N-1. Create New Vegetated Open Space

Photo Credit: Doug Donaldson, March 2017

GHG Mitigation Potential

Varies

Variable reduction in GHG emissions from vegetated open spaces

Co-Benefits (icon key on pg. 34)

Climate Resilience

Creating new vegetated open spaces can reduce the urban heat island effect, mitigate flooding, and improve water quality, as well as provide recreational spaces that improve health and community resilience. Vegetated open space can also provide wildlife habitat and corridors for wildlife migration in the face of increasing temperatures and changing precipitation patterns.

Health and Equity Considerations

Prioritize open space creation in communities that have the lowest level of access to parks, gardens, and open spaces.

Measure Description

This measure would convert previously developed areas to vegetated open spaces. By creating new vegetated areas from previously settled land, the project would sequester CO_2 that would not have been captured without the land conversion. Trees and other vegetation also incorporate carbon into their biomass during their growth phase (stored carbon).

Scale of Application

Project/Site and Plan/Community

Implementation Requirements

Implementation must involve conversion of cleared areas to vegetated open spaces. This measure does not give any GHG reduction for the preservation of existing lands.

Cost Considerations

Upfront costs of creating more green spaces will depend on how the land is currently being used and how much construction is required to make it suitable. However, vegetated open spaces can achieve cost savings from improved storm water management, and can also reduce the incidence and cost of heat exposure and pollution-related illnesses.

Expanded Mitigation Options

A best practice for creating new open spaces is to ensure the habitat type(s) are native or will thrive in the local climate.

GHG Reduction Formula

RePlan

Users are directed to the California Strategic Growth Council's (2021) *RePlan: Regional Conservation and Development Planning Tool* (RePlan). RePlan provides an estimate of total stored carbon throughout California. The tool was developed using CARB's Natural and Working Lands (NWL) inventory method. Users can identify total stored carbon across five geographic scales: statewide, ecoregion, county, watershed, and user-drawn polygon for a specific area. Based on the scale selected, RePlan returns the metric tons (equivalent to megagrams, as used by RePlan) of stored carbon per hectare (ha). The carbon storage value is representative of current conditions, per CARB's inventory and the analysis conducted by the Strategic Growth Council. The result is not an annual accumulation value or sequestration rate.

Users converting previously developed areas to vegetated open spaces can use RePlan to obtain estimated total ecosystem carbon storage on parcels within the same general area of the project that contain similar land cover types. RePlan can also be used to estimate existing stored carbon (if any) on the project site that will be converted to the new land cover type. Existing stored carbon on the project site should be subtracted from the estimated carbon storage of the future land use type.

Alternative Quantification Method

RePlan integrates the latest planning and environmental data to support robust quantification of carbon storage throughout the state. The tool is aligned with California's conservation, resource management, and development objectives. While RePlan is recommended as the primary quantification tool for this measure, users may consult the below equation and method to generate a high-level estimate of stored soil carbon plus above and belowground biomass carbon pools, which can serve as an estimate of total CO_2 stored.

$$A = [(B_C \times C_C) + (B_S \times C_S \times D)] \times E$$

GHG Calculation Variables

ID	Variable	Value	Unit	Source
Output				
A	CO_2 benefit from new land cover type (soil and above and belowground carbon storage)	[ ]	MT CO_2e per year (over accumulation period)	calculated
User Inputs				
B_C	Hectare (Ha) of land-by-land cover type	[ ]	ha	user input
B_S	Ha of land by soil type	[ ]	ha	user input
Constants, Assumptions, and Available Defaults				
C_C	Annual above and belowground biomass carbon accumulation by land cover type	Table N-1.1	MT carbon per ha per year	CARB 2021a
C_S	Annual soil carbon accumulation by soil type and land use type	Table N-1.2	MT carbon per ha per year	CARB 2020a

ID	Variable	Value	Unit	Source
D	Soil carbon gain from conversion from settlements to vegetated land	30	%	CARB 2020a
E	Molecular weight ratio of CO_2 to carbon	44/12	MT CO_2 to MT carbon	assumed

Further explanation of key variables:

- (A) – If the existing land use type currently generates CO_2e or includes soil carbon plus above or belowground stored carbon, those emissions should be added or removed, respectively, from the CO_2e reduction quantified under this measure.
- (B_C) – The land cover types are based on those defined in CARB's NWL inventory.
- (B_S) – The soil types and land use types are based on those defined in CARB's *Benefits Calculator Tool for Agricultural Lands Conservation* (CARB 2020a). The soil type for the project area can be obtained from UC Davis' SoilWeb (UC Davis n.d.). CARB's *Agricultural Lands Conservation Easement Quantification Methodology* provides detailed instructions for using this tool (CARB 2020b).
- (C_C) – Average annual above or belowground stored carbon accumulation rates per ha of land cover type and air basin are provided in Table N-1.1 in Appendix C, *Emissions Factors and Data Tables*. These rates include above and belowground carbon storage in biomass pools. They were developed by CARB (2021a) from their NWL inventory. The rates have been annualized over the following accumulation periods.
  - Forest = 60 years. This is the median project duration under the California Climate Investments Forest Health Quantification Method for the California Department of Forestry and Fire Protection's Forest Health Program. The median project duration represents one stand rotation, which is the typical time to harvest (CARB 2021b).
  - Grasslands = 20 years. This represents the typical amount of time for restored grasslands on former agricultural sites to accumulate the same amount of biomass carbon as native grasslands (Matamala et al. 2008).
  - Shrublands = 35 years. This rate represents the average frequency of wildfires in Southern California Chaparral systems (Luo et al. 2007).
- (C_S) – Average annual soil carbon accumulation rates per ha of land use type are provided in Table N-1.2 in Appendix C (CARB 2020a). The rates have been annualized over a 20-year accumulation period, consistent with IPCC's (2006) GHG inventory framework.

GHG Calculation Caps or Maximums

None. If the existing land use cover currently includes stored carbon, and that value exceeds that of the new land cover type, this measure may result in a GHG emissions increase.

Example GHG Reduction Quantification

The user reduces GHG emissions by converting 20 ha of developed area to Broadleaf Forest (B_C) with a Spodosols (B_S) soil type. The project is in the Lake Tahoe Air Basin where the resulting annual average above and belowground biomass carbon accumulation per ha is 1.69 MT (C_C). The annual average carbon stock per ha is 5.89 MT (C_S). The resulting CO_2e reduction is 254 MT per year.

$$A = \left[\left(\mathbf{20\ ha} \times 1.69\ \frac{\text{MT carbon}}{\text{ha}\cdot\text{yr}}\right) + \left(\mathbf{20\ ha} \times 5.89\ \frac{\text{MT carbon}}{\text{ha}\cdot\text{yr}} \times 30\%\right)\right] \times \frac{44}{12}\frac{\text{MT CO}_2}{\text{MT carbon}} = 254\ \frac{\text{MT CO}_2\text{e}}{\text{yr}}$$

Quantified Co-Benefits

None quantified. Depending on the land cover type created, successful implementation of this measure could achieve improved air quality, improved public health, and improved ecosystem health.

Sources

- California Air Resources Board (CARB). 2020a. *Benefits Calculator Tool for Agricultural Lands Conservation.* Available: https://ww2.arb.ca.gov/sites/default/files/classic/cc/capandtrade/auctionproceeds/alc_tool_final_2020.xlsx. Accessed: March 2021.
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- California Air Resources Board (CARB). 2021a. Carbon Accumulation Values for Major Cover Types for Each California Air Basin. Database provided to ICF in March 2021.
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- Matamala, R., J. Jastrow, R. Miller, R. and C. Garten. 2008. *Temporal Changes in C and N Stocks of Restored Prairie: Implications for C Sequestration Strategies*. September. Available: https://doi.org/10.1890/07-1609.1. Accessed: March 2021.
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