2022 Scoping Plan Update

Modeling and Scenario Workshop

NATURAL AND WORKING LANDS

DECEMBER 2, 2021 CARB

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Thanks for another stimulating workshop on NWL The scenarios outline a heterogeneous spectrum of policy options. Within each of the five, there are some policies that will help us to achieve 30 x 30, maximize sequestration, and promote carbon storage in soil and botanicals. There are also some that threaten these objectives. So, instead of selecting one of the scenarios for each kind of land, the greenest policies have been favored while policies that will sequester less are opposed. The numbers 1 through 5 refer to the scenario in which each policy is presently located. Italics indicate my revisions or additions to your scenarios.

It is recommended that each of the 5 scenarios be revised so that the greenest policies are in Scenario 1, the second greenest policies are in Scenario 2, etc.

Conservation is the most effective policy for NWL, but other policies can complement this (1). Some of these measures require collaboration with other agencies or the Legislature (2).

FORESTS

Favored

1 Minimize disturbances, prioritize conservation, and maximize short-term carbon storage..

2 Prioritize restoration and climate resilience

4 Prioritize wildfire reduction only in the UWI, with additional policies that decrease wildfire risk by improving forest health and resilience (*instead of by destroying forests*).

Policies that promote the greatest increase in carbon stocks statewide by 2045.
No clearcuts, no combustion methods for fuels management, increase afforestation, no forest/shrubland land conversion, and use only mechanical means of thinning floor vegetation.

Decrease fire severity only in and near UWI and stabilize carbon stocks by 2045, *but 2030 is preferable*.
Decrease harvesting frequency, 30x30 strategy.

Align regional management with regional plans/reports, where feasible? *Perhaps. This depends on each policy. It is a commendable goal to strive for.*

Decrease wildfire emissions, wildfire around communities, and fire sizes *if they are near UWI.*

Using mechanical means, increase fuel breaks in lands around communities.
Cease use of prescribed fire and thinning. Increase heterogeneous management.
Expand more sustainable harvesting, e.g. with longer rotation intervals.
increase harvesting in ownerships with little commercial harvesting;
Only use anthropogenic organic waste for biomass and biofuel energy. Do not use forest floor detached organic matter or agricultural crops.

Opposed

2 Increase biomass availability for bioenergy.

3 Model mix of strategies from current commitments/plans

4 Increase prescribed fire and thinning, increased heterogeneous harvesting and management, biomass available for advanced bioenergy and wood products. Maximize fire suppression.

5 - Focused on resource utilization

Forests managed passively, I.e., via proforestation, sequester and store more carbon than forests which are actively managed. This is true even for forests that have reached old-growth maturity (3,4,5).

Logs and other woody biomass should be harvested using Forest Stewardship Council guidelines. FSC-managed forests store significantly more carbon than forests that do not meet these guidelines. FSC standards are evolving. An annual increase of the rotation cycle by 1 year is needed to keep up with the increasing momentum of climate change.

BIOMASS INCINERATION

Globally we harvest more trees and fallen biomass than we are planting or growing by deferred logging. In the USA, we harvest twice the amount that is added by new growth each year. Harvesting biomass contributes to this deforestation and decreases the ecosystem services of forests. Incineration of biomass is not carbon neutral (6.7,8,9,10,11,12,13). Incineration of biomass for electricity generation emits a quantity of GHGs (including hazardous co-pollutants) that is up to 50 percent greater than the amount emitted from burning coal. Biomass electricity generation releases 350 percent more GHGs than natural gas (70 - 90 percent methane) (14). The combustion of biofuels, e.g. for transportation, also immediately releases GHG and toxic emissions

and is inefficient compared to ZE battery electric power and renewable electrolytic hydrogen fuel cells.

- *In California, there are about 30 biomass incineration facilities. These are 30 - 40 years old, inefficient, and heavily subsidized. They are not cost-competitive with renewable energy generation. They emit tons of GHGs and toxic air pollutants. They should be shuttered and the land used for conservation or more climate-friendly kinds of buildings.*
- *Burning biomass for generation of electricity and production of biofuels should be banned, as biomass incineration is a source of emissions that can easily be eradicated. There are much cleaner means of electricity generation that are more scalable and economical than biomass.*
- *Use biomass as mulch, compost, and lumber.*
- *Use biomass and non-wood botanicals, HempWood, and PCR for paper. Lifecycle analyses of Biomass Electricity Carbon Capture have not been published. This technology should not be used commercially until independent LCA research proving its efficacy has been published. Depending on the power source for capture equipment, net emissions may increase.*

ECOSYSTEM SERVICES

Ecosystem services of forests include watershed creation, decreased erosion, decreased siltation, decreased flooding, improvement of water quality, carbon sequestration and storage, decrease in many air pollutants, recreation; cooler air, water, and topsoil temperatures; habitat for biodiversity, attenuation of wind velocity (a major factor influencing wildfire damage), exudation of phytoncides which activate our immune cells, phytoremediation (extraction or breakdown of pollutants in soil), and soil enrichment. When combined, these decrease property damage, decrease water treatment costs for municipalities, improve public health, decrease medical costs paid by public programs (e.g., Medicare), and significantly diminish some causes of climate change as well as its effects (15.16.17). The kind of forest that provides the greatest magnitude of ecosystem benefits is old growth (18.19).

Forests significantly decrease atmospheric levels of CO2 and more hazardous GHGs that are emitted from the combustion of fossil fuels.

** nitrogen oxides, e.g., NO2, exacerbate and increase incidence of respiratory disorders, diabetes mellitus, and cardiovascular disorders*

** ozone (O3) near ground level increases respiratory disorders and shortness of breath*

** sulphur oxides (e.g. SO2) decrease longevity and induce wheezing*

** carbon monoxide (CO) causes confusion, shortness of breath, and cognitive impairment*

** particulate matter (especially PM<2.5um) causes congenital disorders, cancer, cardiovascular disorders, respiratory disorders, neurodegenerative disorders, and chronic kidney disease*

Established urban trees were studied for decreasing the 5 asterisked pollutants. Trees significantly decreased premature deaths and medical costs. In 2010 dollars, the economic value thereof totaled $389/hectare/year. The average value for each of the 86 cities studied was $173 million annually (5). (This excluded the economic values of carbon sequestration, less intense heat islands, increased property values, subdued noise pollution and wind damage, and hedonic benefits.) (20,21,22,23,24)

In 2018, worldwide, 8.7 million people suffered premature mortality from particulate matter (PM) dumped into our air by fossil fuel (FF) industry emissions. A 2021 study estimated 10.2 million (25.26). Estimates of the number of annual premature deaths from FF PM in the US range from 335,000 and 355,000. The value of a statistical life in the US is $10,000,000 (27,28). The product of 340,000 people times $10M equals an annual cost of $3.4 trillion. There are about one dozen toxic co-pollutants from FF combustion. Some of these have GHG effects. The above mortality and cost estimates only include effects of FF PM. These estimates also exclude increased morbidity, which is probably many times higher than premature mortality.

The value of carbon sequestration should be calculated using the cost of removing a metric ton of CO2 from the atmosphere by using Direct Air Capture powered by combustion-free renewable electricity. This cost is currently between $250 and $600/MT (29).

There are millions of acres of forest in the US that are more suitable for timber harvest. Old growth forests, worldwide, should be protected from timber harvest, including salvage logging, until the level of carbon in the atmosphere returns to 350 parts per million. The current level is 420 ppm, a record high.

All wood products including lumber, paper, and biomass should be harvested using Forest Stewardship Council guidelines. FSC-managed forests store significantly more carbon than forests that do not meet these guidelines. FSC standards are evolving. An annual increase of the rotation cycle by at least 1 year is needed to keep up with the increasing momentum of climate change (30).

Proforestation is required to maximize ecosystem services of our forests. This minimizes anthropogenic management (31).

WILDFIRE AND MANAGEMENT

This is a controversial topic because some voices call for following traditions that have not been proven cost effective during a period of climate change, other voices favor active management, while other voices support proforestation. The latter relies on natural processes, outside of UWI zones, to auto-regulate fire return intervals. Because it has been proven to be sustainable for thousands of millenia, proforestation is to be relied upon until better research is available (32,33,34,35,36,37). The quality of forest that is least prone to wildfire is unmanaged old growth (38). These have cooler temperatures, a higher moisture content, and are naturally wind-sheltered.

CARBON OFFSETS

This is another controversial topic for which better research is needed. Offset programs should not be used until more definitive research is available (39). The ways in which they are designed and regulated currently may be increasing net emissions, when a lifecycle analysis is conducted to evaluate efficacy (40,41,42,43,44).

Standards to define effective offset programs are needed on a global scope.
Polluters are allowed to emit GHGs in CA and other parts of the US, in exchange for buying offset credits in third world nations where regulations are weak and obscure. A global inventory of tracts of land for which credits have been purchased would help to prevent double dipping.

Offset programs do not decrease toxic emissions, fossil fuel production, or fossil fuel combustion.

The fees to buy offset credits are so low in CA and most other states that it does not curtail emissions. Fees increase the cost of products. Because these are so small, polluters are easily able to raise prices without affecting demand for their "goods".

AGRICULTURE

Favor

1 Maximize soil carbon stocks and perennial biomass carbon.
Maximize climate smart ag practices and nutrient cycling (e.g. via orchard recycling, mulching, or composting) at upper bounds of topography, water, and agronomic constraints for carbon. Only model land conversion away from ag resulting from SGMA.

2 Increase in climate smart practices focused on drought resilience. Increase ag practices and nutrient cycling that increases carbon with an emphasis on the co-benefit of increased drought resilience. Model low level of conversion from ag based on existing conversion rates and SGMA. *Increase organic regenerative agriculture*.

3 Moderate increases in climate smart practices focused on biodiversity.
Increase nutrient cycling. *Use woody biomass for composting only naturally on forest floors. That is, leave detached organic matter where it falls in forests to provide habitat, carbon storage, and nutrient recharging of forest soil. This avoids the emissions of scavenging woody biomass and transporting it to agricultural lands. It also avoids degradation of forest habitat, impoverished soil quality, diminished capacity to form watershed, decreased carbon storage, and ability of forests to maintain cooler temperatures. To decrease risk of wildfire in UWI, use mechanical thinning and chipping of forest floor vegetation (growing and detached) and leave the chips where they fall. Use only non-forest waste for mulch, soil amendments, and composting on agricultural lands.*

4 Increase *organic regenerative* agriculture. *Replace pesticides with Integrated Pest Management (45).*

Oppose

5 Same as BAU

Livestock raising generates more GHG emissions than passenger autos and vans (46) The livestock industry is unsustainable by many criteria and should be gradually replaced with organic, regenerative crop agriculture (47,48,49,50). CAFOs are breeding grounds for the next pandemic. H1N1 originated in a CAFO (51). Campylobacter jejuni from CAFO cattle receives no attention, though it's estimated to infect 1 in 7 people (52). 60% of GHGs from agriculture are from livestock farming (53). The fossil fuel industry is destroying arable land and potable water and more stringent regulations are needed to halt this (54). Enteric methane from cattle has been reduced with 3-NOP and seaweed feed additives. These warrant further research (55) A financial incentive to regulate livestock emissions was just proposed ((56). Methane-devouring bacteria used successfully in CAFO lagoons are worthy of further investigation (57)

SETTLEMENTS

Favor

1. Large increase in urban forests. *Increase urban tree cover where appropriate. Good locations are parks, open spaces, near buildings to provide shade (but not obstruct PV solar), pedestrian-friendly neighborhoods, boulevards with high density traffic, and bordering town squares, parking lots, and courtyards. However, narrow streets bordered by tall buildings obstruct sunlight that may be*

insufficient for tree growth. Trees adjacent to community floral or vegetable gardens may obstruct sunlight.

Protect WUI communities from fire. Establish defensible space where legally feasible. *(See Forest section above Agriculture.)*

2 See 1. above.

Oppose

3 Ensure maximum wildfire defensible space. *This would destroy all forest in CA.*
Moderate increase in urban cover. Establish defensible space where legally feasible. (same as alt 1)
Ensure maximum wildfire defensible space. Moderate increase in urban cover. Establish defensible scientifically recommended defensible space. (same as alt 2)

Favor with the qualifications in 1. above.

4 See 1, above,
Large increase in urban forests. Protect WUI communities from fire.
Increase urban tree cover as much as feasible. Establish defensible space where legally feasible.

5 (same as alt 1)

GRASSLANDS

Oppose

1 Conserve with no land use change.

2 Conserve and restore.Tree encroachment reduction.

3 Conservation consistent with 30x30 and increase practices in line with 1M acre strategy and implementation plan.

4 Conserve and restore. Wildfire risk reduction.

5 Moderate conservation and management

Instead of any one of the above, allow natural tree encroachment. Woodlands and forest provide a greater range and magnitude of recreational and ecosystem benefits than grasslands. There is higher commercial value and demand for lumber than for grass. There is commercial value in using some grasslands as rangeland for cattle. However, in order to solve climate change, a decrease in the raising of livestock is necessary. The livestock industry has the second highest adverse environmental

impact, while the fossil fuel industry is the most destructive. Annual conversion of more grazing lands to crop agriculture is recommended in suitable locations while natural conversion to woodland or forest is recommended for other locations.

WETLANDS

Favor

1 Conserve wetland soil organic carbon and restore wetlands. Increase restoration of riparian, coastal, and delta wetlands.

2 Conserve wetland soil organic carbon and restore wetlands.
Increase restoration of riparian, coastal, and delta wetlands.(same as alt 1)

3 Conserve wetland soil organic carbon and restore wetlands .Increase restoration of riparian, coastal, and delta wetlands. (same as alt 1)

4 Conserve wetland soil organic carbon and restore wetlands. Increase restoration of riparian, coastal, and delta wetlands. (same as alt 1)

Oppose

5 Same as BAU

Wetlands sequester and store CO2, but they also emit CH4 (from decomposition). Research is needed to determine whether there is net sequestration or emission of GHGs.

OTHER, INCLUDING DESERTS

Because land of this kind provides the least ecosystem benefits (including sequestration of CO2), it is most suitable for commercial development (e.g. mining, solar and wind farms, warehouses, trucking hubs, manufacturing, geothermal energy plants). It is suitable for residential development only if there is ample local CA-sourced potable water supply, crop agriculture potential, and at least ten inches of annual precipitation in the counties being considered. Absence of regular rain degrades air quality and increases morbidity and mortality commensurately.

Due to increasing drought conditions, new golf courses should be prohibited on all kinds of developed and undeveloped lands where annual precipitation is less than ten inches.

Favor

1 Allow land conversion, *as noted above.*

2 Consistent conservation with goals/targets from other sectors.

3 Consistent conservation with goals/targets from other sectors.
(same as alt 2)

4 Consistent conservation with goals/targets from other sectors.
(same as alt 2)

Oppose

5 Same as BAU

CONCLUSION

The achievement of annual increases in carbon sequestration and storage from NWL, plus decreases in criteria, toxic, and GHG emissions, will be difficult without addressing the growth rate of population and GDP. Infinite growth of these is unrealistic. As the two grow, there is increased consumption of natural resources, energy. and goods, which drives up emissions. We can have low to modest GDP and population growth only if there is a significant annual decline in *per capita* consumption. To have high growth rates of the two, drastic decreases in annual *per capita* consumption are necessary.

A decreasing standard of living is politically unacceptable to nearly all stakeholders. Thus, the least onerous path is to set sustainable annual targets for population and GDP (58). In keeping with the precautionary principle of climate change, a maximum target growth rate is 1% annually. If emissions targets are not met, the rates should be decreased to zero. Carbon bombs produced in first world nations have a higher environmental impact than those from second and third world nations. It is our responsibility to model climate-friendly policies that other nations may emulate.

It is more economical to conserve NWL to prevent pandemics, rather than continuing BAU and incurring the costs of treating pandemics (59). Please factor this into your cost : benefit studies.

CO2 levels are forecast to continue rising until there is significant decarbonization of our global economy. The precautionary principle espoused by climate scientists calls for maximizing all proven anthropogenic changes that decrease and sequester GHG emissions. Due to climate lag, successful decarbonization and GHG emissions reductions will need to continue for 38 years before the atmosphere will begin to cool. Ocean cooling will take significantly longer.

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