AFOGNAK FOREST CARBON PROJECT

NON-PERMANENCE RISK REPORT MONITORING PERIOD: 2015-2017

Document Prepared By: 3GreenTree Ecosystem Services Ltd. and Camco International Group, Inc.

Project Title	Afognak Forest Carbon Project
Version	1.3
Report ID	
Date of Issue	10-Jan-2019
Project ID	872
Monitoring Period	01-January-2015 to 31-December-2017
Prepared By	3GreenTree Ecosystem Services Ltd. and Camco International Group, Inc.
Contact	Mike Vitt #24 – 3871 River Road W. Ladner BC, Canada V4K3N2 mike.vitt@3greentree.com Tel: +1 (206) 307-7096 www.3greentree.com

Table of Contents

1 INTERNAL RISK

1.1 Project Management

a) The project does not involve operational reforestation, and reforestation within the baseline (and relating to previous management) are based on natural regeneration from on-site native tree sources.

b) The project area is managed by the State of Alaska DNR staff along with adjacent state managed forests. No history of illegal activities exist in the region. The remote access and limited infrastructure requirements are clear barriers to illegal encroachment. No supplemental enforcement is required.

c) The project management team at RMEF, Camco, and 3GreenTree hold all necessary experience related to all project activities, including experience developing and managing VCS forest and non-forest carbon projects. Camco, as the Project Proponent Partner and primary project manager, is one of the world's leading carbon project companies, with extensive experience globally across all major carbon standards, for multiple project types. 3GreenTree, as the Project Implementing Partner, is one of the leading forest carbon project developers with experience including creating methodology VM0012, developing multiple VCS forest carbon projects in North America, and extensive forest management and ecosystem modeling expertise. Additional details on key staff can be provided to the audit team upon request.

d) RMEF has an ongoing conservation program in Alaska that is generally proximal to Afognak Island. Camco and 3GreenTree are located within one days travel distance to the project site in Colorado and British Columbia, respectively via frequent commercial airline options. Camco is the primary project manager, and the base for the project is considered their offices near Denver, Colorado.

e) 3GreenTree holds significant experience developing and managing VCS AFOLU projects (further details at: http://3greentree.com/whatwe'vedone.html). Key staff include Mike Vitt BScF, MBA; Clive Welham, PhD., RPBio, and Brad Seely, PhD. (http://3greentree.com/team.html). Camco holds significant experience developing and managing VCS non-AFOLU projects and projects under other carbon standards (further details at: http://www.camcoglobal.com/en/ourexpcarb.html). Key project staff include Charles Purshouse (http://www.camcoglobal.com/en/managementteam.html).

f) Although the Alaska DNR does undertake adaptive management and other planning processes, these are more regional in nature and hence we have not claimed this mitigation factor.

1.2 Financial Viability

The project has achieved breakeven, with sales from previously issued credits exceeding the project costs to date. Therefore the project has selected item d) with a cashflow breakeven point less than 4 years. See tab "Financial Viability" in the Afognak Financial Model file for calculations.

The project has secured all of the necessary funding to cover the total cash required until breakeven, and therefore the project selects risk rating h).

RMEF has available callable financial resources as necessary to support the project to breakeven and beyond, and such has selected the mitigation factor i) (noting that this mitigation factor does not affect the TFV calculation – below zero). Recent publicly available financial statements for RMEF are available here: http://www.rmef.org/NewsandMedia/PressRoom/AboutRMEF/Financials.aspx

1.3 Opportunity Cost

The NPV of the timber harvesting in the baseline scenario is likely between 20% more to 20% less than the returns from carbon in the project scenario, on an operational EBITDA basis and excluding consideration of acquisition capital. This leads to the selection of risk rating "d". The range is dependent on market conditions for logs and comparative VCU market price projections. See tab "Financial Viability"

in the Afognak Financial Model for calculations. Note that due to the mitigation factors selected below, the NPV calculation step is relatively immaterial to the OP category risk rating result.

RMEF is a non-profit conservation organization, so the project has selected risk mitigation rating "g".

The Afognak project area is protected by a legally binding perpetual Federal Conservation Easement over 100 years, so the project has applied the risk mitigation rating "i".

Under this Risk Report Tool, these mitigation selections are immaterial as the entire category cannot be less than zero.

1.4 Project Longevity

The Afognak has a legally binding Federal Conservation Easement that mandates continuation of the project scenario conservation management in perpetuity. The project crediting period is 30 years, however as per Section 2.2.4, Item 5 in the risk rating tool, the presence of a legally binding perpetual (i.e. >100 year) conservation rating assigns the project longevity score of zero.

2 EXTERNAL RISK

2.1 Land Tenure and Resource Access Impacts

The carbon proof of right and right of use are held by ALC and RMEF, while the surface rights are owned by the State of Alaska under a Federal Conservation Easement, which results in a selection of risk rating "b".

There are no known land ownership disputes, as asserted by ALC/RMEF as per title search and insurance processes and government due diligence during the transactions. Given the history of the land transaction (from long held federal land to native corporations in land treaty settlement, to willing sale from native corporation to ALC/RMEF/State of Alaska as fee simple, the likelihood of outstanding land ownership dispute is very low. Therefore the project has selected a risk rating of zero (as per 2.3.1, Item 2 – there are no additional disputes to be added to the risk score), and neither "c)","d)", or e) are applicable.

The Afognak project is protected by a Federal Conservation Easement to continue project scenario management practices in perpetuity (>100 years), therefore the project has applied the risk mitigation "f".

There are no land or tenure disputes related to the Afognak Property, therefore risk mitigation "g" is not applicable.

2.2 Community Engagement

No populations are living on the project area or within 20km of the project area; nor are populations reliant on the property area for subsistence purposes. Therefore this risk rating is not applicable to the project, as per section 2.3.2 in the tool, resulting in selection of zero for all rows.

2.3 Political Risk

Over the last five years of available data (2013-2017), the United States has an average WBI Governance Indicator of 1.24, therefore risk rating e) has been applied.

Governance Indicator	Year	Governance Score (-2.5 to +2.5)
Voice and Accountability	2013	1.1
	2014	1.07
	2015	1.11
	2016	1.11
	2017	1.05
Political Stability	2013	0.64
	2014	0.58
	2015	0.68
	2016	0.4
	2017	0.3
Government Effectiveness	2013	1.52
	2014	1.47
	2015	1.46
	2016	1.48
	2017	1.55
Regulatory Quality	2013	1.27
	2014	1.28
	2015	1.26
	2016	1.5
	2017	1.63
Rule of Law	2013	1.56
	2014	1.61
	2015	1.6
	2016	1.62
	2017	1.64
Control of Corruption	2013	1.31
	2014	1.38
	2015	1.4
	2016	1.37
	2017	1.38

Year:	Average Score
2013	1.23
2014	1.23
2015	1.25
2016	1.25
2017	1.26
5 Yr. Avg:	1.24

Source: http://info.worldbank.org/governance/wgi/index.aspx#reports
Accessed Nov 28, 2018.

The U.S. has an established FSC standard body, hence risk mitigation rating “f” has been applied.

3 NATURAL RISK

3.1 Natural Risk

Fire

Major – There is no fire history for the Afognak project area (the stands are primary forests with no known fire history), however to be conservative, the project has selected a major rating to reflect the potential a fire could impact significant areas of the property if it were to occur. The spatial separation and natural fire breaks created by old logging inside and outside the project area, along with lakes, ocean, other topography, and remote location reduce the risk of extensive fire damage.

Fire history records for the project area show no recorded wildfires since 1930 (see: (http://fire.ak.blm.gov/predsvcs/maps.php and http://fire.ak.blm.gov/content/maps/aicc/Alaska_Fire_History.pdf) There is no evidence of stand or tree level fire damage noted during field reconnaissance nor on any year of aerial photos available for the project area. Plot data average stand age of 190 years (range 152-233 years by plot) is supporting evidence that no fire mortality occurred within that timeframe on those sampled areas.

3.1.1 Significance

Major – There is no fire history for the Afognak project area (the stands are primary forests with no known fire history), however to be conservative, the project has selected a major rating to reflect the potential a fire could impact significant areas of the property if it were to occur due to the remote location and difficulty and cost to deploy significant firefighting resources to the project area. However, the spatial separation and natural fire breaks created by old logging inside and outside the project area, along with lakes, ocean, and other topography reduce the risk of extensive fire damage.

Fire history records for the project area show no recorded wildfires since 1930 (see: (http://fire.ak.blm.gov/predsvcs/maps.php and http://fire.ak.blm.gov/content/maps/aicc/Alaska_Fire_History.pdf) There is no evidence of stand or tree level fire damage noted during field reconnaissance nor on any year of aerial photos available for the project area. Plot data average stand age of 195+ years (range 159-240 years by plot) is supporting evidence that no visual fire mortality occurred within that timeframe on those sampled areas.

3.1.2 Likelihood

Every 100 years or More - The project area is a very wet coastal rainforest ecosystem with fire return intervals in excess of 500 years. Fahnestock and Agee (1983[1]) estimated fire return intervals for similar Sitka Spruce coastal forest types in Western Washington at 1,146 years. Daniels and Gray (2006[2]) estimated fire return intervals for similar hypermaritime forest types in British Columbia at >1,000 years. Berg and Anderson (2006[3]) demonstrated nearby coastal forests on Kenai Penisula, AK to have fire return intervals of 469 yrs, and a time of over 880 years since last fire. Project area forest stand ages from plot data indicate an average of 195+ years old (ranging from 159 to 240 years) for these primary forests, which is further supporting sampled data that stand affecting fires have not occurred on the project area over this time period.

3.1.3 Score (LS)

0

3.1.4 Mitigation

The Alaska DNR has extensive firefighting expertise and capability; however this remote location and lack of other valuable development assets would reduce their response spending. The existing all weather road system would contribute ground based fire capabilities, and mobile fire fighting equipment would conceivably be available from Kodiak and mainland Alaska. We have not applied the mitigation factors because of the remote project location.

3.2 Natural Risk

Pest and disease.

Extensive forest health aerial surveys by the Alaska Division of Forestry have monitored State-wide pest and disease conditions since at least 1999. Reports have been published online since 2002. In particular, the 2010 survey path flew approximately over the project area and noted no observed forest health concerns in the area (http://forestry.alaska.gov/pdfs/insects/FHP20116_2010_FHProtRpt.pdf). No significant pest or disease indicators were observed during field plot installation and re-measurement work for the project or during multiple field verification reviews of the project area, nor from aerial photos available from multiple years within or shortly before the project period. Further, tree age data from the installed plots show average stand ages of 195+ years (range of 159 – 240 years), which is a sampled indicator that significant tree mortality due to pest and disease has not occurred on the project area over this time period.

3.2.1 Significance

Major – Although there is no apparent history of historical pest or disease on the project area, the Afognak forest is a single canopy tree species, and hence there is risk that IF an outbreak was to occur, there could be damage across the forest. We are unaware of an example of a devastating, stand

[1] Fahnestock, G.R., and Agee, J.K. 1983. Biomass consumption and smoke production by prehistoric and modern forest fires in western Washington. J. For. 81: 653-657.

[2] Daniels, L.D. and R.W. Gray. 2006. Disturbance regimes in coastal British Columbia. BC Journal of Ecosystems and Management. 7(2):44–56.

[3] Berg, E.E. and Anderson, S.R. 2006. Fire history of white and Lutz spruce forests on the Kenai Peninsula, Alaska, over the last two millennia as determined from soil charcoal. Forest Ecology and Management 227 (2006) 275-283.

replacing type of outbreak in natural coastal rainforest ecosystems on Afognak, so the risk of devastating outbreak is low or non-existent. To be conservative, the project has rated the potential significance as major.

3.2.2 Likelihood

Every 50-100 Years - The project area is a very robust primary coastal rainforest ecosystem with no evidence of material pest or disease impacts over the 250-300 year history of the forest. However, to be conservative, the project has selected every 50-100 years.

While Sitka spruce is susceptible to several pest and disease agents through its range in the northwestern coastal region of North America, it is clear that the risk of stand-replacing events is much greater in the southern portion of its range (e.g. south of Alaska) (Burns, 1990[4]). Agents that can impact sitka spruce include the following:

- White pine weevil (Pissodes strobe) – significant damaging agent in Oregon, Washington and southern British Columbia. Not a problem in Alaska due to cooler temperatures (Burns, 1990)
- Spruce aphid – mainly a problem for ornamental trees, short-lived epidemics (Burns, 1990)
- Root-collar weevil (Stremnius carinatus) – only causes mortality in seedlings (Burns, 1990).
- Spruce bark beetle (Dendroctonus rufipennis) – periodically damages stands throughout the range (Burns, 1990), but tends to 'thin' stands instead of causing stand replacing mortality. Berg et al (2006[5])) report a mean return interval of 52 years on the Kenai Peninsula (an transitional forest type with high white, black, and hybrid spruce species) and found that it outbreaks generally cause a thinning effect after which residual trees show a positive growth response and generally close canopy within a 5-10 year period.

There is no evidence or record of extensive pest or disease outbreaks in the Afognak forests. The project area is old growth, native forest that would be naturally resilient to most pest and disease. Based on the forest age, it is clear no observable stand changing outbreak has occurred in the past 150-250 years.

To account for the impact of endemic gap disturbance events from natural disturbance agents, the stand-level simulations conducted in FORECAST included the periodic disturbance events for Sitka spruce. These events occurred every 20 years beginning at age 40 and caused mortality of 3% of the live spruce stems distributed evenly across the size profile. This modelled disturbance regime produces a snag population that is consistent with the snag population observed in the field plots.

3.2.3 Score (LS)

1

3.2.4 Mitigation

1.0: The Alaska DNR has extensive experience and expertise in forest health assessments and management, and therefore if an encroaching outbreak was found, management actions could be undertaken to mitigate the risk of extensive damage. However, this remote location and lack of other valuable development assets would reduce their response spending, so we have not applied the mitigation factors because of the remote project location.

3.3 Natural Risk

Extreme Weather

[4] Burns, R. M. (1990). Silvics of North America: 1. Conifers; 2. Hardwoods. Agriculture Handbook 654. Washington, DC: U.S. Department of Agriculture, Forest Service.

[5] Berg, E. E., Henry, J. D., Fastie, C. L., De Volder, A. D., & Matsuoka, S. (2006). Spruce beetle outbreaks on the Kenai Peninsula, Alaska, and Kluane National Park and Reserve, Yukon Territory: Relationship to summer temperatures and regional differences in disturbance regimes. Forest Ecology and Management , 227:219-232.

There are no published or formal records of forest impacts from extreme weather events for the project area. However, ground and aerial observations on the project area along with tree age data from the sampling plots are indicators of minimal levels of stand mortality or impact from extreme weather events.

3.3.1 Significance

Insignificant – There is no evidence of visible or stand replacing weather damage events on the project area. Stand ages are consistently above 160 years. Therefore, we have assumed that extreme weather might impact individual or small groups of trees via blowdown or breakage, the openings of which would be recovered relatively rapidly by the surrounding stand. This single tree 'gap dynamic' disturbance process is a typical stand dynamic for coastal rainforest ecosystems.

3.3.2 Likelihood

Every 50 to 100 Years - Although this area is subject to severe marine weather, and particularly wind, there is no visible evidence of large areas of blowdown or other weather induced damage on the project site. In fact, ground reconnaissance noticed a remarkable lack of material levels of even single tree blowdown, particularly within stands and along old harvest boundaries (as would be expected in this coastal environment - this site had none of the blowdown evidence common to, for example, coastal BC). These forests appear remarkably well adapted to their environment. To be conservative, we have assumed that some type of major wind event might affect the property on a 50-100 year interval.

3.3.3 Score (LS)

0

3.3.4 Mitigation

1.0: No mitigation factor has been applied.

3.4 Natural Risk

Geological Risk

3.4.1 Significance

Minor – The 1964 earthquake was the largest ever recorded in North America (9.2) and the second largest in the world, with an epicenter within 150km of Afognak. This major earthquake, aftershocks and landslides on the mainland unleashed a series of the largest tsunamis ever recorded. Kodiak and Afognak Islands were hit by 6-20m waves (i.e.: www.wcatwc.arh.noaa.gov/web_tsus/19640328/kodiak.gif) which affected manmade structures in Kodiak and various other villages significantly. However, there is no obvious evidence of impact in the forests along the beach on the properties (i.e. old and young trees exist at the high tide line throughout). The terrain is rolling and would be stable landforms, and certainly the current forests have stood for at least 160-250+ years based on current live tree ages. The lack of damage from the very large tsunami shows either the bay was relatively protected on this event and/or that there is enough elevation gain from the shoreline to prevent significant forest damage. It is our assessment that given the magnitude of the events on the record and the lack of material damage to the project area forests, that the risk of an earthquake or tsunami impacting a significant amount of carbon biomass on the properties is low, and under the worst conditions might be related to lower elevation shoreline areas involving a very low proportion of the carbon involved in the project.

Similarly, the 1912 Novarupta eruption blanketed Afognak and Kodiak Islands with over 1 foot of ash, which had detrimental affects on humans and wildlife; however the affects on spruce trees were short-lived, and if anything positive for tree growth and biomass development. Tree ring studies by Eggler (1967)[6] showed spruce on the mainland near Afognak had depressed growth for 2-4 years, followed by an increase in growth for the following decade. Other studies show short term growth can be limited after major ash events, but trees survive and can improve growth in future years. It is our assessment that

[6] Eggler, W.A. 1967. Influence of Volcanic Eruptions on Xylem Growth Patterns. Ecology. 48-644-647.

there is no direct damage threat from volcanoes on the property, and the impacts of major ash events are limited to short term growth inhibition followed by longer term growth enhancement; and such the overall significance to the site carbon balance will be minor (or even positive).

3.4.2 Likelihood

Every 100 years or More - The Afognak properties lie within an active volcanic and tectonic region. There are no active volcanoes or active fault lines on Afognak Island (http://www.avo.alaska.edu/map), however, similar to the west coast of North America there is a major fault line several hundred miles southwest which caused a major earthquake and tsunami in 1964. The property was also subject to significant ash fall from a volcano on mainland Alaska (Novarupta, 161km NW) in 1912, which was the largest global volcanic eruption of the 20th century, and the largest in Alaskan recorded history. No other major events have occurred since white settlement in the late 1700's, and the likely return interval is in the hundreds, if not thousands of years.

3.4.3 Score (LS)

0

3.4.4 Mitigation

1.0: No mitigation factor has been applied.