction with validation and prior to ERT issuance upon any newly enrolled lands, unless otherwise specified in the methodology. All projects, including aggregated and PDA, must report a consolidated minimum buffer percentage (Equation 1). While an entire PDA project is subject to risk assessment when new lands are enrolled, one could expect previously enrolled lands' contributions to total risk to remain unchanged unless underlying data sources or inputs have changed.

1.5 RISK REPORTING

The risk assessment performed at AFOLU project initial validation must reported within or as an addendum to the GHG Project Plan. Subsequent risk assessements performed throughout the project life must be reported within or as an addendum to Monitoring Reports.

Risk assessment reporting must include a complete description of how the project calculated its minimum buffer percentage and buffer contribution according to this tool. This includes:

- A list of applicable risk and adjustment categories (section 2);
- The risks and adjustments derived from each category;
- The inputs and results for each applicable equation within this tool; and
- A description of how each applicable category was determined.

[1] For requirements regarding the composition of buffer contribution, please see the *ACR Buffer Pool Terms and Conditions.*
[2] See the *ACR Standard* for details on alternative risk mitigation mechanisms.

1.6 UTILIZATION OF THE BUFFER POOL FOR AGGREGATED AND PDA PROJECTS

The aggregated and PDA project types consolidate multiple sites into a single project. PDA projects allow sites or groups of sites to enter the project over time. A site or group of sites sharing the same validation and verification schedule are considered a "cohort".

Aggregated and PDA project types have three options for how to utilize the buffer pool to mitigate unintentional reversals. The option chosen must be recorded in the validated Project Design Document (which is included as an addendum to the GHG Project Plan validated for the initial cohort entering at the project's start date) and remain unchanged over the project term. If no option is chosen, the project is assumed to utilize Option 1 (project level reporting), which is the default choice.

Option 1 **Calculate and report whether an unintentional reversal has occurred at the project level.** Projects utilizing Option 1 may be eligible for a diversified risk adjustment (section A.10) and are not subject to a buffer-insured area adjustment (section A.9). Projects reporting reversals at the project level are not required to report net carbon stock change at any organizational level other than the project level.

Option 2 **Calculate and report whether an unintentional reversal has occurred at the cohort level.** This may be preferable if the Project Proponent wishes to insure unaffected cohorts from reversals occuring outside the cohort boundary using the ACR buffer pool, but it may require a higher buffer pool contribution rate at each issuance. Projects utilizing Option 2 are not eligible for a diversified risk adjustment (section A.10) and may be subject to a buffer-insured area adjustment (section A.9). Projects reporting reversals at the cohort level must perform calculations of net carbon stock change for each cohort, and these results must be reported in each Monitoring Report throughout the life of the project.

Option 3 **Calculate and report whether an unintentional reversal has occurred at the site level.** This may be preferable if the Project Proponent wishes to insure unaffected individual sites from reversals occuring outside the site boundary using the ACR buffer pool, but it may require a higher buffer pool contribution rate at each issuance. Projects utilizing Option 3 are not eligible for a diversified risk adjustment (section A.10) and may be subject to a buffer-insured area adjustment (section A.9). Projects reporting reversals at the site level must perform calculations of net carbon stock change for each site, and these results must be reported in each Monitoring Report throughout the life of the project.

2 RISK AND ADJUSTMENT CATEGORIES

Table 1: Management and Governance Risks

FINANCIAL	Financial failure may compromise the continued monitoring, reporting, and verification of project stocks and could terminate the project without assuring the permanence of previously issued ERTs over the minimum project term.
SOCIAL AND POLITICAL	Social and political risks are attributed to the expropriation of carbon project land by both governmental and non-governmental actors, corruption, shifts in politics, legal frameworks, or social perception, or resource needs which may increase risks to carbon stocks.
ILLEGAL LOGGING AND CONVERSION	The loss of carbon stocks through illegal logging or land conversion by outside actors is considered an intentional reversal (and thus is not covered by the ACR buffer pool). However, these losses could ultimately contribute to financial failure and project termination.

Table 2: Natural Disaster Risks

WILDFIRE	Wildfire may result in a reduction of carbon stocks depending on severity. Wildfire risk is highly regional and only applies to certain project types.
BIOTIC	Insects and diseases are present in most terrestrial ecosystems and can have variable impacts upon carbon stocks. Risk to carbon stocks can be assessed based on prevalence of host species, geography, and proximity to established populations.
HYDROLOGIC	Flood events, potentially compounded with levee or infrastructure failures, can have detrimental effects upon carbon stocks.
OTHER NATURAL DISASTER	Other natural disasters include hurricanes, tornadoes, other extreme storms, windthrow, drought, and geologic and volcanic events.

Table 3: General Risk Adjustments

CONSERVATION COMMITMENT ADJUSTMENT	Risk can be reduced if a project can provide verifiable evidence of a legally binding and enforceable conservation commitment. Further reduction can be applied if the conservation commitment requires annual monitoring by a non-project participant.
BUFFER-INSURED AREA ADJUSTMENT	Aggregated and PDA projects which insure cohorts or sites with the buffer pool (Options 2 and 3 per section 1.6) are subject to increased risk, because natural disasters have a proportionally greater impact on smaller areas' carbon stocks. If the median cohort or site size is less than 5,000 acres, these projects must increase their buffer pool contribution accordingly.
DIVERSIFIED RISK ADJUSTMENT	Aggregated and PDA projects which utilize the buffer pool to mitigate reversals at the project level (Option 1 per section 1.6) may be eligible for decreased buffer pool contributions if they demonstrate sufficient diversification across ecoregions, number of landowners, and project area.

3 CALCULATION PROCEDURES

3.1 ASSIGNING RISK AND ADJUSTMENT CATEGORIES

All projects are subject to the following risk categories and are potentially subject to the following adjustments:

- Financial Risk;
- Social and Political Risk;
- Conservation Commitment Adjustment;
- Buffer-Insured Area Adjustment; and
- Diverisifed Risk Adjustment.

Certain project types are subject to additional categorical risk assessments as follows:

Forest projects must determine scores for each of the following categories:

- Illegal Logging and Conversion Risk;
- Wildfire Risk;
- Biotic Risk;
- Hydrologic Risk; and
- Other Natural Disaster Risk.

Wetland projects must determine scores for each of the following categories:

- Wildfire Risk;
- Hydrologic Risk; and
- Other Natural Disaster Risk.

Agricultural land, grassland, and shrubland projects must determine scores for each of the following categories:

- Wildfire Risk; and
- Other Natural Disaster Risk.

3.2 DETERMINING RISKS AND ADJUSTMENTS

Detailed calculation and determination procedures for each risk and adjustment category are available in Appendix A of this document.

3.3 CALCULATING MINIMUM BUFFER PERCENTAGE AND BUFFER CONTRIBUTION

A project's minimum buffer percentage is calculated by combining the scores from each of the applicable risk and adjustment categories (calculated per Appendix A) in Equation 1:

Equation 1

$$\begin{aligned}\textbf{Minimum Buffer Percentage} &= 100\% \\ &- [\,(100\% - \textbf{Financial Risk}) \times (100\% - \textbf{Social and Political Risk}) \\ &\times (100\% - \textbf{Illegal Logging and Conversion Risk}) \times (100\% - \textbf{Wildfire Risk}) \\ &\times (100\% - \textbf{Biotic Risk}) \times (100\% - \textbf{Hydrologic Risk}) \\ &\times (100\% - \textbf{Other Natural Disaster Risk}) \\ &\times (100\% - \textbf{Conservation Commitment Adjustment}) \\ &\times (100\% - \textbf{Buffer-Insured Area Adjustment}) \\ &\times (100\% - \textbf{Diversified Risk Adjustment})\,]\end{aligned}$$

Apply this percentage to the gross ERTs generated for the reporting period to calculate the required buffer contribution per Equation 2:

Equation 2

$$\textbf{Buffer Contribution} = \textbf{Gross ERTs} \times \textbf{Minimum Buffer Percentage}$$

APPENDIX A: RISK AND ADJUSTMENT DETERMINATION INSTRUCTIONS

Projects must calculate scores for each applicable risk and adjustment category as follows:

A.1 FINANCIAL RISK

All projects must estimate financial risk using one of the following options:

- Assume the conservative default value ($\text{Financial Risk} = 5.75\%$).
- Assign financial risk with the Project Proponent's credit rating by referencing Table 4. Credit ratings must be sourced from either Moody's Investor Service[3], S&P Global Ratings[4], or Fitch Ratings[5] per the Project Proponent's discretion, and they must be current at time of verification.

Table 4: Financial risk based on credit rating

MOODY'S	S&P / FITCH	ACR FINANCIAL RISK	MOODY'S	S&P / FITCH	ACR FINANCIAL RISK
Aaa	AAA	3.000%	A2	A	4.375%
Aa1	AA+	3.275%	A3	A−	4.650%
Aa2	AA	3.550%	Baa1	BBB+	4.925%
Aa3	AA−	3.825%	Baa2	BBB	5.200%
A1	A+	4.100%	Baa3	BBB−	5.475%

- Calculate financial risk with Project Proponent's business credit score using Equation 4. Eligible business credit scores include the Dun & Bradstreet Failure Score[6], Experian Financial Stability Risk score[7], or Equifax Business Risk Score[8]. Other reputable third-party measures of credit worthiness or bankruptcy risk may be proposed for use and are subject to

[3] https://www.moodys.com/
[4] https://www.spglobal.com/ratings/en/
[5] https://www.fitchratings.com/search/
[6] https://www.dnb.com/resources/financial-stress-score-definition-information.html
[7] https://www.experian.com/assets/business-information/brochures/financial-stability-risk-score-ps.pdf
[8] https://www.equifax.com/business/product/business-risk-score/

verification and ACR approval. Credit inquiries must be initiated by the Project Proponent themselves (ACR will not perform a credit check on behalf of any project). Prior to use in Equation 4, business credit scores must be scaled from 0 to 100, where 0 is the most risky and 100 is the least risky. Business credit scores are expressed as a percent deduction, multiplied by 5.5% and added to the minimum financial risk rating (3%).

Equation 3

$$\textbf{Financial Risk} = \left(\left[1 - \frac{\textbf{Business Credit Score}}{\textbf{100}}\right] \times \textbf{5.5\%}\right) + \textbf{3\%}$$

- For applicable organizations (land trusts and other non-profit conservation organizations), demonstrate accreditation by the Land Trust Accreditation Commission[9] in good standing at the time of verification ($\text{Financial Risk} = 3.5\%$). If seeking accreditation renewal or if conditionally renewed, all outstanding issues related to the Finance Requirements must be addressed to qualify for reduced risk.
- Propose another measure of financial stability, subject to verification and ACR approval, to reduce risk below the default value. Risk reduction will be assessed according to the rigor of the proposed measure.

A.2 SOCIAL AND POLITICAL RISK

All projects shall evaluate governance of the country where the project is located using the World Bank Worldwide Governance Indicators (WGI)[10]. The most recent version of the dataset at the time of verification must be used. Since this risk category represents a wide range of social and political threats to carbon stock permanence, all six indicators (Voice and Accountability, Political Stability and Absence of Violence/Terrorism, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption) must be used. These shall be averaged for the project's host country for the past five years (Average WGI Score). The WGI are based on a 5-point scale ranging from -2.5 to +2.5; Equation 5 translates the averaged WGI to a percent deduction which is then multiplied by the assumed maximum risk (8%):

Equation 4

$$\textbf{Social and Political Risk} = \left(1 - \frac{\textbf{Average WGI Score} + \textbf{2.5}}{\textbf{5}}\right) \times \textbf{8\%}$$

[9] https://www.landtrustaccreditation.org/
[10] Two links to the full dataset (Stata and Excel) are available on the Home tab of: https://info.worldbank.org/governance/wgi/

A.3 ILLEGAL LOGGING AND CONVERSION RISK

Forest projects shall utilize the most current version (as of verification) of the Forest Trends Global Illegal Logging and Associated Trade (ILAT) Risk Data Tool[11] to determine the risk of timber theft and illegal deforestation based on the country where the project is located. Annex I lists ILAT Risk Scores by country[12], which must be used in Equation 6. ILAT Risk Scores are indexed on a scale of 1 to 100, expressed as a percentage, and multiplied by half of Financial Risk (Equation 6). As illegal logging and conversion activities are considered intentional, the ACR buffer pool will only compensate for reversals contributing to financial failure and project termination.

Equation 5

$$\textbf{Illegal Logging and Conversion Risk} = \frac{\textbf{ILAT Risk Score}}{\textbf{100}} \times \textbf{Financial Risk} \times \textbf{0.5}$$

A.4 WILDFIRE RISK

- **Forest projects located in the USA** shall estimate wildfire risk using the most recently published version (at the time of verification) of the Wildfire Hazard Potential (WHP) pixelated raster dataset.[13] The classified (rather than the continuous) dataset must be used in conjunction with Table 5:

Table 5: Wildfire risk associated with Wildfire Hazard Potential (WHP) classes for forest projects located in the USA

WHP CLASSES	*ACR WILDFIRE RISK*
Very Low	4%
Low	6%
Moderate	8%
High	10%
Very High	12%

[11] https://www.forest-trends.org/wp-content/uploads/2021/08/Methodology-for-State-ILAT-Project-Aug-2021.pdf
[12] As of the most recent ILAT publication (dated August 2021) at time of writing, ILAT risk score for USA is 5.53, and ILAT risk score for Canada is 3.39.
[13] https://www.firelab.org/project/wildfire-hazard-potential

WHP CLASSES	ACR WILDFIRE RISK
Non-burnable	0%
Water	0%

The following steps (or an equivalent approach producing the same results) are required. Steps 2 and 3 use geographic information system (GIS) software:

Step 1 Download the data publication zip file.[14] Projects located outside Alaska and Hawaii shall use the classified raster layer for conterminous United States ("whp2020_cls_conus"), while projects located in Alaska and Hawaii shall use their applicable layers ("whp2020_cls_ak" and "whp2020_cls_hi" respectively).

Step 2 Clip the classified raster layer to the project area polygon, creating a raster data layer that approximately matches the boundaries of the project area.

Step 3 Use Table 5 to assign wildfire risks to each of the WHP classes within the tabular data from the clipped raster layer. Create an average of the wildfire risks weighted by area ($\text{Base Wildfire Risk}$). The class_desc field contains the WHP classes. The Count field represents the number of 270-meter pixels, which may be used as a surrogate for area. The weighted average may include pixels of 0 risk (Non-burnable and Water), but base risk may not equal less than 4% ($\text{Base Wildfire Risk} \geq 4\%$).

Step 4 Projects may opt to reduce their base risk by 25% by demonstrating that recent (since the WHP dataset's depiction of conditions) mitigation treatments have occurred ($\text{Mitigation Adjustment} = 25\%$). Verifiable records must be provided. Qualifying mitigation treatments must alter fuel conditions in the project area such that they effectively reduce wildfire risk. Mitigation treatment effectiveness must be justified by at least one Substantiating Source (as defined in this tool). Duration of treatment effectiveness must be considered. Coordination with local fire prevention services and other prepareness efforts that do not reduce fuel loads or create fire breaks do not qualify for risk reduction.

Step 5 Calculate wildfire risk to carbon stocks using equation 7:

Equation 6

$$\textbf{Wildfire Risk} = \textbf{Base Wildfire Risk} \times (1 - \textbf{Mitigation Adjustment})$$

- **Forest projects located outside of the USA** must estimate wildfire risk using one of the following options:

[14] Most recent publication as of time of writing can be found at: https://www.fs.usda.gov/rds/archive/Catalog/RDS-2015-0047-3

- Determine wildfire risk at a regional scale and assign the default values in Table 6. The choice of regional wildfire risk must be justified by at least one Substantiating Source. Projects claiming "high" regional wildfire risk require no justification.

  Projects spanning multiple wildfire risk regions must calculate an average weighted by area. The regionally derived wildfire risk ($\text{Regional Wildfire Risk}$) is used in Equation 8.

Table 6: Regional wildfire risk for forest projects located outside of the USA

REGIONAL WILDFIRE RISK	ACR WILDFIRE RISK
Low	5%
Moderate	7%
High	11%

Projects may opt to reduce their risk by 25% by providing verifiable records of recent mitigation treatments ($\text{Mitigation Adjustment} = 25\%$). Qualifying mitigation treatments must alter fuel conditions in the project area such that they effectively reduce wildfire risk. Mitigation treatment effectiveness must be justified by at least one Substantiating Source. Duration of treatment effectiveness must be considered. Coordination with local fire prevention services and other prepareness efforts that do not reduce fuel loads or create fire breaks do not qualfiy for risk reduction.

Equation 7

$$\textbf{Wildfire Risk} = \textbf{Regional Wildfire Risk} \times (1 - \textbf{Mitigation Adjustment})$$

- Propose an approach for project-specific estimation of wildfire risk using publicly available data, peer reviewed literature, or other verifiable sources. The principles for risk estimation and reduction from the USA approach (i.e., verifiable, substantiated, durable) may be applied. Proposed approaches are subject to verification and ACR approval.

- **Wetland, agricultural land, grassland, and shrubland projects located in the USA** shall estimate wildfire risk using the most recently published version of the Wildfire Hazard Potential (WHP) pixelated raster dataset, following the procedures described for forest projects located in the USA except for the following modifications:
  - Wetland, agricultural land, grassland, and shrubland projects must use WHP classified data in conjunction with Table 7 (instead of Table 5):

Table 7: Wildfire risk associated with Wildfire Hazard Potential (WHP) classes for wetland, agricultural land, grassland, and shrubland projects located in the USA

WHP CLASSES	ACR WILDFIRE RISK
Very Low	2%
Low	3%
Moderate	4%
High	5%
Very High	6%
Non-burnable	0%
Water	0%

- For wetland projects, Step 3's average wildfre risk weighted by area has no minimum value beyond the limits of the WHP dataset ($\text{Base Wildfire Risk} \geq 0\%$).

  For agricultural land, grassland, and shrubland projects, Step 3's average wildfire risk weighted by area may not equal less than 2% ($\text{Base Wildfire Risk} \geq 2\%$), rather than 4%.
- Steps 4 and 5 are omitted for wetland, agricultural land, grassland, and shrubland projects ($\text{Wildfire Risk} = \text{Base Wildfire Risk}$).

- **Wetland, agricultural land, grassland and shrubland projects located outside of the USA** must estimate wildfire risk using one of the following options:
  - Apply a default value. Wetland projects may apply a default value of 2% ($\text{Wildfire Risk} = 2\%$), and agricultural land, grassland, and shrubland projects may apply a default value of 3% ($\text{Wildfire Risk} = 3\%$).
  - Propose an approach for project-specific estimation of wildfire risk using publicly available data, peer reviewed literature, or other verifiable sources. The principles for risk estimation from the USA approach may be applied. Proposed approaches are subject to verification and ACR approval.

A.5 BIOTIC

- **Forest projects located in the USA** shall determine biotic risk using the National Insect & Disease Risk and Hazard Mapping (NIDRM) pixelated raster dataset.[15] The most recently published version (at the time of verification) which contains composite and agent-specific hazards must be used. The composite hazard shall be used to determine the risk from all

[15] https://www.fs.usda.gov/foresthealth/applied-sciences/mapping-reporting/national-risk-maps.shtml

agents (insects and disease). The following steps (or an equivalent approach producing the same results) are required. Steps 2 and 3 use GIS software:

Step 1 For projects located outside Alaska and Hawaii, download the raster layer named "pct_tbaloss" found in the "L48_composite_hazard.zip" file.[16] Projects located in Alaska or Hawaii may find their "pct_tbaloss" raster layers in the "ak.zip" and "hi.zip" files respectively.

Step 2 Clip the "pct_tbaloss" raster layer to the project area polygon, creating a raster data layer that approximately matches the boundaries of the project area.

Step 3 Using the tabular data from the clipped raster layer, create an average of the percent risk weighted by area (Base Biotic Risk). The VALUE field represents the integer percent live basal area subject to mortality from insects and disease. The COUNT field represents the number of 240-meter pixels, which may be used as a surrogate for area.

Step 4 Projects whose accounting includes standing dead wood are expected to transfer carbon stocks in live trees killed by insects or disease to the standing dead wood pool,[17] thereby reducing reversal risk. Accounting for standing dead wood is assumed to reduce reversal risk by half ($\text{Dead Wood Inclusion Adjustment} = 50\%$). Projects whose carbon pool boundaries exclude standing dead wood do not apply this reduction ($\text{Dead Wood Inclusion Adjustment} = 0$). Regardless of the weighted average, base risk adjusted for dead wood inclusion may not equal less than 4% ($\text{Base Biotic Risk} \times (1 - \text{Dead Wood Inclusion Adjustment}) \geq 4\%$).

Step 5 Projects may reduce their base risk by demonstrating that conditions described by the NIDRM dataset are no longer accurate, and that either mitigation treatments and/or recent biotically-driven mortality (as predicted by the NIDRM) has occured. These risk reductions are combined and then expressed as a percentage of base risk ($\text{Mitigation and Recent Mortality Adjustment}$).

If claiming NIDRM dataset conditions are no longer accurate due to recent mitigation treatments, verifiable records of treatments (occuring since the NIDRM dataset's depiction of conditions) must be provided. Qualifying mitigation treatments must be justified to effectively reduce mortality from a specific agent(s) (threatening the project area according to the NIDRM dataset) by at least one Substantiating Source. Duration of treatment effectiveness must be considered. Justified mitigation treatments reduce risk by 25% ($\text{Mitigation and Recent Mortality Adjustment} = 25\%$).

Projects which have experienced recent biotically-driven mortality (occuring since the NIDRM dataset's depiction of conditions) may reduce risk with verifiable

[16] As of the most recent NIDRM dataset at time of writing, this file can be found in the website section titled "GIS Data for the 2012 National Insect & Disease Risk Map Report", labeled "Composite hazard from all pests".

[17] Hicke, Jeffrey A.; Allen, Craig D.; Desai, Ankur R.; Dietze, Michael C.; Hall, Ronald J.; Hogg, Edward (Ted) H.; Kashian, Daniel M.; Moore, David; Raffa, Kenneth F.; Sturrock, Rona N.; and Vogelmann, James, "Effects of biotic disturbances on forest carbon cycling in the United States and Canada" (2012). USGS Staff -- Published Research. 510

evidence, including NIDRM updates, remote imagery, forest inventory data, or other verifiable sources. Recent mortality must be mapped such that it can be related to NIDRM data. While a pixel by pixel analysis is not required, a verifiable approach that systematically and conservatively reduces risk must be used.

Risk reductions from either mitigation treatments, recent mortality, or both may not exceed 25% ($\text{Mitigation and Recent Mortality Adjustment} \leq 25\%$).

Step 6 Calculate biotic risk to carbon stocks using equation 9:

Equation 8

$$\textbf{Biotic Risk} = [\textbf{Base Biotic Risk} \times (1 - \textbf{Dead Wood Inclusion Adjustment})] \times (1 - \textbf{Mitigation and Recent Mortality Adjustment})$$

- **Forest projects located outside of the USA** must estimate biotic risk using one of the following options:
  - Apply a default value according to Equation 10. This default value (8%) is reduced by half if the project includes the standing dead wood pool ($\text{Dead Wood Inclusion Adjustment} = 50\%$). Projects whose carbon pool boundaries exclude standing dead wood do not apply this reduction ($\text{Dead Wood Inclusion Adjustment} = 0$).

Equation 9

$$\textbf{Biotic Risk} = 8\% \times (1 - \textbf{Dead Wood Inclusion Adjustment})$$

  - Propose an approach for project-specific estimation of biotic risk using publicly available data, peer reviewed literature, or other verifiable sources. The principles for risk estimation and reduction from the USA approach (i.e., verifiable, substantiated, durable) may be applied. Proposed approaches are subject to verification and ACR approval.

A.6 HYDROLOGIC RISK

- **Forest and wetland projects located in the USA** shall determine hydrologic risk using the most recently available version (at the time of verification) of the National Flood Hazard Layer (NFHL) dataset.[18] Flood zone designations[19] must be used in conjunction with Table 8:

Table 8: Hydrologic risk associated with National Flood Hazard Layer (NFHL) flood zones for forest and wetland projects located in the USA

[18] https://www.fema.gov/flood-maps/national-flood-hazard-layer
[19] https://www.fema.gov/glossary/flood-zones

NFHL FLOOD HAZARD ZONES	FLOOD ZONE SUBTYPE	ANNUAL FLOOD PROBABILITY	ACR HYDROLOGIC RISK
All zones starting with A or V (Special Flood Hazard Zones)	–	1%	5%
B, X	0.2 PCT ANNUAL CHANCE FLOOD HAZARD; AREA WITH REDUCED FLOOD RISK DUE TO LEVEE; 1 PCT DEPTH LESS THAN 1 FOOT	0.2%	1%
C, X	AREA OF MINIMAL FLOOD HAZARD	<0.2%	0%

The following steps (or an equivalent approach producing the same results) are required. Steps 2 and 3 use GIS software:

Step 1 Download the geographically applicable NFHL dataset from the Federal Emergency Management Agency (FEMA) Flood Map Service Center.[20] By navigating to "MSC Search All Products" on the left-hand side, selecting the relevant state, and then searching any County and Community, data for the entire state (NFHL Data-State) may be found under Effective Products. Projects spanning multiple states would need to repeat this process. Data is downloaded as a geodatabase (.gdb) within a compressed zip file.

Step 2 Each state's respective geodatabase contains a polygon layer named "S_FLD_HAZ_AR". Clip this layer to the project area polygon. This creates a flood harzard zone polygon layer that matches the boundaries of the project area. If no NFHL data is available for the project area, move to Step 5.

Step 3 Add a non-integer numeric field to the clipped data to calculate geometry for each flood hazard zone in acres.

Step 4 Use Table 8 to assign hydrologic risks to each of the flood hazard zones within the tabular data of the clipped layer. The FLD_ZONE and ZONE_SUBTY fields must both be used to crosswalk with Table 8. Projects which alter hydrology may not be accurately described by the NFHL, and any such areas must be assigned 5% risk.

[20] https://msc.fema.gov/

Step 5 Assign hydrologic risk to any areas where NFHL data is not available. Wetland projects must assume 5% risk for these areas. Forest projects may either assume 5% risk or may demonstrate reduced or no hydrologic risk. Demonstrations may include other FEMA products, remote imagery, digital elevation models, peer-reviewed or public agency publications, and other verifiable sources. While a precise mapping of flood risk is not required, a verifiable approach which systematically and conservatively estimates risk must be used. Table 8's range of values should be used as a guide when estimating risk for areas for which NFHL data is unavailable.

Step 6 Areas that include flood tolerant species (which are included in carbon project stocking) may reduce their risk. To reduce risk, projects must demonstrate both the presence of the species and their flood tolerance.

Species presence must be demonstrated with forest inventory data, remote imagery, or other verifiable sources.

Species flood tolerance must be demonstrated with the most recently available version of the regionally appropriate National Wetland Plant List (NWPL)[21] or another source of similar rigor (subject to verification and ACR approval). If utilizing the NWPL, plants designated as hydrophytes (indicator statuses OBL, FACW, and FAC)[22] are considered flood tolerant. Obligate (OBL) species are eligible for 100% risk reduction, Facultative Wetland (FACW) are eligible for 75% risk reduction, and Facultative (FAC) species are eligible for 50% risk reduction.

Areas which are partially composed of flood tolerant species, or are composed of a mix of species with different NWPL indicator statuses, may prorate the risk reduction based on species contribution to carbon stocking. For example, to reduce risk by 50%, an area's carbon stocks could either be completely composed of Facultative (FAC) species, composed of half Obligate (OBL) and half flood intolerant species (as measured by carbon stocking, not species presence), or composed of some other species mixture with a weighted reduction of 50%.

Areas of similar hydrologic risk (Table 8) and species composition should be considered in aggregate to facilitate risk reduction calculations.

Step 7 Once all areas have been assigned risk and risk reductions have been applied where applicable, create an average weighted by area. This weighted average represents the total hydrologic risk to the project ($Hydrologic\ Risk$) to be used in Equation 1.

- **Forest and wetland projects located outside of the USA** must estimate hydrologic risk using one of the following options:

[21] U.S. Army Corps of Engineers 2020. National Wetland Plant List, version 3.5. https://wetland-plants.sec.usace.army.mil/

[22] Lichvar, R.W, et al. National Wetland Plant List Indicator Rating Definitions. (2012) Wetland Regulatory Assistance Program, U.S. Army Corps of Engineers. ERDC/CRREL TN-12-1. https://www.fws.gov/wetlands/documents/National-Wetland-Plant-List-2016-Wetland-Ratings.pdf

- Apply a default value ($Hydrologic\ Risk$) according to Table 9:

Table 9: Default hydrologic risk for forest and wetland projects located outside of the USA

PROJECT ATTRIBUTES	ACR HYDROLOGIC RISK
Wetland projects	5%
Forest projects whose area consists of ≥60% wetlands	3%
Forest projects whose area consists of <60% wetlands	0%

The values from Table 9 may be reduced by half (50%) by demonstrating that flood tolerant species are present. To reduce risk, projects must demonstrate both the presence of the species and their flood tolerance. Species presence must be demonstrated with forest inventory data, remote imagery, or other verifiable sources. Species flood tolerance must be justified by at least one Substantiating Source.

- Propose an approach for project-specific estimation of hydrologic risk using publicly available data, peer reviewed literature, or other verifiable sources. The principles for risk estimation and reduction from the USA approach (i.e., verifiable, substantiated) may be applied. Proposed approaches are subject to verification and ACR approval.

A.7 OTHER NATURAL DISASTER RISK

- **All projects** must estimate risk from natural disasters not otherwise specified by this tool using one of the following options:
  - Apply a default value of 2% ($Other\ Natural\ Disaster\ Risk = 2\%$).
  - Propose an approach for project-specific estimation of other natural disaster risks using publicly available data, peer reviewed literature, or other verifiable sources. Proposed approaches are subject to verification and ACR approval. If a proposed approach is approved for use, the newly specified risk must be included in the calculation of minimum buffer percentage (equation 1) and total natural disaster risk (if applicable; equation 11), and the project must estimate the risk from other natural disasters using a value of 1% ($Other\ Natural\ Disaster\ Risk = 1\%$).

A.8 CONSERVATION COMMITMENT ADJUSTMENT

Projects with a legally binding conservation commitment are eligible to reduce risk with a conservation commitment adjustment. Conservation commitments can include conservation

easements, covenants, deed restrictions, or other legally binding agreements or mechanisms to maintain the project land cover and associated carbon stocks. An eligible conservation commitment must minimally be in effect through the end of the minimum project term. Projects that provide verifiable evidence of the conservation commitment are eligible for a 2% risk reduction ($\text{Conservation Commitment Adjustment} = -2\%$). Conservation commitments which require annual monitoring by a third-party (outside of carbon project monitoring, reporting and verification) of the carbon stocks quantified by the carbon project may further reduce risk ($\text{Conservation Commitment Adjustment} = -3\%$). The conservation commitment may cover all or parts of the project area. If less than all the project area is covered, this adjustment must be pro-rated by area.

A.9 BUFFER-INSURED AREA ADJUSTMENT

Aggregated and Programmatic Development Approach (PDA) projects utilizing the buffer pool to mitigate unintentional reversals at the cohort or site level (Options 2 and 3 per section 1.6), and whose median cohort or site size is less than 5000 acres, are subject to a buffer-insured area adjustment. Given the small size of the areas insured by the buffer pool (combined with the wider geographic expanse of the total Aggregated/PDA project), these projects are more likely to incur unintentional reversals and thus are more likely to require compensation from the buffer pool. This risk is exacerbated for projects more prone to natural disasters.

To account for these two effects, Equation 11 first evaluates total natural disaster risk, and Equation 12 then calculates the buffer-insured area adjustment. An exponential function is used, as likelihood of incurring unintentional reversals is expected to increase as the insured area decreases. If the Aggregated/PDA project is utilizing the buffer pool to mitigate unintentional reversals at the cohort level (Option 2 per section 1.6), use the median cohort size (in acres) in Equation 12 ($\text{Median Cohort or Site Size}$). If the project is instead mitigating unintentional reversals at the site level (Option 3 per section 1.6), use the median site size (in acres) in Equation 12 ($\text{Median Cohort or Site Size}$).

Equation 10

$$\begin{aligned}\textbf{Total Natural Disaster Risk} \\ &= 100\% \\ &- [\,(1 - \textbf{Wildfire Risk}) \times (1 - \textbf{Biotic Risk}) \times (1 - \textbf{Hydrologic Risk}) \\ &\times (1 - \textbf{Other Natural Disaster Risk})]\end{aligned}$$

Equation 11

$$\textbf{Buffer-Insured Area Adjustment} = \left(0.1\,\hat{}\left[\frac{\textbf{Median Cohort or Site Size}}{5000}\right] - 0.1\right) \times \textbf{Total Natural Disaster Risk}$$

A.10 DIVERSIFIED RISK ADJUSTMENT

Aggregated and Programmatic Development Approach (PDA) projects utilizing the buffer pool to mitigate unintentional reversals at the project level (Option 1 per section 1.6) may be subject to a diversified risk adjustment if they meet the following applicability criteria:

1. The total project area exceeds 10,000 acre; and
2. The number of separate landowners enrolled in the carbon project (and with non-adjacent sites) exceeds 5. Any adjacent sites (even if owned by different landowners) are counted as 1 site when qualifying for this criterion.

Aggregated/PDA projects meeting the applicability criteria must determine diverisifed risk adjustment by referencing Table 10:

Table 10: Diversified risk adjustment for Aggregated/PDA projects by ecoregions, total area, and number of non-adjacent landowners

ECOREGIONS	*TOTAL PROJECT ACRES*	*NUMBER OF NON-ADJACENT LANDOWNERS*	*ACR DIVERSIFIED RISK ADJUSTMENT*
1	10,000 – 19,999	5 – 14	- 1.50%
1	10,000 – 19,999	15+	- 1.75%
1	20,000+	5 – 14	- 2.00%
1	20,000+	15+	- 2.25%
2	10,000 – 19,999	5 – 14	- 2.50%
2	10,000 – 19,999	15+	- 2.75%
2	20,000+	5 – 14	- 3.00%
2	20,000+	15+	- 3.25%
3+	10,000 – 19,999	5 – 14	- 3.50%
3+	10,000 – 19,999	15+	- 3.75%
3+	20,000+	5 – 14	- 4.00%

ECOREGIONS	TOTAL PROJECT ACRES	NUMBER OF NON-ADJACENT LANDOWNERS	ACR DIVERSIFIED RISK ADJUSTMENT
3+	20,000+	15+	- 4.25%

For projects located in the USA, ecoregions are defined at the province-level based on Bailey's ecoregions.[23] For projects located outside of the USA, ecoregions are as defined by One Earth[24] or another ecological mapping system of similar resolution subject to verification and ACR approval. To qualify for use in Table 10, each ecoregion must contain at least 10% of the total carbon stocking (including all quantified pools) of the project.

Any groups of landowners with adjacent sites enrolled in the carbon project are counted as 1 landowner when using Table 10.

[23] https://www.fs.usda.gov/rds/archive/Catalog/RDS-2016-0003
[24] https://www.oneearth.org/bioregions/

PUBLIC COMMENT