Submitted: June 3, 2019

Email Message Subject: Stream Protection -- SW Oregon Rivers

Dear Members of the Board of Forestry;

As you decide whether or not to develop new water protection rules to meet the "Protecting Coldwater Criterion" in the Siskiyou Region of Southwest Oregon, I strongly recommend that you carefully and fully consider the relevant economic concerns. In particular, I recommend that you learn from the Board's failure to consider the economic benefits of wider buffers in the recent process that produced a new rule regarding stream side buffers in other parts of the state. As part of that process, ODF prepared, and the Board signed-off on a report that purported to satisfy ORS 527.714(7). That legislation requires the Board to prepare and make available to the public a "comprehensive" analysis of the economic impact of the proposed rule. In fact, the report did not. It was an embarrassment, insofar as its 29 pages gave a detailed description of the potential costs to the timber industry of wider buffers but offered not a single word about the benefits. Not one.

The benefits of leaving trees unlogged in riparian areas are well-known, numerous, and important. They include, but are not limited to:

- Greater sequestration and storage of carbon.
- Better habitat for salmon and other aquatic species: higher flows and cooler water in streams in summer.
- Greater resilience to the impacts of changes in climate.
- More and better opportunities for outdoor recreation.
- Improvements in the quality of life for Oregon's residents, which helps strengthen the economies of nearby communities and Oregon as a whole by attracting workers, families, and investors.
- Improvements in Oregon's attractiveness to visitors, which helps strengthen the economies of nearby communities and Oregon as a whole by bolstering the outdoor recreation industry, which employs far more workers than the timber industry, and exhibits much faster growth.
- Reductions in risks associated with industrial timber production. These risks include wintertime flooding, summertime water shortages, increased potential for degraded water quality from toxic algae and other sources, increased stress for at-risk species, and more. They also include climate-crisis risks associated with the timber industry's emissions of greenhouse gases. Reductions in risk lower the expected expense Oregonians will incur if such outcomes should materialize. They also lower Oregonians' economic well-being even if the outcomes do not materialize.
- Reductions in risks associated with the state's failure to comply with federal requirements for clean water and protection of at-risk species.

At the Board's 25 July 2017 meeting, I presented a summary of the "vast body of research and data that demonstrates that the state's forests make many important, positive contributions to Oregon's economy." This summary (attached) describes a conceptual framework economists

widely use to examine the economic benefits society derives from ecosystems.It also presents the analytical framework federal agencies responsible for managing water resources recently developed for determining and comparing the economic consequences of resource-management alternatives. I recommend that that Board review this information and incorporate it in its decision to develop a new rule for stream side buffers in SW Oregon.

Following my presentation, the State Forester diminished the significance of the information in my summary with statements to the effect that, although the Board and ODF had a statutory obligation to provide the public with a "comprehensive" analysis of the economic impacts of the proposed streamside protection rule, ODF's report did not describe the economic benefits because ODF staff lacked an acceptable method for determining them. That message is simply not correct. In truth, the failure by ODF and the Board to describe and weigh the benefits of wider streamside buffers occurred not because such methods do not exist—they in fact do. The failure occurred because ODF staff did not take advantage of these methods.

To help the Board understand the errors in the State Forester's statements, on 31 July 2017 I submitted to the Board a follow-up memo (attached) that outlines two quick illustrations of analytical methods and data that ODF had ignored. One describes the analysis of the benefits that materialize when trees are left to grow rather than logged. The other describes the analysis of the benefits of actions that increase the flow and improve the quality of water in streams. I recommend that the Board review this information and incorporate it in its decision to develop a new rule for stream side buffers in SW Oregon. It also should employ similar methods and data for other benefits of unlogged forests.

I also recommend that the Board instruct ODF to gather and use the latest scientific and economic data. For example, in 2017, I pointed toward estimates from the Obama administration that showed the value of carbon dioxide sequestered from the atmosphere to be about $40 per metric ton. At that value, the BLM in 2016 demonstrated that the climate costs resulting from logging on its lands would exceed the value of the logs produced by more than 4-to-1. Subsequent research, published last year, however, demonstrated that the value of carbon dioxide is more than $400 per metric ton. This suggests that, by themselves, the climate-related benefits of leaving more trees unlogged in wider streamside buffers could yield economic benefits 40 times greater than the forgone value of the logs that otherwise would be produced. The actual benefit would be higher, insofar as neither of these estimates includes the full portfolio of benefits resulting from sequestering carbon dioxide. They do not, for example, include benefits associated with impacts on ocean acidification.

If you have any questions, please feel free to contact me.

Sincerely,

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25 July 2017

TO: **Members, Oregon Board of Forestry**
FROM: **Ernie Niemi, President**
SUBJECT: **OREGON'S FOREST ECONOMY–IMPORTANCE OF UNLOGGED FORESTS**

A vast body of research and data demonstrates that the state's forests make many important, positive contributions to Oregon's economy. The Board and the Department of Forestry, however, ignore most of this information. They highlight the positive impacts and overlook the negative impacts of logging, but they either ignore or only briefly consider the economic contributions of unlogged forests. Although bearing a statutory requirement to provide the public with a "comprehensive analysis of the economic impact" of proposed changes in streamside management rules, for example, the Board and ODF instead provided the public with a description of negative impacts on logging that would accompany extensions of streamside protections and totally ignored the positive impacts that would accompany improvements in stream habitat, increased carbon storage, etc.

This disparity in its consideration of the different roles logged and unlogged forests play in Oregon's economy undermines the Board's efforts to meet various objectives, including these:

- Maintain economic stability in each management region.
- Ensure that the State Forester has developed Forest Management Plans based on the best available science.
- Meet the elements and breadth of the "greatest permanent value" rule, with means healthy, productive, and sustainable forest ecosystems that over time and across the landscape provide a full range of social, economic, and environmental benefits to the people of Oregon.
- Obtain the greatest benefit for the people of this state, consistent with the conservation of this resource under sound techniques of land management and accounting for all the features of the land that may offer revenue for the Common School Fund.
- Achieve a balance between short-term and long-term economic returns, with a full range of economic, social, and environmental benefits today, as well as in the future.
- Balance economic, social, and environmental values.
- Make trade-offs between revenue-producing and non-revenue producing activities.

To help fill this gap, this memorandum provides an introduction to the contributions unlogged forests make to Oregon's economy. It also identifies the analytical framework for fully considering these contributions, and offers an introduction to relevant research literature. I recommend that the Board incorporate this information into its future decision-making and direct ODF to utilize this information in its future economic analyses.

I. CONCEPTUAL FRAMEWORK

From an economics perspective, Oregon's forest resources are important not in and of themselves but because they produce things that benefit people, impose costs on them, and compose the environment.

One widely accepted approach for describing the economically important products derived from Oregon's forests combines economic with ecological concepts, as shown in Figure 1.[1] Its central feature is the ecosystem's production of *ecosystem goods and services*, which are important to people and, hence, have economic value. The ecosystem produces goods and services through processes, known as ecosystem functions, that derive from the ecosystem's structure. The right side of Figure 1 shows that sometimes humans place values on the structure of the ecosystem, e.g., the character of the landscape, rather than on the goods and services it produces. To simplify things, however, I use the terms, ecosystem services, to represent all those resource-related things that have economic value.[2]

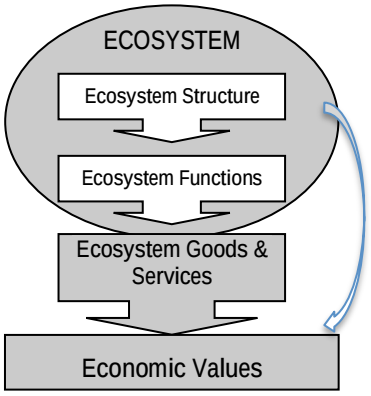

Figure 1. Connections between the Ecosystem and Economic Values[3]

To fully understand the economic impacts of their actions, the Board and ODF must explicitly identify all the services that flow from the state's forest ecosystems and are likely to meaningfully change because of their actions. They must, for example, consider the broad literature on the services produced by rivers, wetlands, floodplains, and other types of ecosystems.[4] Table 1 provides an illustrative list of ecosystem services derived from watersheds that the Board and ODF must address.

[1] An overview of goods and services produced by forest ecosystems is available at https://www.fs.fed.us/ecosystemservices/.

[2] Economists also use "goods and services" to include things, such as damaging floods, that are economically important in a negative rather than positive sense.

[3] Adapted from National Research Council, Committee on Assessing and Valuing the Services of Aquatic and Related Terrestrial Ecosystems. 2004. *Valuing Ecosystem Services: Toward Better Environmental Decision-Making*. National Academies Press.

[4] The separation of ecosystem services into three categories—provisioning, regulating, and cultural—reflects several efforts to distinguish among different types of services (Millennium Ecosystem Assessment (2005), CICES (2016), EPA (2015b), Fisher and Turner (2008)). The examples of cultural services reflect investigations subsequent to the development of the Millennium Ecosystem Assessment by economists and other social scientists (*see* Chan et al.

Table 1. Ecosystem Services Derived from Watersheds

Ecosystem Service	Potential Benefits to Oregon's Economy from Unlogged Forests
1. Provisioning Services[a] Benefits ecosystems generate by delivering water (quantity, quality, timing) to directly provide products for human use	
Deliver water for consumptive use	The watershed's ecosystem affects the quantity, quality, and timing of water supplies for municipal/industrial, domestic, and agricultural uses that remove water from the river.
Deliver water for non-consumptive uses	The watershed's ecosystem affects the quantity, quality, and timing of water supplies for uses that affect the supply of products without removing water from the river: • Salmon, steelhead, and other species for subsistence and commercial harvest. • Power generation • Navigation
2. Regulating Services[a] Benefits ecosystems generate by regulating ecosystem processes, thereby supporting the production of provisioning and cultural services, and directly providing insurance, resilience, and adaptability benefits against undesirable ecosystem changes.	
Support production of and reduce risk to fish and wildlife	The watershed's ecosystem affects the quantity, quality, and timing of water supplies that influence the supply of: • Salmon/steelhead • Lamprey • Other fish • Birds
Reduce risk to life and property	The watershed's ecosystem can buffer flood flows and control erosion.
Reduce risk of undesirable water quality	The watershed's ecosystem can influence risk from algae and pathogens influencing: • Chemical properties (natural filtration) • Biological properties (natural filtration and interactions) • Temperature
Reduce risk of harmful changes in climate	The watershed's ecosystem can influence the risk of warming, sea-level rise, intensity and frequency of storms, etc. by: • Storing carbon in active floodplains • Reducing storage of methane in reservoirs
Enhance resilience of and reduce	Variation of genetic diversity within a species in the watershed and of

(2012), Hernandez-Marcillo et al. (2013), Kovacs et al. (2013), Martin-Lopez et al. (2013), Milcu et al. (2013), and Plieninger et al. (2013)).

Ecosystem Service	Potential Benefits to Oregon's Economy from Unlogged Forests
risk to ecosystems' productivity through biodiversity	species across the watershed may be necessary for ecosystems to exhibit resilience in their functions and ability to sustain the production of services.
Enhance resilience of and reduce risk to ecosystems' productivity through nutrient recycling	Managing the watershed to support larger runs of adult salmon and steelhead, for example, would increase the import of nutrients from the ocean to the basin's aquatic, riparian, and upland ecosystems. A decline in numbers of adult spawners can trigger a shift in ecosystem state.
3. Cultural Services[b] Nonmaterial benefits people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences	
Provide identity value	The ecosystem's status (species abundance, flow patterns, etc.), functions (provision of habitat for species, filtration, etc.), and services can tell people: • Who they are, to what group they belong. • Which practices and knowledge define them. • Which keystone species and associated events and activities shape their identity. • The extent to which the status of species, river flows, etc. signify the risk to whole cultures.
Provide heritage and place value	Past human presence and practices can determine the extent to which a particular site yields services that endow the site with value .
Provide recreational opportunities	The ecosystem, or elements thereof can generate benefits for people who enjoy fishing, river rafting, kayaking, etc.
Provide activity value	In addition to the recreational value derived from experiencing the ecosystem or the sustenance value obtained from fishing and gathering, people may realize benefits, e.g., improved physical and emotional health, from the activity itself.
Provide spiritual value	The ecosystem, or elements thereof can serve as a resource for religious, philosophical, or spiritual thought and experience.
Provide inspirational/educational value	Discrete from spiritual value, the ecosystem, or elements thereof, e.g., a free-flowing river with wilderness characteristics, can create benefits by enabling nature to serve as the inspiration for creative or intellectual thought.
Provide aesthetic value	The ecosystem, or elements thereof can provide aesthetic benefits separate from spiritual or inspirational/educational benefits.
Provide existence, altruistic, and bequest value	The ecosystem, or elements thereof can provide benefit to people who derive satisfaction from knowing that it/they exist or will be available to others in the current or future generations. Economists sometimes use the term, passive-use benefits, to describe these benefits.
Contribute to social cohesion	The realization, by multiple individuals or groups, of other benefits derived from the ecosystem can contribute to social cohesion and the evolution of social capital, thereby helping define behavioral norms that reduce the risk

Ecosystem Service	Potential Benefits to Oregon's Economy from Unlogged Forests
	of conflict, facilitate business transactions, and lower the costs of community governance.
Provide option value	Humans may derive benefits from preserving the processes and functions of an ecosystem so it has the ability to produce services in the future.

[a] Illustrative examples come largely from Abson and Termansen (2010), Brander et al. (2010),Bartkowski (2016), Kumar et al. (2010), Hearnshaw et al. (2010) Poff et al. (2015), Collins et al. (2015), Kohler et al. (2013), National Park Service (2005), Oliver et al. (2015), Scheuerell et al. (2005), and Scheuerell et al. (2015). These sources represent just a small portion of the relevant literature the Board and ODF must incorporate into their identification and analysis of provisioning and regulating services.

[b] Illustrative examples come largely from Chan et al. (2011). Careful research is required to determine the extent to which the categories yield mutually exclusive sets of ecosystem services. These sources represent just a small portion of the relevant literature the Board and ODF must incorporate into their identification and analysis of cultural services.

Sometimes the value of an ecosystem good or service materializes in market prices, as sellers and buyers trade a good or service, or a product derived from it. The absence of a market price, however, does not mean that a good or service has no value. Instead, a good or service can have value even though it is not traded in markets. The economic importance of a good or service may arise when it is extracted, as when the timber industry removes logs from a forest, or when it remains *in situ*, as when anglers fish in a river, or parents hold a desire to pass a healthy ecosystem to their children and grandchildren.

II. ANALYTICAL FRAMEWORK

Federal agencies responsible for managing water resources recently developed an analytical framework for determining and comparing the economic consequences of management alternatives. This framework (CEQ 2013), is known as the *Principles, Requirements and Guidelines for Water and Land Related Resources Implementation Studies* (PR&G). Table 2 briefly summarizes the major elements of this framework. The Board and ODF should develop a full understanding of this framework and then apply it to ensure that they provide Oregonians with a truly comprehensive analysis of the economic impact of future forest-management decision.

Table 2. Major Elements of a Comprehensive Economic Analysis (from the PR&G)

Analytical Component	Requirements for the Board and ODF
1. Net public benefits of each forest-management alternative	Describe the benefits and costs of each alternative, subtract costs from benefits, and determine which alternative will maximize net public benefits. This determination must account for all benefits (increases in the value of goods and services) and costs (decreases).
2. Net impact on jobs, income, etc.	Determine the positive impacts, negative impacts, and net impacts on economic activity for each alternative. They must assume that the economy will be operating at full employment, so that workers can fill new jobs only by leaving their existing jobs, and workers losing jobs will quickly find replacement jobs. This assumption will help the Board and ODF avoid overstatements of the economic impacts of their expenditures and related commercial/industrial expenditures.
3. Sustainable economic development	Assess the potential sustainability of the quantity (supply), quality, timing, location, accessibility, etc. of goods and services produced by the economy under each alternative. It also must assess the sustainability of jobs, incomes and other relevant indicators of economic activity. The assessment must account fully for the market components of the economy (commercial/industrial sectors) and for the non-market components (subsistence activities, ability of local environmental amenities to stimulate economic development by attracting households and businesses).
4. Economic importance of ecosystem services	Account for the economic importance of the services that the watershed's ecosystems provide households, businesses, and communities. They must identify and describe the services these ecosystems provided in the past, provide currently, and would provide in the future under each alternative. They must measure the expected increases and decreases in the value of the ecosystem services and incorporate these values in their determination of each alternative's net benefits. They must describe the roles these services play in the local and regional economies and measure the positive and negative impacts on population, jobs, incomes, etc. that would result from changes in ecosystem services that would take place under each alternative.
5. Economic value of benefits and costs that cannot be monetized	Integrate all effects—monetized, quantified but not monetized, and unquantified—into a single determination of each alternative's net public benefits. The determination must account for environmental, economic, and social goals for the entire watershed. The comparison of the net public benefits of different alternatives must reflect all these effects.

Analytical Component	Requirements for the Board and ODF
6. Non-market mechanisms of economic development	
Account for both market and non-market mechanisms of economic development when describing each alternative's impacts on population, jobs, income, etc. The market mechanisms include the direct, indirect, and induced impacts of the expenditures by the timber industry, outdoor recreation industry, etc. The non-market mechanisms include the ability of the watershed's natural-resource amenities—recreational opportunities, scenic vistas, etc.—to attract households, entrepreneurs, and businesses investment to the watershed.	
7. Cultural values	
Account for cultural services Tribal members and others derive from fish and other components of the watershed's ecosystems as they determine each alternative's net public benefits and net economic-development impacts. Determine the value of these services looking through the eyes of the relevant individuals and communities, rather than apply values that represent other segments of society. In particular, when there exists no reasonable substitute for these services, measure losses of these services looking at the amount of compensation the affected parties would require as compensation before they would be willing to accept the loss, rather than at the amount the parties would be willing to pay to prevent the loss. Fully investigate the potential for healthy ecosystems in the watershed to generate subsistence and other activities that have economic-development impacts comparable to those of market-based expenditures.	
8. Subsidies and externalities	
Account for all of the costs incurred to produce each type of good or service derived from the CRSO. Their determination of each alternative's net public benefits must fully reflect all subsidies (costs imposed on third parties by intent) and externalities (costs imposed inadvertently).	
9. Self-sustaining floodplains	
The determination of each alternative's net public benefits must explicitly and completely incorporate all services derived from floodplains. The determination of the impacts on sustainable economic development similarly must reflect these services. Acknowledge there exist national objectives that give preference to actions that would increase the sustainability of floodplains' ecological processes, functions, and services.	
10. Climate change and other risks	
Describe the expected level of each benefit or cost, the uncertainty inherent in this measurement, and the risk that a cost might be larger and more harmful than expected. Similarly describe each alternative's expected impacts on economic development, the uncertainty in this expectation, and the risk that impacts might be more negative than expected. Especially describe risks associated with the potential for climate change to have greater than expected impacts on the ecosystem and on commercial/industrial sectors of the economy. The analysis of risks must recognize that, if commercial/industrial production increases risks for fish populations or other ecological assets, these risks may limit future commercial/industrial operations.	

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31 July 2017

TO: **Members, Oregon Board of Forestry**
FROM: **Ernie Niemi, President**
SUBJECT: **FOLLOW-UP re IMPORTANCE OF UNLOGGED FORESTS**

Please accept my appreciation—to you and other members of the Board of Forestry—for your acceptance of my written and oral comments at the Board's meeting on 25 July.

I am writing now to follow-up on an issue raised during the subsequent discussion. This issue arises from statements to the effect that, although the Board and ODF had a statutory obligation to provide the public with a "comprehensive" analysis of the economic impacts of the proposed streamside protection rule, ODF's report did not describe the economic benefits because ODF staff lacked an acceptable method for determining them. It is important for the Board to realize, however, that the failure to describe the economic benefits occurred not because such methods do not exist—they in fact do. The failure occurred because ODF staff did not take advantage of these methods.

To support this conclusion, here are two quick illustrations, as well as a short summary.

Carbon Storage

ODF's report focuses on "the decrease in [timber] harvest between the current rule…and the proposed rule."[1] Specifically, it shows the proposed rule would reduce annual softwood harvest by 27,971 mbf. The report also shows that inflation-adjusted prices for softwood logs have been declining. But, if one assumes a price of about $500/mbf will continue, then the annual forgone timber harvest has a value of about $14 million.

Common sense, plus extensive research, indicate that this reduction in timber harvest will increase the amount of carbon stored in the forest. The Forest Service has published estimates for western Oregon of the change in stored carbon that accompanies timber harvest.[2] So too have researchers in Oregon.[3]

Forest managers in other organizations have demonstrated that, unlike ODF's staff, they have the ability to calculate the carbon-storage benefits that accompany reductions in timber harvest. The Bureau of Land Management, for example, recently published an analysis of the increase in stored forest carbon that would accompany a potential timber-harvest reduction on its lands in

[1] Kaetzel, Brandon R. 2017. *Economic Analysis to Satisfy ORS 527.714(7).* p. 3.
[2] *See, for example,* Smith, James E., Linda S. Heath, Kenneth E. Skog, and Richard A. Birdsey. 2006. *Methods for Calculating Forest Ecosystem and Harvested Carbon with Standard Estimates for Forest Types of the United States*; and
[3] Krankina, Olga. 2014. *Projected CO_2 Emissions Due to Increased Logging Under Senator Ron Wyden's "Oregon and California Land Grant Act of 2013"*. Research Note. Geos Institute.

western Oregon.[4] It concluded that the value of the increase in stored carbon would exceed the value of the reduction in timber harvested by a ratio of at least 1.3-to-1. This ratio, indicates that, if the proposed rule would reduce the value of timber harvest by $14 million, it also would increase the value of the stored forest carbon by about $18 million. The BLM also demonstrated that alternative assumptions about the value of stored carbon would more than double the carbon-timber ratio. Those assumptions, combined with the timber-value derived from ODF's report indicate that the annual carbon-related benefits of the proposed rule would be approach $40 million.

There is no apparent reason to conclude that ODF failed to describe the carbon-related benefits of the proposed streamside-protection rule because staff lacked access to the information necessary to complete an analysis similar to the BLM's. The general research about the tradeoff between timber and stored forest carbon is readily available online. If they had questions about the applicability of the research findings to the streamside-protection rule, ODF staff presumably could have contacted the relevant researchers. Moreover, the BLM based its analysis on data obtained from ODF, itself:

> "Greenhouse gas emissions from harvest operations are based on…harvest records maintained by the Oregon Department of Forestry (ODF) for all lands in western Oregon and for Klamath County in eastern Oregon."[5]

Water: Quantity and Quality

The reduction in logging under the proposed streamside-protection rule also would result in increases in streamflows, especially in late summer months, and in reductions in the amount of stream sediment. Both of these effects represent economic benefits of the proposed rule.

Information in ODF's report, plus readily available findings in the relevant research literature can support an estimate of their value. The methods are straightforward:

- **Quantity:** ODF's report estimates the area of land that would not be logged under the proposed streamside rule. Available research findings indicate the increases in streamflow (acre-feet), per acre not logged, and the value per unit.[6] The value of the economic benefits from increased streamflow equals:

  acreage x increase in flow per acre x value per acre-foot of flow

- **Quality:** ODF's report estimates the area of land that would not be logged under the proposed streamside rule. Available research findings indicate the decrease in stream

[4] BLM. 2016. *Proposed Resource Management Plan/Final Environmental Impact Statement: Volume 2, p. 657.*

[5] BLM. 2016. *Proposed Resource Management Plan/Final Environmental Impact Statement: Volume 3, p. 1299.* The BLM also gives the URL for the information: http://www.oregon.gov/odf/pages/pubs/publications.aspx#agency_annual_reports.

[6] Keppeler, Elizabeth. 1998. "The Summer Flow and Water Yield Response to Timber Harvest." In *Proceedings of the Conference on Coastal Watersheds: The Caspar Creek Story*. Edited by Robert Ziemer. U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. Pgs. 35-43; Isaac, L.A. 1946. "Fog Drip and Rain Interception in Coastal Forests. US Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, described in Harr, R.D. 1983. "Potential for Augmenting Water Yield Through Forest Practices in Western Washington and Western Oregon." *Water Resources Bulletin* 19 (3): 383-393; Harr, R.D. 1982. "Fog Drip in the Bull Run Municipal Watershed, Oregon." *Water Resources Bulletin*. 18(5):785:789; and Brown, T.C. 2004. The Marginal Economic Value of Streamflow from National Forests. Discussion Paper DP-04-01, RMRS-4851. Rocky Mountain Research Station, US Forest Service.

sediment (tons) per acre not logged, and the value per unit.[7] The value of the economic benefits from decreased sediment equals:

acreage x decrease in sediment per acre x value per ton of sediment

These methods can readily yield an estimate of the value of the water-quantity and -quality benefits of the proposed rule. In 2013, for example, I used these methods to estimate the potential benefits from reductions in logging on western Oregon lands managed by the BLM.[8] That analysis found water-quantity benefits of about $800 per acre left unlogged and water-quality benefits of about $500 per acre.

Summary: There Is No Excuse

In my 25 July memo to the Board, I presented the well-established conceptual and analytical frameworks that ODF staff should have used to describe the economic benefits of the proposed streamside-protection rule. Here, I describe some of the readily available data and methods for estimating the carbon- and water-related benefits, and highlight some of the analyses that have used them. Combined, this information decisively demonstrates that ODF's failure to describe the proposed rule's economic benefits stems not from the lack of readily available, appropriate analytical frameworks, data, and methods. Instead, the only plausible explanations are that ODF staff failed to use this information either out of ignorance or by intent. Neither explanation is consistent with the high expectations for the agency's professional performance.

I encourage Board members to make it clear that you expect ODF to use this information (and similar information for other benefits) to provide the Board and the public with a full description of the economic benefits of future resource-conservation actions.

[7] Seeds, J. 2010. *Turbidity Analysis for Oregon Public Water Systems Water Quality in Coast Range Drinking Water Source Areas*. Oregon Department of Environmental Quality. DEQ 09-WQ-024. p. 38; and Hansen, L., and M. Ribaudo. 2008. Economic Measures of Soil Conservation Benefits: Regional Values for Policy Assessment. Technical Bulletin 1922. USDA, Economic Research Service.

[8] Niemi, Ernie. 2013. *Economic Value of Goods and Services Produced on the O&C Lands.*