

Why we need to include assessment of Eco-System Services in the SEPA Process

Many wetlands, forests, and other lands have been classified as "non-significant" under the State Environmental policy Act (SEPA), due to the property not meeting criteria such as the presence of endangered species. This has often been enough to allow the land to be developed. When viewed through the lens of climate change, however, much of this land becomes **very** significant. Therefore, it may be appropriate to revise the SEPA process of determining significance to include essential environmental services.

As you're aware, there are two primary forces propelling the impending climate crisis: increasing levels of human-caused emissions of greenhouse gases, especially CO₂, and the destruction of photosynthetic, carbon-sequestering ecosystems. Reducing greenhouse gas emissions is half the battle. Protecting and enhancing carbon-sequestration is the other half. Successfully meeting the challenge of climate change will require coordination and progress on both fronts.

So far, the current SEPA review seems to be focusing almost entirely on reducing emissions of greenhouse gases. While this is very important, it does not address the need to defend forests, meadows, etc. against "development" as a means of protecting our climate.

Ecosystem services of these threatened lands are significant and valuable. They should not be destroyed for narrow, economic reasons. These services include:

- Flood control
- Oxygen production
- Carbon sequestration

We all depend upon these environmental services, but often act as if they're infinite. Valuation of carbon sequestration, oxygen production, and other services as part of the SEPA process will provide a more effective tool that will be useful in development application decisions.

I recommend that the SEPA Threshold Determination of Significance process be amended to include consideration of the environmental services provided by the lands under consideration for development. The values of some of these services have been calculated by environmental economists. My attempt to plug in numbers for the value of intact ecosystems follows in the charts below.

Carbon Sequestration

According to the Greenhouse Gas Emissions calculator at: http://www.epa.gov/climatechange/emissions/ind_calculator.html, a car that gets 25 miles per gallon, and is driven 12,000 miles per year generates 9,802 pounds of carbon dioxide. That's 2,676 pounds of **carbon** per year.¹ One average acre of temperate evergreen forest sequesters this amount of carbon in 6.4 months (that's 6 months and 12 days).

Table 1: Mean annual carbon sequestration values of one average acre of various ecosystems

Temperate evergreen forest	2272 Kg (4998 lbs)
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Temperate deciduous forest	2191 Kg (4820 lbs)
Shrublands	1095 Kg (2,410 lbs)
Temperate grassland	913 Kg (2, 008 lbs)
Cultivated (agricultural) land	1176 kg (2588 lbs)
Swamp / marsh / wetland	4584 kg (10,085 lbs)

Estimates of the value of carbon emissions allowances range from \$15 per ton (Council of Economic Advisers) to \$348 per ton (Energy Information Administration). Based on early market signals, Environmental Financial Products is using market values between \$20 and \$30 per ton of carbon. ² According to the Natural Resources Defense Council (NRDC), the market value/cost of sequestering one ton of carbon is \$100. ³

Table 2: Mean annual carbon sequestration values of one average acre of various ecosystems based on the NRDC evaluation of \$100/ton

Temperate evergreen forest	\$ 249.90
Temperate deciduous forest	\$ 241.00
Shrublands	\$ 120.50
Temperate grassland	\$ 100.40
Cultivated (agricultural) land	\$ 129.40
Swamp / marsh / wetland	\$ 504.25

Oxygen Generation

Table 3: Mean annual O₂ generation of various Washington State ecosystems per acre

Temperate evergreen forest	6059 kg/yr	13, 329 lbs/yr
Temperate deciduous forest	5, 843	12, 854
Shrublands	2920	6, 427

Temperate grassland	2435	5, 356
Agricultural cultivated land	3136	6,901
Swamp/marsh	12,224	26,893

Table 4: Quantity of human adult annual oxygen requirements (the amount of oxygen needed by an adult human being for one year) generated per acre by various ecosystems

Temperate evergreen forest	7.5
Temperate deciduous forest	7.2
Shrublands	3.6
Temperate grassland	3.0
Agricultural cultivated land	3.9
Swamp/marsh	15.1

Table 5: Current monetary value of the net oxygen generated per acre by various ecosystems ⁴

Temperate evergreen forest	\$ 311, 220.00
Temperate deciduous forest	\$ 298, 771.20
Shrublands	\$ 149, 385.60
Temperate grassland	\$ 124, 488.00
Agricultural cultivated land	\$ 161, 834.40
Swamp/marsh	\$ 626, 589.60

The calculations this information is based upon are available on request.
Thank you for your efforts to improve SEPA.

Sincerely,

Dave Zink

Notes:

1. Carbon has an atomic weight of 12, oxygen 16. Therefore, CO₂ has an atomic weight of 44. Carbon is 12/44 or 27.3% of the weight of CO₂. $9,802 \times .273 = 2,676$ pounds of **carbon** per year.
2. Creating a Market for Carbon Emissions Opportunities for U.S. Farmers, by Richard L. Sandor and Jerry R. Skees, published in *Choices Magazine*, American Agricultural Economics Association, First Quarter 1999
3. <http://agoffsets.blogspot.com/2008/01/ag-needs-to-weigh-in-on-offsets-vs.html>
4. Aaro Medical Supply, a major medical; supply company in Olympia, WA, charges \$19 for a 4-hour supply tank of oxygen. Six are needed for one 24-hour supply. $6 \times \$19 \times 364 = \$41,496$ annually.

For background information, see:

Terrestrial Ecosystems, 2nd edition. Aber, John, and Melillo, Jerry. Academic Press, London, 2001.

Cohen and Tilman 1996, quoted in *Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems*, by Daily, Alexander, et al:

<http://www.ecology.org/biod/value/EcosystemServices.html>

<http://www.sciencedaily.com/releases/2007/05/070511100918.htm>

<http://www.independent.co.uk/environment/climate-change/deforestation-the-hidden-cause-of-global-warming-448734.html>

http://en.wikipedia.org/wiki/Natural_capital