Natural Resource Economics

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TO: **Jamie Damon and Samantha Meysohn**
FROM: **Ernie Niemi**
SUBJECT: **POTENTIAL CLIMATE-RELATED ECONOMIC COSTS TO OREGONIANS**

The following text summarizes readily available research findings and data that indicate climate change likely will impose costs of about $27 billion per year on Oregonians in the near future, through just these six mechanisms:

a. Increases in food costs
b. Loss of income
c. Increases in wildfires
d. Increases in exposure to wildfire smoke
e. Increases in heat-related deaths
f. Declines in salmon populations

Divided by the current number of households, this total is equivalent to about $17,000 per household per year. Sufficient information is not currently available to estimate additional expected costs through many more mechanisms, including these:

More frequent and intense extreme storms, droughts, etc.	Increases in agricultural pests and diseases
Changes in the productivity of Oregon's ecosystems	Increased incidence of water- and food-borne diseases
Increased risk of extinction for salmon and other species	Increased stress on threatened and endangered species
Impacts of sea-level rise	Accelerated spread of some undesirable invasive species
Increased cooling costs for commercial and industrial businesses	Increases in fish and wildlife diseases
Increased air conditioning and refrigeration	Increased migration
Degradation of infrastructure from higher temperatures	Expanded range of tropical and sub-tropical diseases
Increased variability in weather conditions	Reduced opportunities for outdoor recreation
Heat stress and irrigation-water shortages for agricultural production	Increased federal taxes to cover climate problems elsewhere
Increases in psycho-social trauma for individuals, families and communities	Increases in violence and suicides stimulated by unusually high temperatures

Moreover, the actual costs likely will be even greater. More than 11,000 scientists have warned that we now are facing a climate emergency that threatens human existence. And, UN Secretary General António Guterres summed recent findings: "We have reached a tipping point on the need for climate action. The disruption to our climate and our planet is already worse than we thought, and it is moving faster than predicted"

A. Costs from Climate-Related Increases in Food Prices

The IPCC has concluded that past and anticipated changes in global climate are expected to reduce world food supplies and increase food prices. The resulting increases in world food prices would materialize in Oregon, increasing costs for Oregon's households. A 2015 assessment by the U.S. Department of Agriculture found that climate-related disruptions in food-production and -delivery systems will limit local food supply worldwide, leading to price hikes of perhaps 35 percent by 2050. Some of the underlying research suggests, though, that the higher prices likely would induce consumers to reduce their purchases by perhaps 3 percent. The Bureau of Labor Statistics has estimated that Americans currently spend about $7,200 per year per household on food, and the Census Bureau estimates that Oregon has more than 1.6 million households. These numbers indicate that changes in climate might increase Oregonians' food costs by about **$3.7 billion per year** in the near future.

B. Costs from Climate-Related Loss of Income

Climate-related storms, diseases, heat waves, etc. can slow economic growth, reducing both the output of goods and services, known as gross domestic product (GDP), and household income derived from GDP. This slowing can occur directly in Oregon, as these events occur here. It also can occur indirectly, as climate-related slowdowns in economic growth in other states and countries have side-effects on Oregon's economy. The Office of Management and Budget (OMB) found that climate-related slowing of GDP growth in the near future will reduce federal revenues by more than $500 per household per year. The slowdown in GDP also will lower household incomes. In recent years, before the Trump Administration and the onset of the pandemic, federal receipts have been about 17 percent of national GDP. If this percentage remains unchanged, the potential climate-related reduction in annual GDP per household will roughly equal or exceed ($500 ÷ 17 percent =) $2,900. In Oregon, personal income has been equal to about 80 percent of the state's GDP. These numbers suggest that, in the near future, changes in climate might cause Oregon's 1.6 million households to experience reductions in income of about **$3.8 billion per year**.

C. Non-Suppression Costs from Climate-Related Wildfires

In 2017, the (federal, state, and local) costs of suppressing wildfires in Oregon totaled $454 million. Recent research suggests, though, that fire-suppression activities constitute only about 9 percent of the total costs of wildfires. The full complement of costs includes:

o Home and property loss	21%
o Immediate road & landscape stabilization	3%
o Aid relief & evacuation	2%
o Degraded ecosystem services	34%
o Energy & infrastructure	4%
o Long-term landscape rehabilitation	16%
o Tax, business, natural resource loss	2%
o Human casualties	1%
o Other	0.1%

These numbers suggest that Oregon's non-suppression wildfire-related costs in 2017 were about $4.6 billion. Changes in climate might cause a 200 percent increase in the acreage burned in the near future. If costs correlate with acres burned, then Oregon will experience additional,

climate-related wildfire-related costs of more than **$9.2 billion per year**. These costs do not include the costs from exposure to wildfire smoke, which are described in the next section.

D. Costs from Exposure to Climate-Related Wildfire Smoke

The wildfire-related costs discussed in the preceding section do not include costs associated with smoke from climate-related wildfires. Smoky days are not just inconvenient, they're expensive. Low levels can negatively affect the health of some. At high levels, everybody can have difficulty breathing. Some people require hospitalization, some people die. In addition, the smoke disrupts the economy and diminishes non-health aspects of our quality of life. Economists have estimated that the costs from exposure to dense wildfire smoke can total about $370 per adult per day. Smoke intrusions can last several days, and, to illustrate their economic importance, I assume that climate-related wildfire smoke will, sometime in the near future, impose these costs on Oregon's more 2.6 million adults for seven days per year. Overall costs will total **$6.8 billion per year**.

E. Costs from Premature Human Deaths Resulting from Climate-Related Increases in Summer Temperatures

Climate-related increases in summer temperatures can make most people uncomfortable and many people sick. Some die. A 2015 analysis of climate-related premature deaths that covered some of Oregon's major population centers suggests that, for the state as a whole, the increases in climate-related heat resulting from "moderate" increases in greenhouse-gas (GHG) emissions might kill an additional 250 Oregonians per year by mid-century, relative to 1990.

It would be inappropriate to estimate the economic cost associated with the individual persons who will die prematurely because of climate-related heat. Economists have, however, estimated the costs associated with an increase, across society as a whole, in the risk of death. A large and robust literature on the economic value of an increased risk of death, across society as a whole, indicates this cost is about $10 million per potential death. This cost, multiplied times the risk that climate-related heat will cause up to 250 premature deaths, indicates the total cost to Oregon might total **$2.5 billion per year**.

F. Costs from Declines in Salmon Populations

Climate-related erosion, impacts to coastal marshes and riparian areas, rising water temperatures, and ocean acidification will all contribute to degraded habitat and reduced numbers of fish. Salmon that rely on both ocean and river habitats will be at risk, with particular species (juvenile chum, Coastal Coho, and Chinook salmon) potentially seeing more damage. A 2009 analysis projected that, by 2040, the declines in salmon populations will impose economic losses on Oregonians of more than **$1.0 billion per year**.