CLIMATE FORWARD

Reduced Emissions from Megafires Forecast Methodology Version 1.0

Overview Webinar

May 9, 2023

A program of the CLIMATE ACTION RESERVE

Housekeeping

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- All attendees are in listen-only mode
- Questions may be submitted via the Q&A dialog and will be addressed at the end of the meeting
- Zoom technical issues addressed via chat dialog
- We will follow up via email to answer any questions not addressed during the meeting
- The slides and a recording of the presentation will be posted online

Agenda

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Introduction to Climate Action Reserve, Climate Forward, and methodology development team

Overview of Reduced Emissions from Megafires (REM) Forecast Methodology

Q & A

Climate Action Reserve

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Regulatory-quality standard setting and credit generation

Publicly accessible web-based system

Comprehensive protocol development process

Working to ensure integrity, transparency, and financial value in the North American carbon market

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Climate Forward accelerates action on climate change by encouraging investment in projects that mitigate future greenhouse gas emissions

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Climate Forward:
a carbon project registry

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Issues Forecasted Mitigation Units (FMUs) to projects that follow Reserve-approved methodologies

- Follows ISO 14064-2 and GHG Protocol for Project Accounting Standards
- Credits typically issued about one year after project implementation, for the forecasted climate benefit over the project's lifetime
- No long-term, ongoing monitoring, reporting and verification requirements

Expands the scope and scale of carbon project types

- Enormous potential for diverse, creative climate solutions

Tracks FMUs ownership and project activities in a publicly accessible database

- A registry of forward-looking GHG reductions to balance against forward-looking GHG impacts

Accelerating Climate Mitigation: CLIMATE FORWARD

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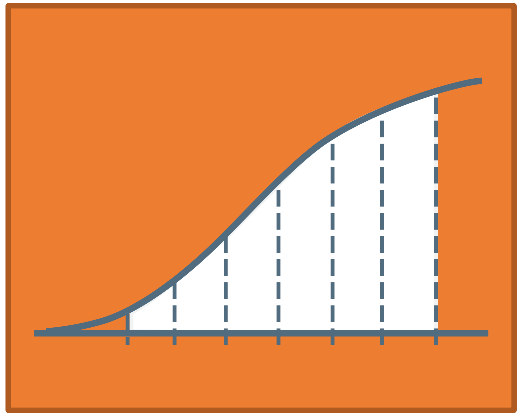
Offsets / CRTs

Climate Reserve Tonnes

1 CRT = 1 tCO_2e of achieved reductions/removals

Ex post



Issued for **achieved** GHG removals

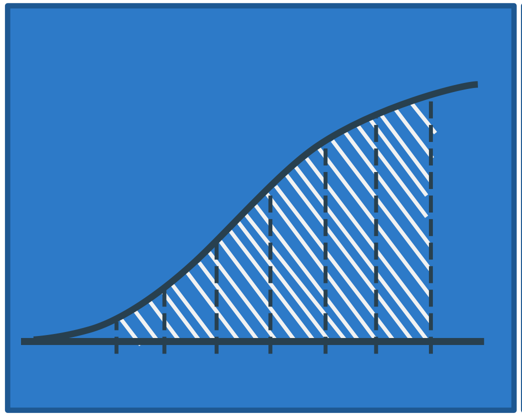
Used to mitigate any emissions

FMUs

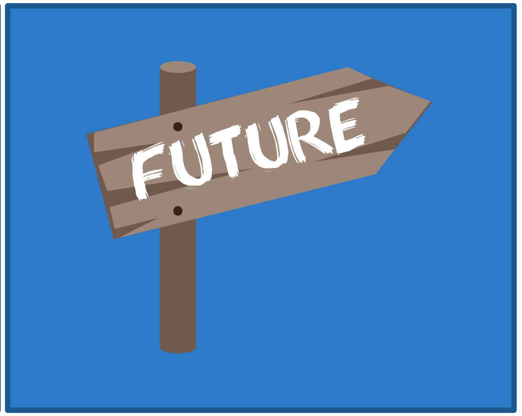
Forecasted Mitigation Units

1 FMU = 1 tCO_2e of anticipated reductions/removals

Ex ante



Issued for **forecasted** GHG removals



Used to mitigate anticipated emissions

tCO_2e = tonne of carbon dioxide equivalent

Introductions

CLIMATE ACTION RESERVE

Spatial Informatics Group

Dogwood Springs Forestry

Coalition for the UPPER SOUTH PLATTE

Carbonomics®

Methodology Development Process

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1. Methodology drafting (began in 2021)
2. Kick-off meeting (Oct ‘21)
3. Work-group formation (end of ‘21)
4. Work-group process, (3 meetings in early ‘22)
5. Public comment period (June – July ‘22)
6. Final methodology approval release (March ‘23)

Work-group process:

- Methodology overview
- Quantification approach
- Eligibility, monitoring and confirmation

Workgroup Members (Organizations)

Blue Forest	Sierra Nevada Conservancy
California Department of Forestry and Fire Protection	Sierra Pacific Industries
Colorado State Forest Service	The Nature Conservancy
FRST	TSS Consultants
Firewise Landscapes Inc / Frontline Wildfire Defense	US Forest Service
HQPlantations Pty Ltd	University of California, Berkeley
Placer County Air Pollution Control District	University of New Mexico
Renew West	

Funding support

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CALIFORNIA DEPARTMENT OF FORESTRY & FIRE PROTECTION CAL FIRE SINCE 1885

Coalition for the UPPER SOUTH PLATTE

anew

coco

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Shoulders we're standing on…

SMUD

Forest Service U.S. Department of Agriculture

Spatial Informatics Group

California Department of Forestry & Fire Protection CAL FIRE Since 1885

Placer County Air Pollution Control District

Coalition for the Upper South Platte

Sierra Pacific Industries Growing Forests For Our Future

Why address wildfire emissions?

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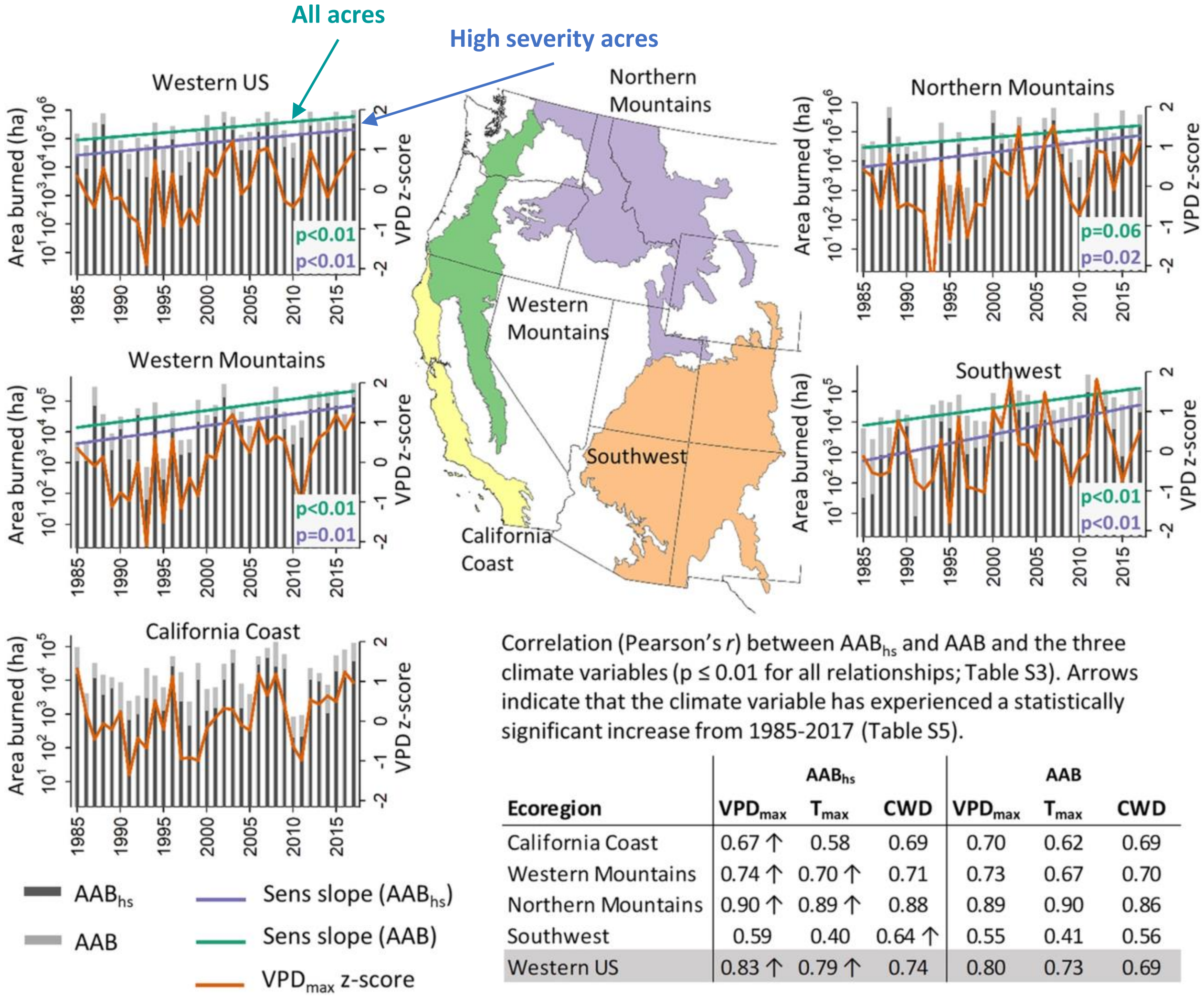
Loyalton Fire, Calpine, CA, August 2020 By Duncan Kennedy: CC-BY-SA-4.0



Correlation (Pearson's *r*) between AAB_{hs} and AAB and the three climate variables ($p \leq 0.01$ for all relationships; Table S3). Arrows indicate that the climate variable has experienced a statistically significant increase from 1985-2017 (Table S5).

	AAB_{hs}			AAB		
Ecoregion	VPD_{max}	T_{max}	CWD	VPD_{max}	T_{max}	CWD
California Coast	0.67 ↑	0.58	0.69	0.70	0.62	0.69
Western Mountains	0.74 ↑	0.70 ↑	0.71	0.73	0.67	0.70
Northern Mountains	0.90 ↑	0.89 ↑	0.88	0.89	0.90	0.86
Southwest	0.59	0.40	0.64 ↑	0.55	0.41	0.56
Western US	0.83 ↑	0.79 ↑	0.74	0.80	0.73	0.69

Parks, S. A., & Abatzoglou, J. T. (2020). Warmer and drier fire seasons contribute to increases in area burned at high severity in western US forests from 1985 to 2017. *Geophysical Research Letters*, *47*(22).

Methodology Overview

Methodology introduction

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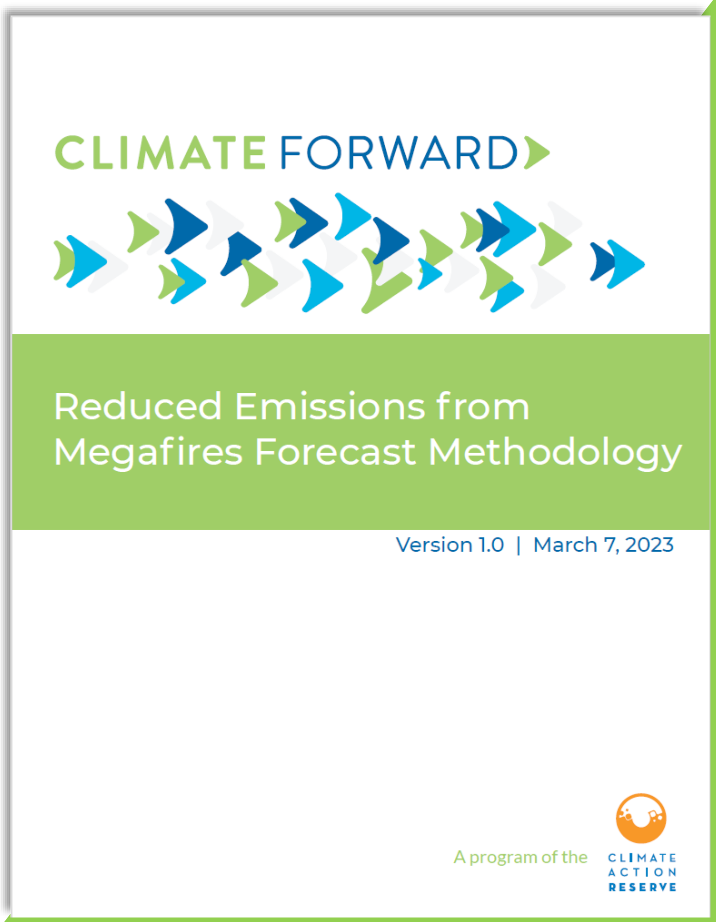
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Reduced Emissions from Megafires Forecast Methodology

Version 1.0 | March 7, 2023

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Accounts for emissions reductions associated with **fuel treatment activities that modify the behavior of wildfires, reducing their severity and extent**

Establishes eligibility rules, methods to calculate expected GHG emissions reductions, and procedures for reporting project information to the Reserve

Provides guidance for **independent confirmation** by a Reserve-approved confirmation body selected by the project proponent

Methodology Components

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Project Definition

Eligibility

- Project Location
- Start Date / Crediting period
- Additionality
  - Performance Standard Test
  - Legal Requirement Test
  - Enhancement Payments
- Environmental/Social Safeguards
- Regulatory compliance
- Ownership & Double-Counting

Project Area Definition

Defining GHG Boundary

Quantification

- Delineating the project area
- Quantifying project emissions reduction
- Programmatic risk deduction

Monitoring / Reporting / Confirmation

- Sampling
- Confirmation field visit

Section 2

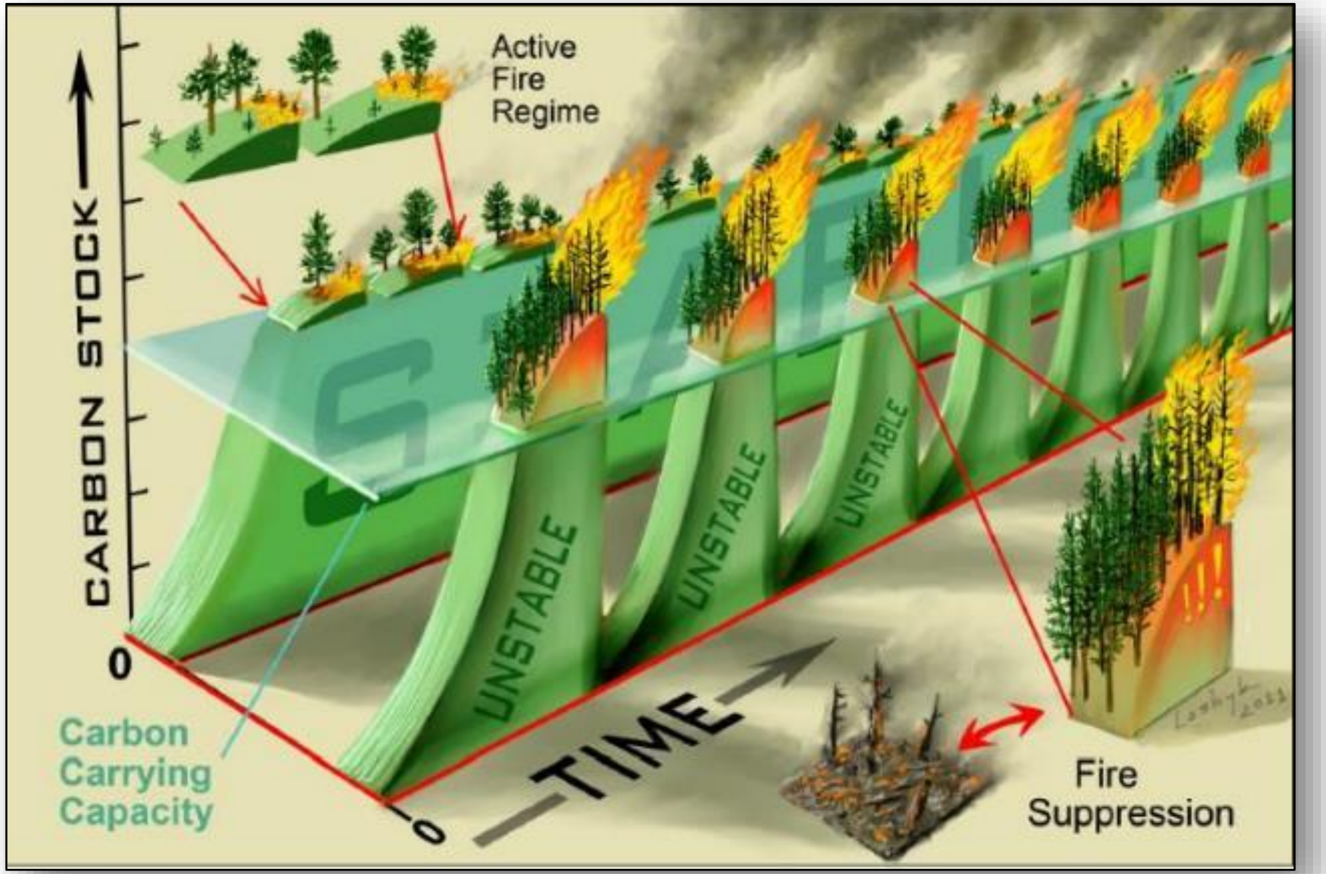
The GHG Reduction Project

2.1 Project Definition and Purpose

Activity or set of activities that result in reduced wildfire emissions from forestlands relative to business-as-usual

Fuel treatments

- Mastication
- Broadcast / prescribed / cultural burns
- Thinning (e.g., thinning from below, crown thinning, selection cut), resulting in:
  - Increased quadratic mean diameter
  - Minimum basal area of 50 ft^2
- Pruning
- Removal of surface fuels



Hurteau 2013

2.2 Project Proponent

Who can register a project and be issued FMUs?

Entity that:

- Has a Climate Forward registry account
- Submits the project to the registry
- Is responsible for reporting and confirmation

Generally is the entity responsible for one or more of the following:

- Organizing
- Planning
- Implementing or overseeing the implementation

Not required to be underlying landowner of treatment areas

- Must have written agreements with landowners whose lands are being treated

Can aggregate treatments across ownerships, including across ownership types

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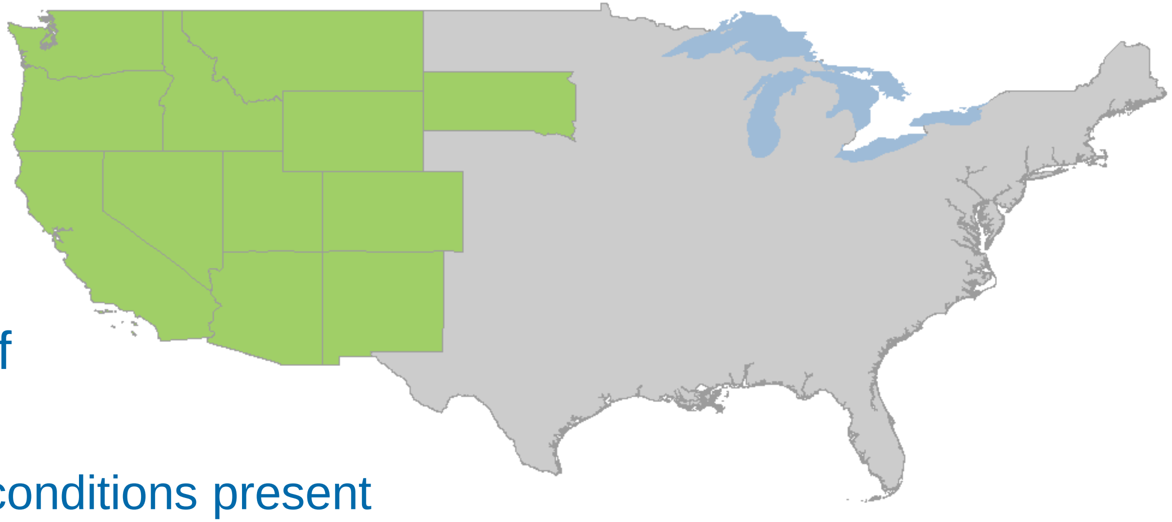
Section 3

Eligibility

3.1 Location

- Western U.S.
- Currently limited based on data availability
- Private or public lands
- May be on locations where prior REM projects took place (subject to quantification of net climate benefits)
  - New REM project on same location uses fuel conditions present at the time it is initiated, including as impacted by previous projects
  - Altered conditions from prior treatments (and other activities/disturbances within the project area) are part of the baseline for new projects
- May be on locations where other C projects exist (e.g., stacked with an IFM project), but need to seek Reserve approval and guidance to prevent double-counting



3.2 Start Date & Crediting Period

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Project start date

- Date that fuel treatment activities are first initiated
- May be up to 12 months prior to release of final methodology (i.e., March 8, 2022)

Project listing deadline

- Submitted for listing within 1 year of the project start date
- If start date is prior to release of the methodology, may be submitted up to 1 year after the methodology release date (i.e., by March 6, 2024)

Crediting period

- Length of time over which forecasted GHG reductions are recognized for crediting
- 40 years

3.3 Additionality

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Projects must yield surplus GHG reductions "additional" to what would have occurred in the absence of the project

Performance standard test

- Given the generally low prevalence of fuel treatments in the Western US and the financial challenges associated with them, project activities are considered additional to the extent they reduce GHG emissions below what would have occurred under the baseline.

Legal requirement test

- Project activities must not be legally required
- Project proponent signs Attestation of Legal Additionality

3.3 Additionality

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Enhancement payment stacking

Submitting a project based on a practice that is also funded by the government or other parties via grants, subsidies, payments, etc., on the same land.

- Examples: California Climate Investment funds, Natural Resources Conservation Service grants
- Would practice have still happened in the absence of carbon project revenues?

Projects are allowed to receiving enhancement payments up to 50% of the cost of fuel treatments

- **If payments received >50%, seek Reserve guidance as soon as possible—may still be allowed**

BUT if payments are based on quantified climate benefits generated ($/tCO2e), then possibly:

- Considered non-additional, or
- Require quantification adjustments

3.4 Environmental & Social Safeguards

Existing laws/regulations provide basic environmental and social safeguards

Project proponents must:

- Report on potential adverse impacts to environmental and social issues, including air and water quality, endangered species, environmental justice.
- Disclose project activities to relevant local resource agencies and fire planning entities, e.g., resource conservation districts, fire safety councils, government agencies
  - Provide fuels management plan for minimum of 5 years from project start date
  - Indicate locations, timing, and types of planned treatments
  - Intent of requirement:
    - Promote aggregation/cooperation among smaller projects and prevent competition to be “first in”
    - Allow projects at scale → benefits of the whole greater than the sum of its parts

3.5 Regulatory Compliance

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- Project must be in compliance with all relevant legal requirements
- Sign an Attestation of Regulatory Compliance
- Provide an assessment of the risk of future non-compliance during the crediting period and identify how such risks will be reduced or mitigated

3.6 Ownership & Double-Counting

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Ownership

- Credits issued to project proponent based on implementation of fuel treatments and their influence on future fire behavior and GHG emissions
  - Direct effects (from impacts on fire behavior within fuel treatment sites)
  - Indirect effects (from impacts on fire behavior flowing from fuel treatments sites onto non-treated sites within the project area, i.e., shadow areas)

Double-counting

- Avoid crediting for same GHG benefits recognized under another project
- Stacking projects may be allowed where no double-counting would occur
  - Example: REM project stacking with an Improved Forest Management (IFM) project
  - REM project must omit harvested wood products C from project accounting since they would also be counted under the IFM project

Section 4

Project Area

4 Project Area

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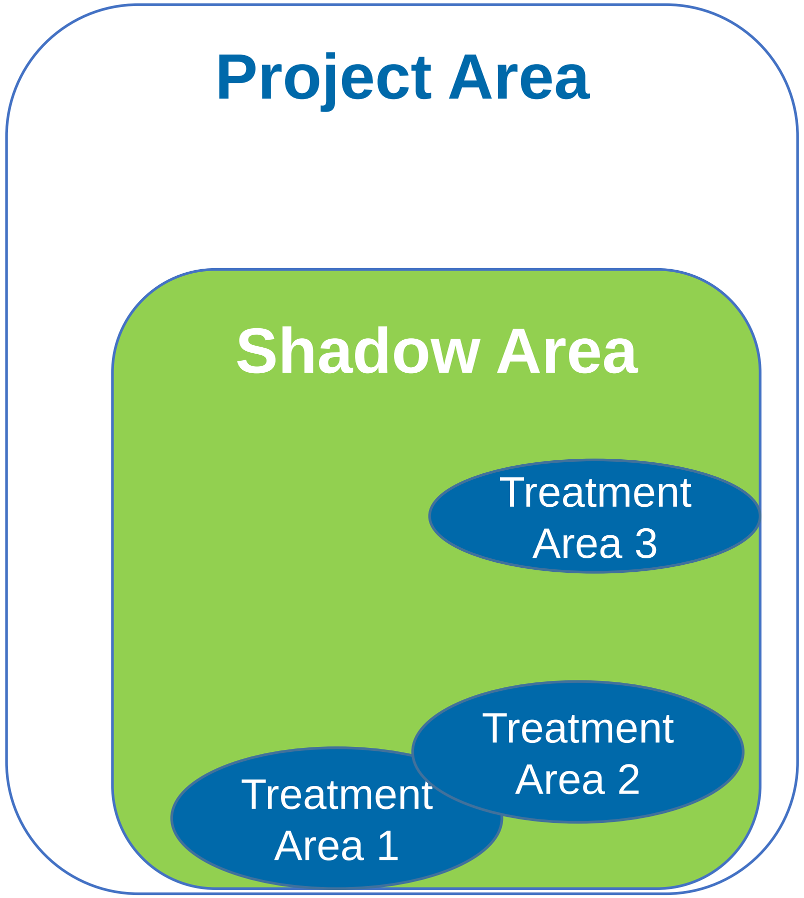
- Consists of:
  - Treatment areas – Locations where fuel treatment activities are performed
  - Non-treatment areas – Locations where fuel treatments are not performed but that have the potential to have fire behavior and severity influenced by activities in treatment areas
- May comprise multiple ownerships/ownership types
- Established by creation of buffer around treatment area(s), based on professional judgement



Section 5

GHG Assessment Boundary

5 GHG Assessment Boundary

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Included pools:

- Standing live and dead trees
- Shrubs and herbaceous understory
- Lying dead wood
- Litter and duff
- Harvested wood products in use and in landfills (as long as not stacked with another project that accounts for it)
- Biomass combustion emissions (from prescribed burns and wildfires)
- Mobile combustion emissions (heavy machinery use for fuel treatments)

Section 6

Quantifying GHG Emission Reductions

Credit Calculation

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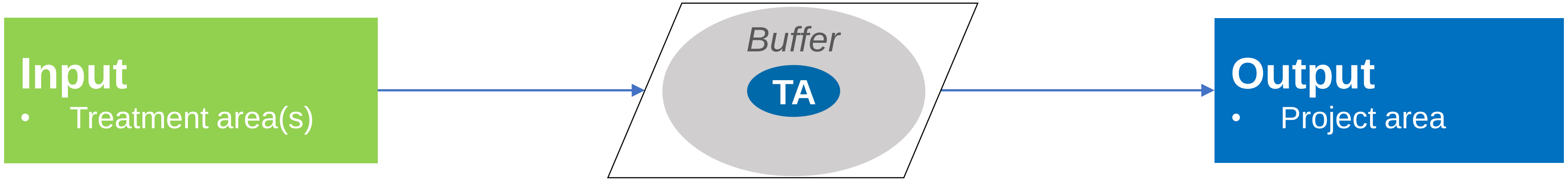
Emissions Reductions =

$$([Emissions_{baseline}] – [Sequestered\ C_{baseline}]) – ([Emissions_{project}] – [Sequestered\ C_{project}])$$

Emissions savings > Diminished C sequestration

Project Area Delineation

Define the project area by drawing a buffer around the Treatment Area(s), encompassing area with the potential for a fire igniting with the project area burning through any portion of the Treatment Area(s) within 8 hours from the time of ignition.



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Model Forest Growth Without Fire

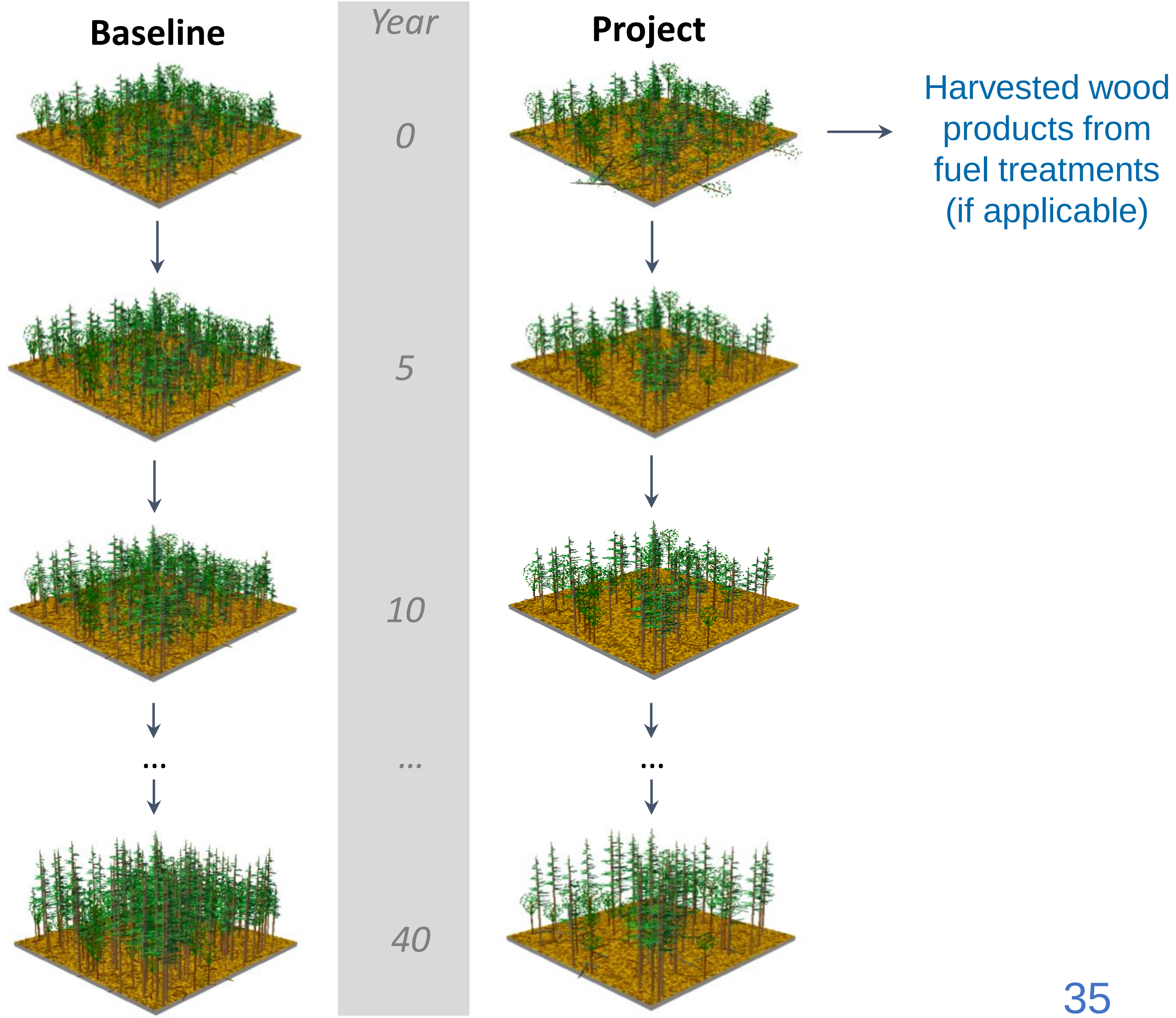
Model changes to tree and surface fuels data for each stand witih FFE-FVS over crediting period for baseline and project, absent wildfires and including backround harvesting to estimate changes in forest C

Input

- Project area
- Tree lists
- Surface fuel models
- Background harvesting
- Fuel treatments
- Regeneration

Output

- Tree lists
- Surface fuel models
- Wood products C



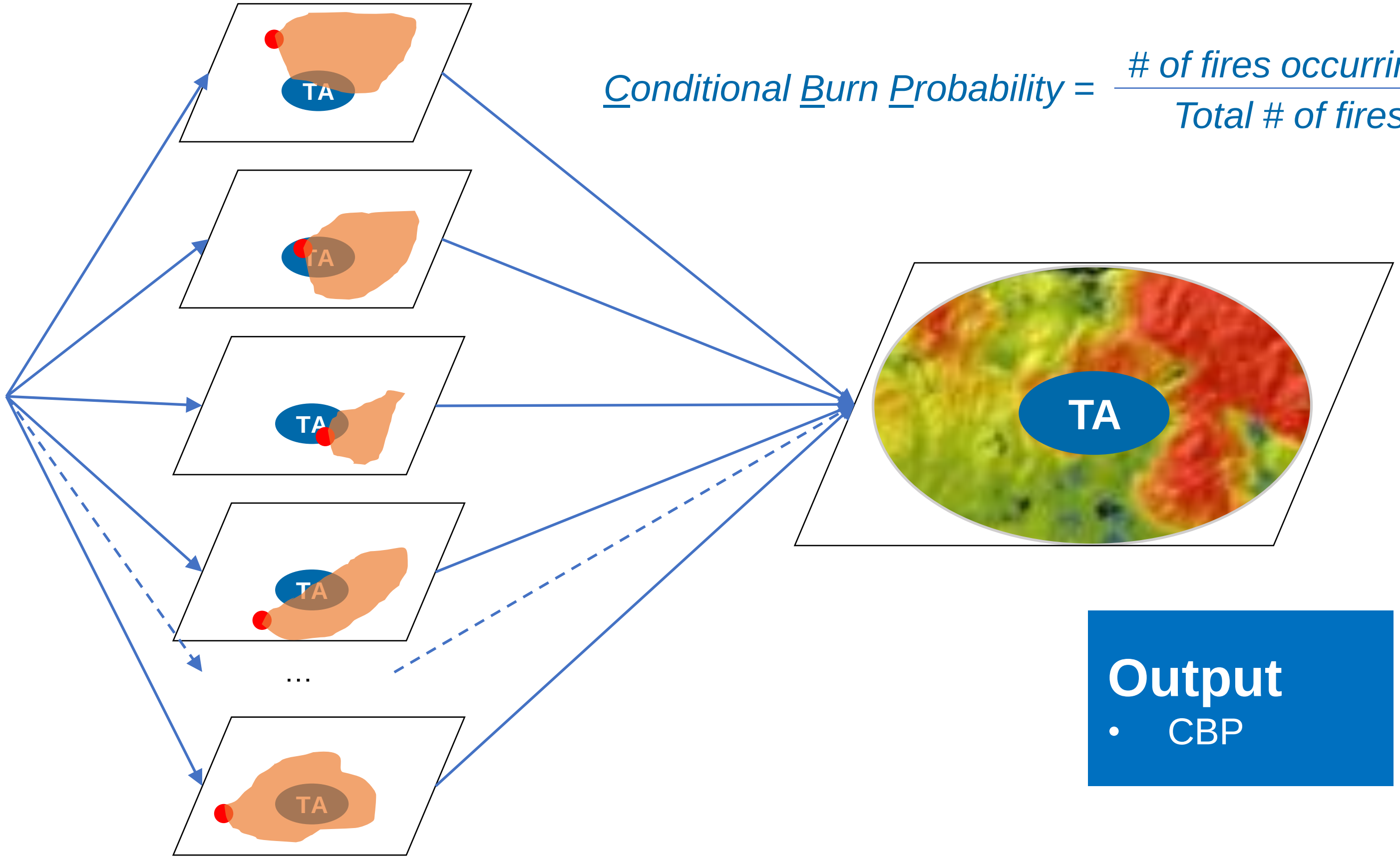
Calculate Conditional Burn Probability

At each time step for the baseline and the project: Model wildfire behavior, to adjust emissions outcomes based on likelihood of individual pixels to burn from a fire starting from each ignition point

Input
- Topography
- Weather (97th %ile)
- Tree lists
- Surface fuel models
- Treatment areas
- Ignition points
- Fixed burn time

Wildfire behavior model

$$\text{Conditional Burn Probability} = \frac{\text{\# of fires occurring on a pixel}}{\text{Total \# of fires modeled}}$$



Output
- CBP

Model Fire Impacts – Emissions, Regen

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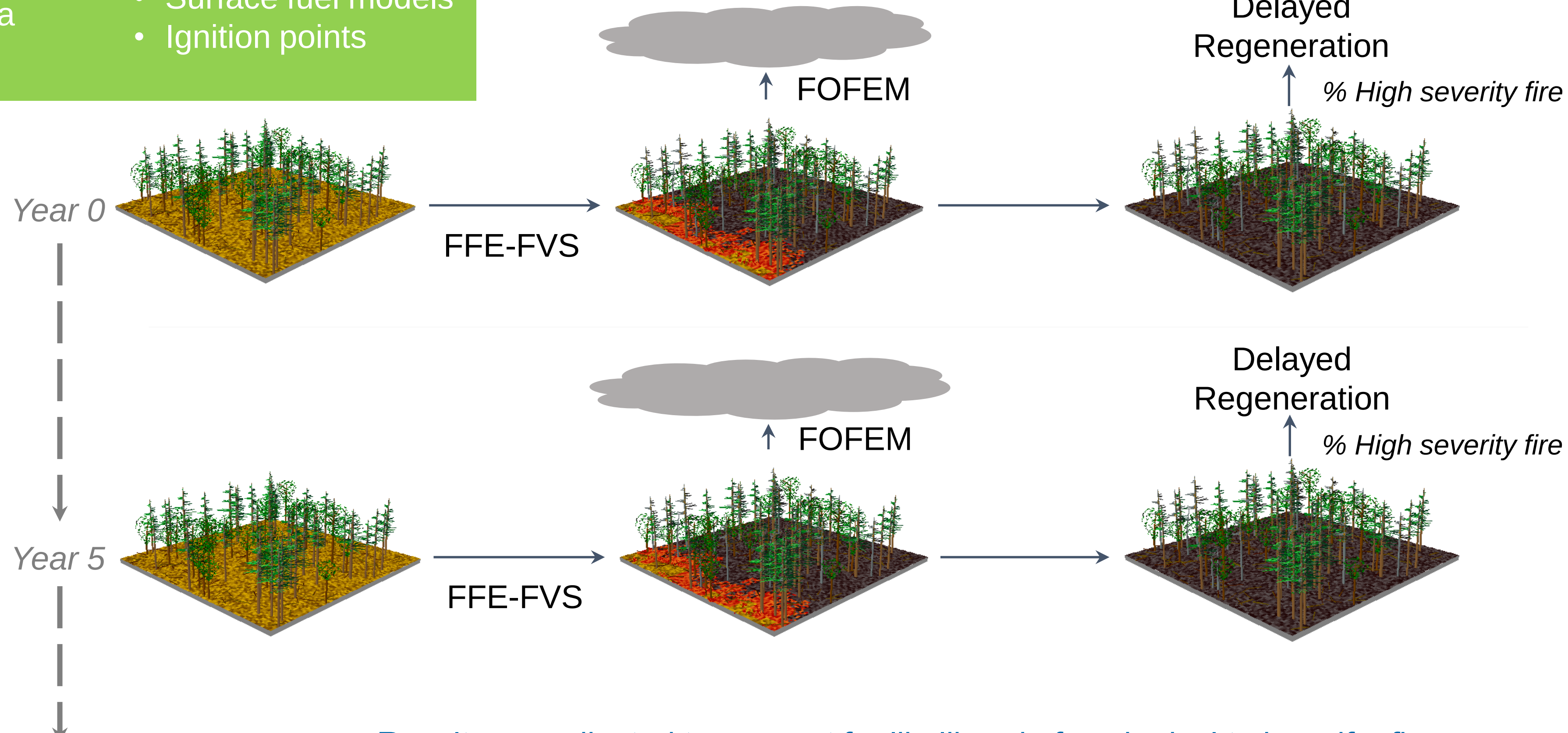
At each time step for the baseline and the project: Estimate GHG emissions from fire and determine resulting stand conditions and delayed regeneration

Input

- Project area
- Tree lists
- Surface fuel models
- Ignition points



Output

- Tree lists
- Surface fuel models
- Wildfire GHG emissions
- Delayed regeneration data

Results are adjusted to account for likelihood of each pixel to burn if a fire occurs…

Adjust for Annual Fire Probability

At each time step for the baseline and the project: Adjust emissions outcomes and delayed regeneration results to account for probability of fire occurring in a given year

Input
- GHG Emissions adjusted by CBP
- Delayed regeneration estimates
- Fire return interval

→ [% Annual Fire Risk] →

Output
- Probable annual emissions
- Probable delayed regeneration

6.1 - 6.7 Quantification

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Accounting steps:

1) Project area delineation
2) **Forest condition modeling**
3) Wildfire behavior modeling
4) Fire emissions modeling
5) **Delayed regeneration**
6) **Fire ignition probability (fire return interval) assessment**
7) FMU Calculation

1) Project area delineation

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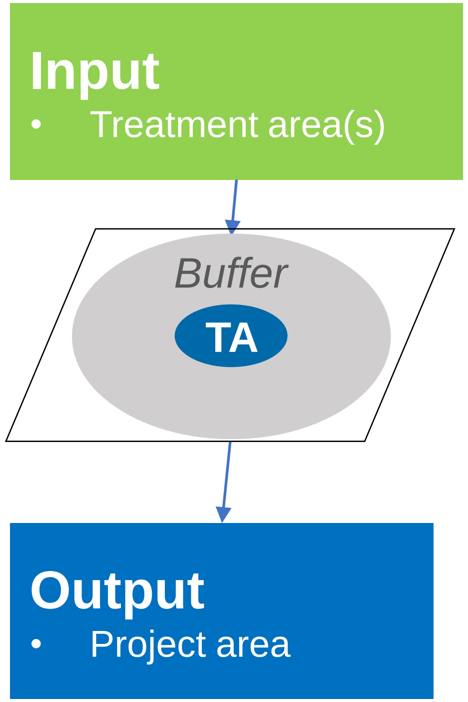
Standardized input

- N/A

Approach

- Sufficient buffer to model realistic wildfire behavior
- Optional: model buffer area based on ignition point map and 8h burn time limit



2) Forest condition modeling – treatments and baseline assumptions

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Standardized input

- Background forest management assumptions

Approach

- Treatment types
- Locations
- Timing

Treatment	Year	Entity	Activity
A	0	Federal	Remove ladder fuels & thin co-dominants
A	1	Private	Prescribed burn
B	1	Federal	Remove ladder fuels & thin co-dominants
B	3	Private	Prescribed burn
C	2	Federal	Prescribed burn
A	2	Federal	Prescribed burn
B	3	State	Prescribed burn

Example: Eve et al. 2014

Table 6-6: Common Silvicultural Options by Most Commonly Managed Forest Type

Region	Forest Type	Generalized Practice
Rocky Mountain North[g]	Ponderosa pine	Plant 400–500 trees per acre, precommercial thin to 200–300 trees per acre, commercial thin to 150–200 trees per acre at age 30–40; clearcut harvest at age 60–80
	Lodgepole pine	Site prepare to expose mineral soil seedbed, natural regeneration by seeding, precommercial thin to 200–400 trees per acre, patch clearcut harvest at age 80–100
Pacific Southwest[h]	Mixed conifer: ponderosa pine, sugar pine, Douglas fir, incense cedar, white fir, Jeffrey pine, and California black oak	Commercial thin: Starting at ages near 40 and continuing at various periodic cycles until regeneration; post-thinning stocking generally ranges between 150–250 ft^2; variable rotation length, depending on objectives
		Commercial thinning with both patch regeneration and reserved areas: Similar to above, but with higher levels of variation in post-thinning stocking levels, small patches of regeneration, primarily to increase pine species, and small areas reserved from harvest, maintaining larger/older trees providing relatively unique wildlife habitats; variable rotation length, depending on objectives
Pacific Northwest, East[i]	Douglas fir/Ponderosa pine – low intensity	Site preparation by site scarification in small spots, natural regeneration, precommercial thin at age 20–25 years to 100–250 trees per acre, patch clearcut or seed-tree harvest at age 50–70
	Douglas fir/Ponderosa pine – medium intensity (on more productive sites)	Mechanical site preparation to scarify soil and remove competing vegetation, plant with improved seedlings at approx. 400–500 per acre, precommercial thin at age 15–20, commercial thin at age 30–40, patch clearcut or seed-tree harvest at age 50–70
Pacific Northwest, West[j]	Douglas fir	Site prepare stand with pre-emergent herbicides, plant with improved seedlings at approx. 450 per acre, commercial thinning as needed at age 20–30, fertilize as needed at age 30–40, clearcut harvest at age 40–50

2) Forest condition modeling – forest growth and yield

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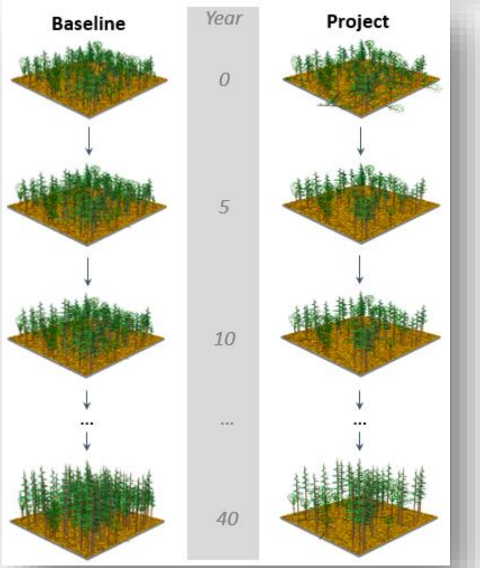
Standardized input:

- Tree inventory (TreeMap)
- Weather data (Two representative RAWS locations, 97th percentile, windspeed, temperature, fuel moisture)
- Surface fuel data
- Topographic data
- Fuel treatment type(s) and schedule
- Regeneration assumptions

Approach

- FVS parametrization using verifiable sources
- FVS simulation runs (year 0 to 40 in 5-year timesteps):
  - Baseline, no wildfire
  - Project, no wildfire

Example: TreeMap USDA



2) Forest condition modeling - Harvested wood products estimate

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Standardized input

- Tree inventory

Approach

- Use harvested wood products output from fuel treatments only from FVS simulation runs
- No consideration of bioenergy or wood product substitution effects

2) Forest condition modeling - Mobile combustion emissions from fuel treatments

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Standardized input

- Fossil fuel emissions by volume of biomass removed

Approach

- Fossil fuel-based emissions from mobile equipment, based on volume of biomass removed by fuel treatments as a part of FVS simulation runs and standardized emissions factor

3) Wildfire behavior modeling

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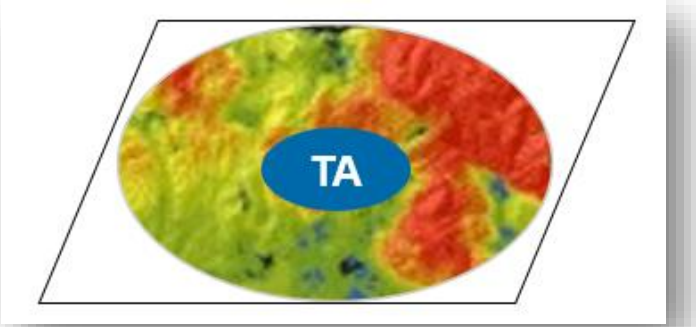
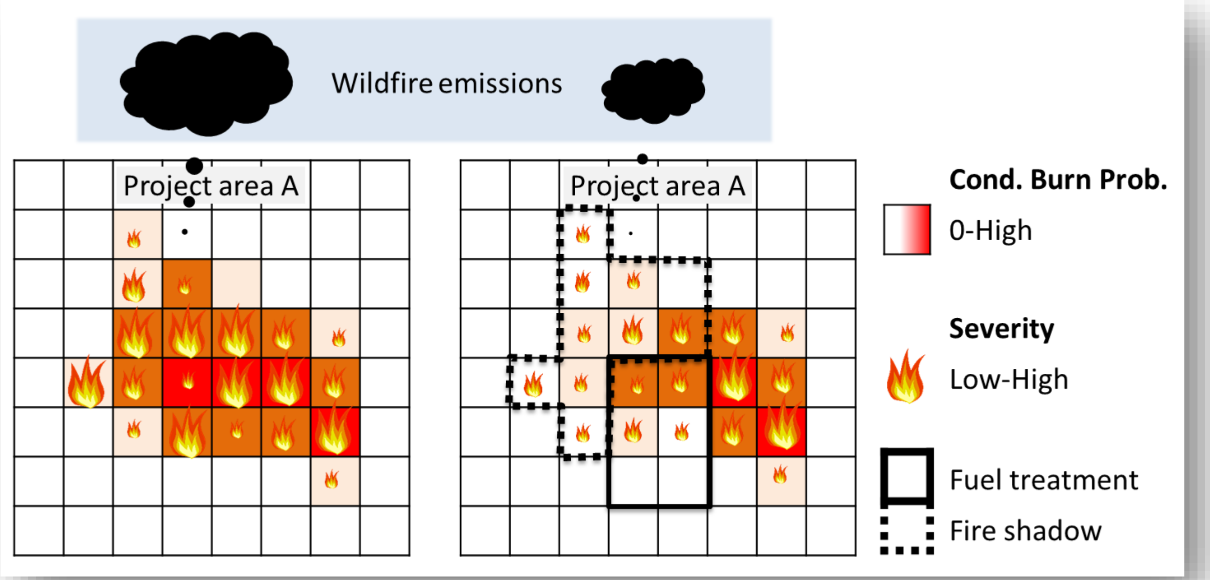
Standardized input

- Approved fire behavior models



Approach

- Fire spread model with 8-hr runs
- Determine Conditional Burn Probability (*CBP*) for each stand in Baseline and Project
- Where CBP_{PR}/CBP_{BSL} ratio <1, multiply wildfire emissions for that stand with *CBP* delta (CBP_{BSL}-CBP_{PR})



4) Fire emissions modeling

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Standardized input

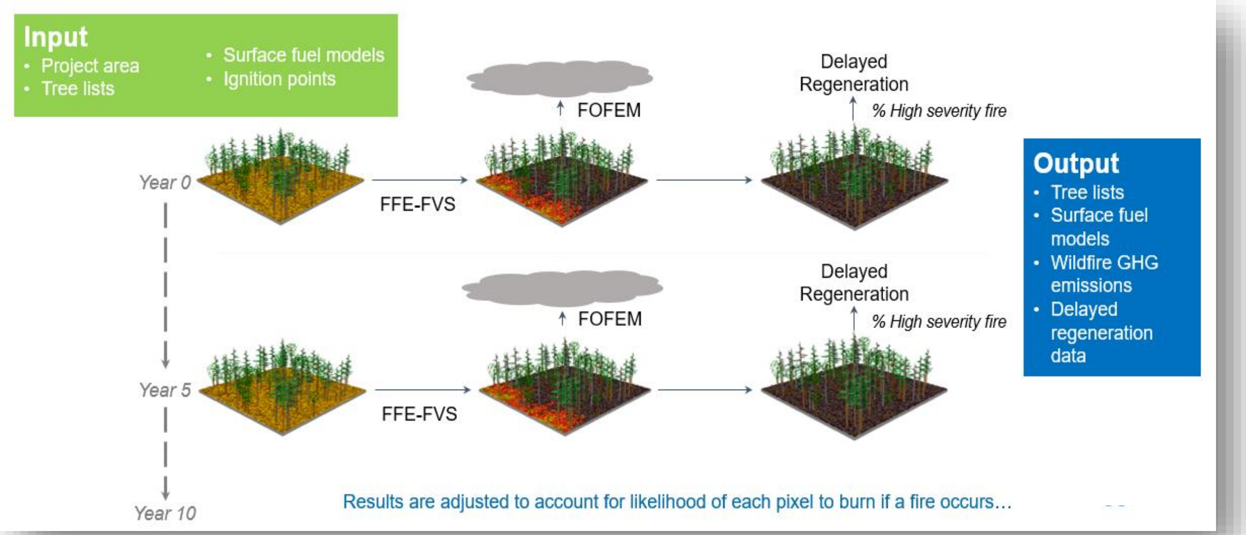
- Surface fuel models

Approach

- FVS-FFE simulation runs (year 0 to 40 in 5-year timesteps):
  - Baseline with periodic wildfire (0, 5, …, 40)
  - Project with periodic wildfire (0, 5, …, 40)
- Crosswalk FVS-FFE into FOFEM for non-CO_2 GHG emissions

Table 6.4. Non-CO_2 GHG emissions GWPs for conversion to CO_2e

GHG	GWP Factor[10]
CH_4	28
CO	1.8
NMVOC	5
N_2O	265
$PM_{2.5}$	9



5) Delayed regeneration calculation

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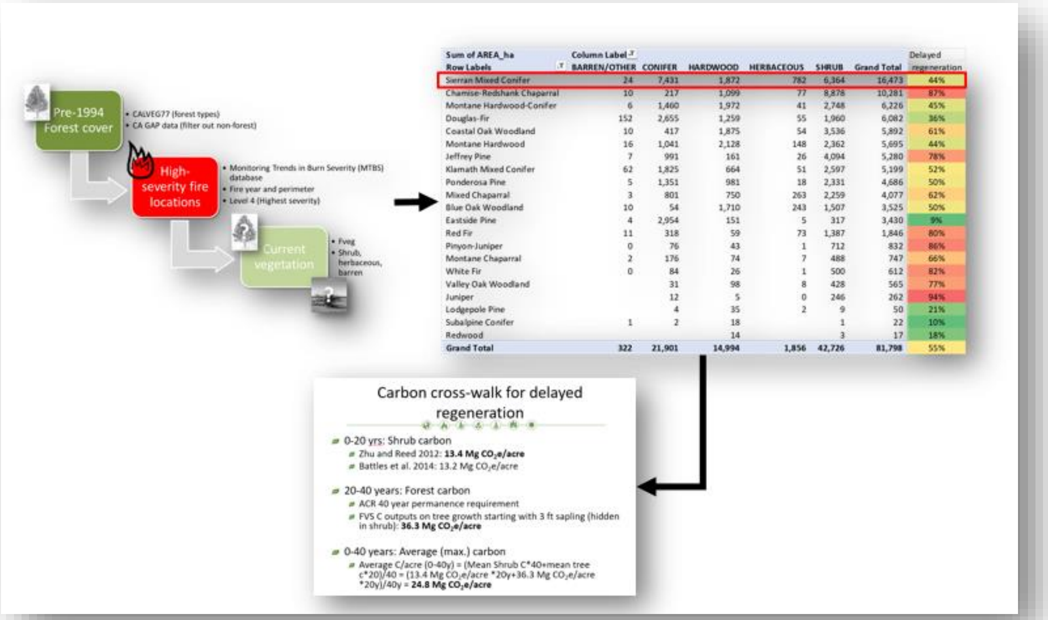
Standardized input

- Percentage of acreage affected by delayed regeneration by forest type and ecoregion ($P_{TC,f}$)
- Carbon in redirected vegetation type (c_{TC})

Approach

- Determine proportion of entire project area where delayed reforestation is likely to occur based on are that burned with flame length >4' for each combination of:
  - Baseline or project
  - Time step
  - Forest type
- Multiply by difference between C stocking of pre-fire stand and C stocking of vegetation type



Sum of AREA_ha / Row Labels	Column Label: BARREN/OTHER	CONIFER	HARDWOOD	HERBACEOUS	SHRUB	Grand Total	Delayed regeneration
Sierran Mixed Conifer	24	7,431	1,872	782	6,364	16,473	44%
Chamise-Redshank Chaparral	10	217	1,099	77	8,878	10,281	87%
Montane Hardwood-Conifer	6	1,460	1,972	41	2,748	6,226	45%
Douglas-Fir	152	2,655	1,259	55	1,960	6,082	36%
Coastal Oak Woodland	10	417	1,875	54	3,536	5,892	61%
Montane Hardwood	16	1,041	2,128	148	2,362	5,695	44%
Jeffrey Pine	7	991	161	26	4,094	5,280	78%
Klamath Mixed Conifer	62	1,825	664	51	2,597	5,199	52%
Ponderosa Pine	5	1,351	981	18	2,331	4,686	50%
Mixed Chaparral	3	801	750	263	2,259	4,077	62%
Blue Oak Woodland	10	54	1,710	243	1,507	3,525	50%
Eastside Pine	4	2,954	151	5	317	3,430	9%
Red Fir	11	318	59	73	1,387	1,846	80%
Pinyon-Juniper	0	76	43	1	712	832	86%
Montane Chaparral	2	176	74	7	488	747	66%
White Fir	0	84	26	1	500	612	82%
Valley Oak Woodland		31	98	8	428	565	77%
Juniper		12	5	0	246	262	94%
Lodgepole Pine		4	35	2	9	50	21%
Subalpine Conifer	1	2	18		1	22	10%
Redwood			14		3	17	18%
Grand Total	322	21,901	14,994	1,856	42,726	81,798	55%

5) Delayed regeneration calculation

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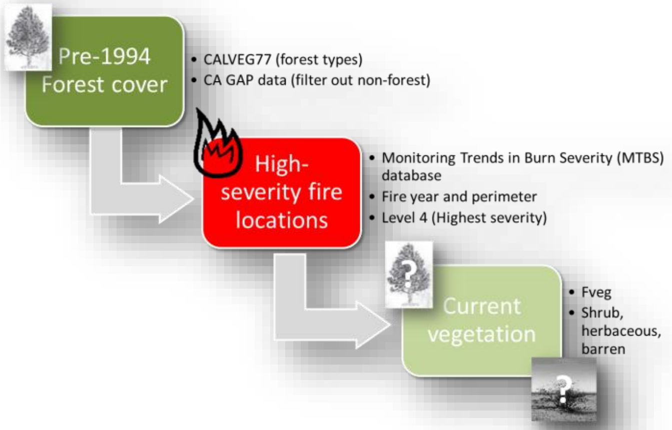

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Montane Hardwood	16	1,041	2,128	148	2,362	5,695	44%
Jeffrey Pine	7	991	161	26	4,094	5,280	78%
Klamath Mixed Conifer	62	1,825	664	51	2,597	5,199	52%
Ponderosa Pine	5	1,351	981	18	2,331	4,686	50%
Mixed Chaparral	3	801	750	263	2,259	4,077	62%
Blue Oak Woodland	10	54	1,710	243	1,507	3,525	50%
Eastside Pine	4	2,954	151	5	317	3,430	9%
Red Fir	11	318	59	73	1,387	1,846	80%
Pinyon-Juniper	0	76	43	1	712	832	86%
Montane Chaparral	2	176	74	7	488	747	66%
White Fir	0	84	26	1	500	612	82%
Valley Oak Woodland		31	98	8	428	565	77%
Juniper		12	5	0	246	262	94%
Lodgepole Pine		4	35	2	9	50	21%
Subalpine Conifer	1	2	18		1	22	10%
Redwood			14		3	17	18%
Grand Total	**322**	**21,901**	**14,994**	**1,856**	**42,726**	**81,798**	55%

Carbon cross-walk for delayed regeneration

- 0-20 yrs: Shrub carbon
  - Zhu and Reed 2012: **13.4 Mg CO_2e/acre**
  - Battles et al. 2014: 13.2 Mg CO_2e/acre
- 20-40 years: Forest carbon
  - ACR 40 year permanence requirement
  - FVS C outputs on tree growth starting with 3 ft sapling (hidden in shrub): **36.3 Mg CO_2e/acre**
- 0-40 years: Average (max.) carbon
  - Average C/acre (0-40y) = (Mean Shrub C*40+mean tree c*20)/40 = (13.4 Mg CO_2e/acre *20y+36.3 Mg CO_2e/acre *20y)/40y = **24.8 Mg CO_2e/acre**

6) Fire ignition probability (fire return interval) assessment

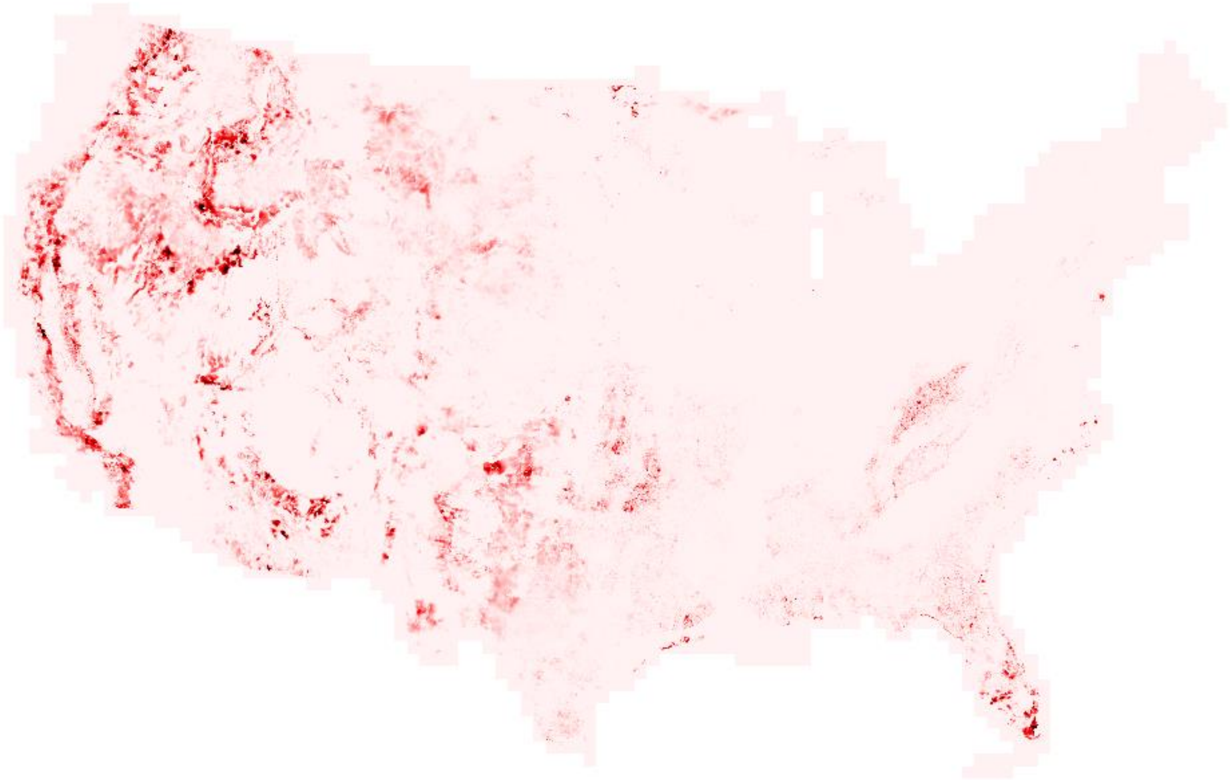
CLIMATE FORWARD

Standardized input

- Fire probability map
  - 1 km resolution
  - Method: Park et al. 2021

Approach

- Calculate mean fire probability for project area



7) FMU Calculation

CLIMATE FORWARD

Standardized input

- REM FMU Calculation Worksheet

Approach

- Insert outputs from previous steps:
  - Forest carbon stocks (baseline and project)
  - CO_2 wildfire emissions (baseline and project)
  - Non-CO_2 wildfire emissions (baseline and project; in CO_2e)
  - Fuel treatment mobile emissions (project only)
  - Wood products (net)
  - Delayed regeneration (baseline and project)
  - Fire probability

Reduced Emissions from Megafires (REM) FMU Calculation Tool

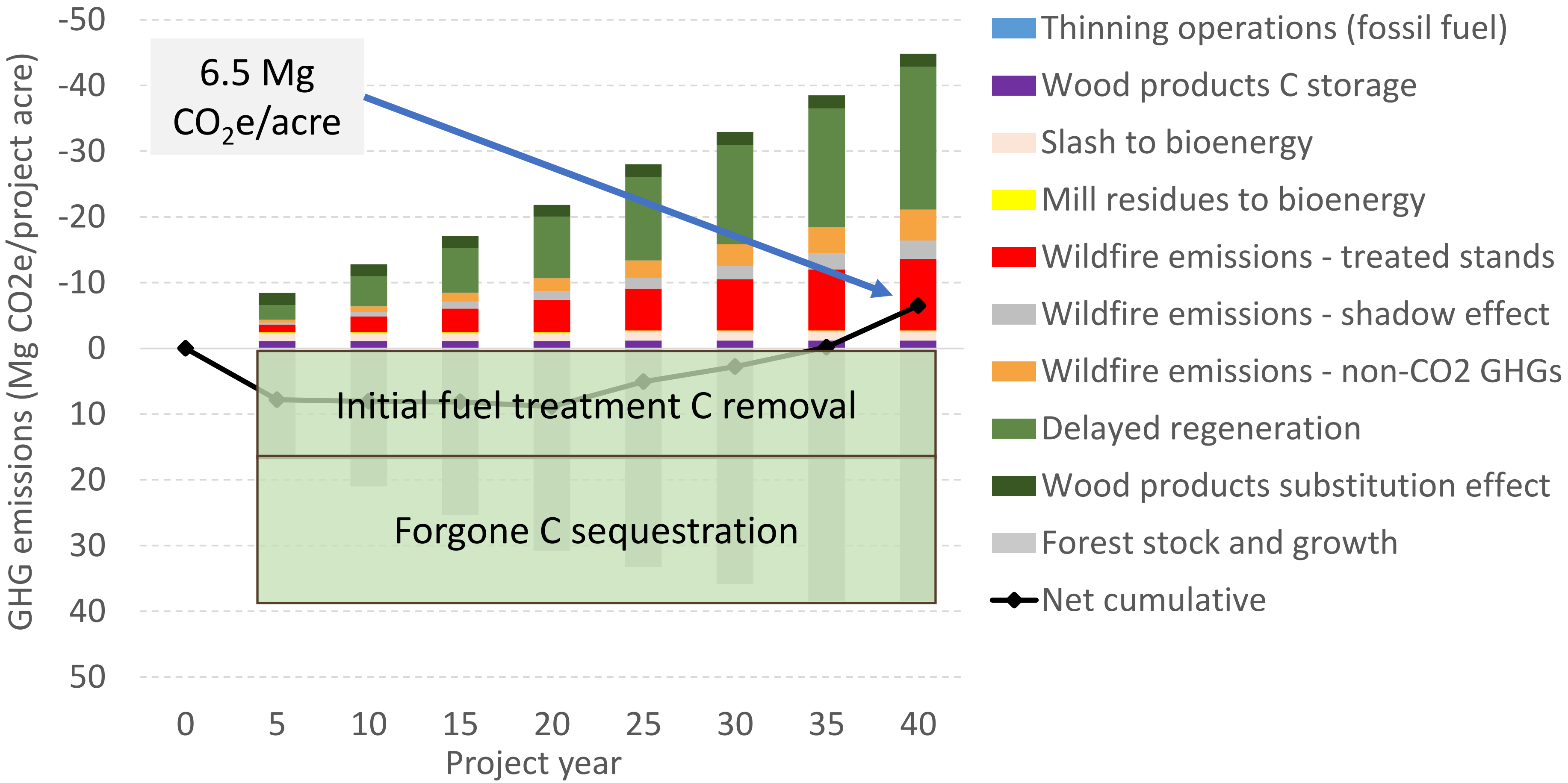
Project Name	
Project Acreage	15,000
Forest Type	Lodgepole Pine
Shrub Region	Western Cordillera
Sapling input	
Fire Probability	

(orange)	Data input by Forest Owner
(purple)	Data calculated automatically

Symbol	0	5	10	15	20	25	30	35	40	Total
Equation 6.1										
Consite, B, i										
Consite, PR, i										
CWP										
Ebsl										
Epr										
Cbsl	0	0	0	0	0	0	0	0	0	
Cpr	0	0	0	0	0	0	0	0	0	
ER										
Equation 6.2										
CO2i										
CH4i										
mb,i										
COi										
PM2.5i										
NMVOCi										
WBSL,i	0	0	0	0	0	0	0	0	0	
Equation 6.3										
CO2i										
CH4i										
mb,i										
COi										
PM2.5i										
NMVOCi										
UWPR,i	0	0	0	0	0	0	0	0	0	
CBP ratio	0	0	0	0	0	0	0	0	0	
WPR,i	0	0	0	0	0	0	0	0	0	
Equation 6.4										
CTC	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	
AHS,f										
PTC,f	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	
PDRbsl	-	-	-	-	-	-	-	-	-	
PDRpr	-	-	-	-	-	-	-	-	-	
CDR	0	0	0	0	0	0	0	0	0	
Equation 6.5										
FRI										
Pfire										
Equation 6.6										
V										
COPS	0	0	0	0	0	0	0	0	0	

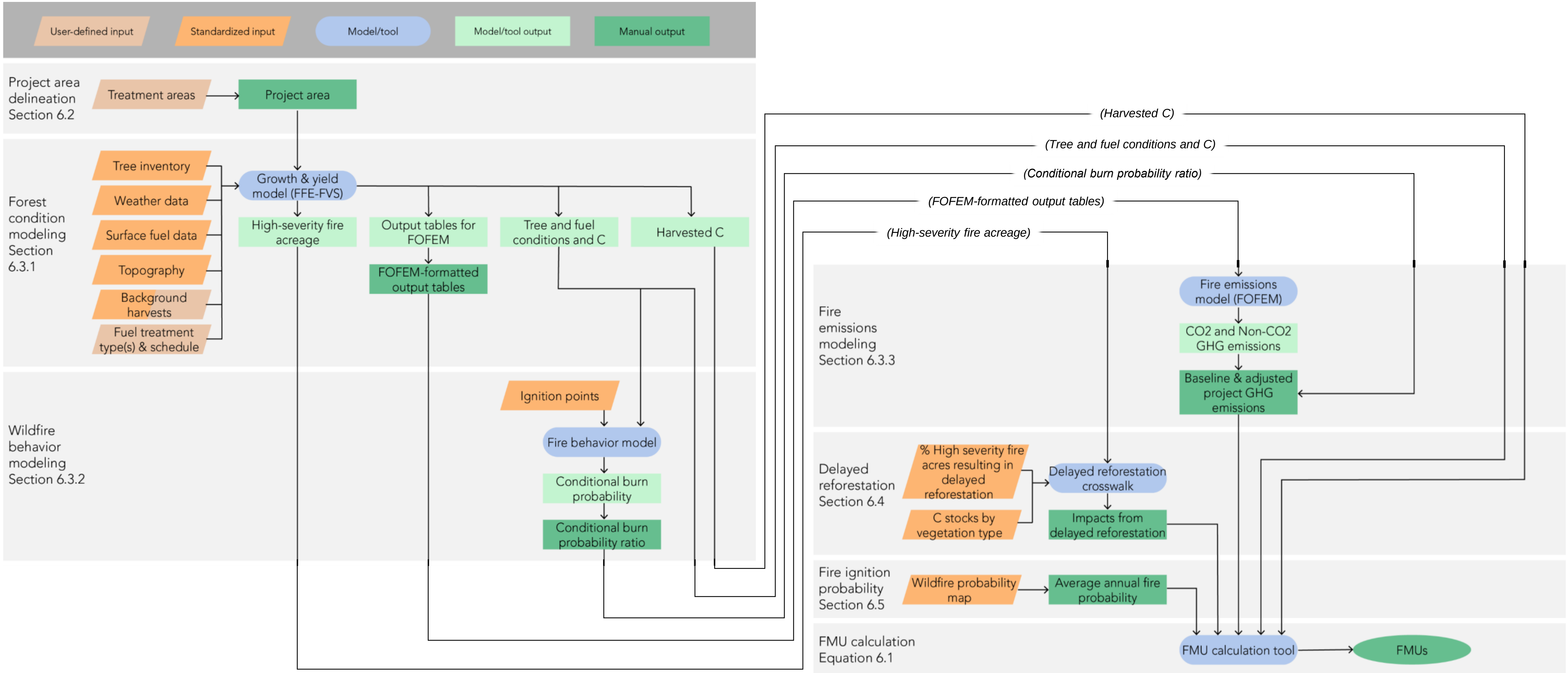
Eldorado case study: Accumulated C fluxes

CLIMATE FORWARD



Overview of Quantification Steps

CLIMATE FORWARD



Standardized data

CLIMATE FORWARD

Tool or dataset	Description	Relevance for the methodology
Topographic data	Topographic data from Landfire	Topographic data is a relevant input in establishing the project area and for fire behavior modeling.
Tree inventory	TreeMap dataset from USFS	TreeMap provides a tree-level model of inventory data for conterminous U.S. forests at a 30m resolution. Data has to be updated to reflect disturbances (harvests, wildfire, fuel treatments, etc.) that occurred between the TreeMap vintage year and the project's starting year.
Surface fuel models	Pre-treatment surface fuel models based on LANDFIRE 2016 from the First Street Foundation	Surface fuel models drive wildfire behavior and emissions and is a key driver for REM results.
Weather	Weather data from RAWS	Weather data (based on ≥10-yr average) is needed simulate stand-level wildfire impacts and wildfire behavior/spread.
Ignition points	Ignition points from USFS Spatial wildfire occurrence data	Historical ignition points are required to model wildfire behavior.
Background forest management assumptions	Assumed forest management activities on all forestlands not undergoing fuel treatments within the entire project area, under both the baseline and the project.	Intent is to provide representative background management conditions throughout the crediting period to capture activities that would alter forest and fuel conditions within the project area whether the project does or does not occur.

Standardized data

CLIMATE FORWARD

Tool or dataset	Description	Relevance for the methodology
Regeneration assumptions	Adjustments and a pulse of regeneration applied at every growth and yield modeling time step, along with a small-tree growth rate multiplier.	Inappropriate default regeneration assumptions in certain FVS variants can distort forest stand conditions as they are projected into the future based on user inputs which may be inconsistent or subjective. Adjustments to applied assumptions may be required to address this shortcoming.
Delayed regeneration data	Delayed regeneration data and assumptions are currently available for California and may be developed for other eligible project areas based on Buchholz *et al.* 2019.	Delayed regeneration data is used to quantify the emissions associated areas projected to be temporarily or permanently converted from forestland to grass or shrubland following high severity fire.
Approved fire behavior models	GridFire FlamMap ElmFire FSim	The wildfire behavior model is used to calculate wildfire spread and the probability of a stand to burn.
Fire probability map	Annual fire probability risk based on Kearns *et al.* 2022	Average annual fire risk within the project area is applied to modeling outcomes to provide probabilistic emissions estimates for FMU quantification.

6.8 Performance Decline

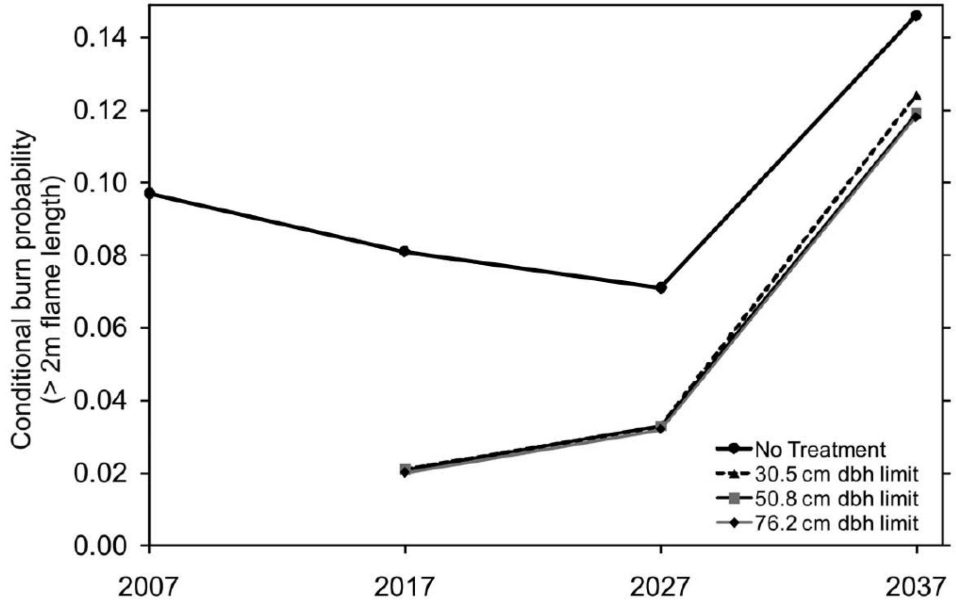
CLIMATE FORWARD

Fuel treatments have limited efficacy periods—accounted for in project modeling

No requirement for ongoing management to achieve forecasted benefits from project activities

10% programmatic ex ante risk discount is applied to all projects to address:

- Goal of crediting on conservative basis
- Uncertainty associated with
    - Estimating future climate benefits from treatments today
    - Probabilistic occurrence of future wildfires



Sections 7 / 8 / 9

Monitoring / Reporting / Confirmation

8.1 Project Submittal Documentation

CLIMATE FORWARD

LISTING:

- Project Submission form
- KML (map) file of treatment areas

CONFIRMATION:

- Signed Attestation of Title form
- Signed Attestation of Legal Additionality form
- Signed Attestation of Regulatory Compliance form
- Project Implementation Report (PIR)
- KML (map) file of project area
- Confirmation Report, and Confirmation Statement
- From Confirmation Body: confirmation plan, sampling plan, and list of findings (not made public)

9 Confirmation

Confirmation process may commence once project is listed and project activities are completed

Desktop review to evaluate PIR and companion documents

- Eligibility requirements
- Modeling and FMU quantification
- Photo plot imagery

Site visit to confirm project activities

- Project area
- Treatment area boundaries
- Post-treatment conditions

7.1.1 Treatment Area Monitoring / 9 Confirmation

CLIMATE FORWARD

Monitoring of treatment areas, before and after treatments, via photo plots to show:

- Data being used by the models—specifically, the post-treatment fuel conditions—are representative of actual conditions on the project site
- QMD has increased following fuel treatments based on thinnings

Plot attribute	Project proponent	Confirmation body
Location	Georeferenced datapoints; plots stratified by treatment type	Confirm location, statistics
# of plots	Based on treatment size	Confirm plot number in accordance with procedures

Imaging	Single north-facing image, both **pre-** and **post-**treatment, providing perspective of fuel conditions in the landscape in the vicinity of the plot.	Confirm:
		• Pre- and post-treatment images corroborate the characterization of treatments performed
		• For randomly selected 20% of plot locations:
		  • Location in the field corresponds to the location visible in the images
		  • Fuel conditions in the field and post-treatment surface fuel models reported for the project match

9 Confirmation

If photo plot review results in a failed assessment, project proponent options are to:

- Perform on-the-ground adjustments to the treatment area(s)
- Adjust data inputs for modeling inputs to reflect post-treatment conditions

Confirmation Body also reviews whether stands where thinnings occur have >50 ft^2 in basal area, either based on professional judgement or conducting random samples.

Additional guidance for confirmation bodies seeking approval to conduct project audits will be provided in a separate training module.

Companion Documents

CLIMATE FORWARD

Additional documents and data for project development and submission, available on methodology webpage:

Data repository

- Standardized data and assumptions for use in project modeling

REM FMU Calculation Worksheet

- Tool facilitating quantification of FMUs from modeling results

Project submittal form

- Fillable form to list project

Project Implementation Report template

- Fillable form that facilitates fulfillment of project reporting

Questions?

Contact Information

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