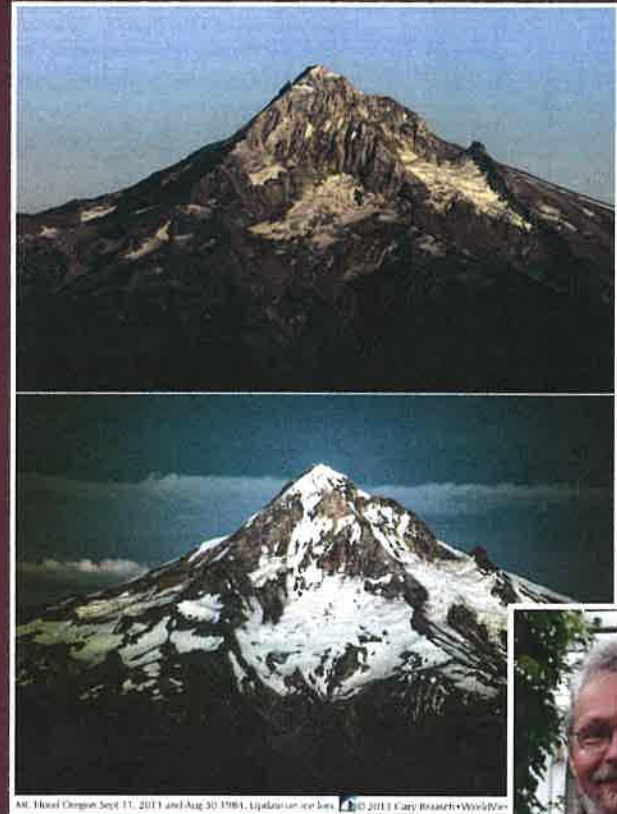


A Tribute to Gary Braasch (1944-2016)



MR. FROST Changes Sept. 11, 2011 and Aug. 30, 1984. Updata on snow Jan. 10, 2011 © Gary Braasch/WorldView



Gary Braasch was a world-caliber environmental photojournalist from Oregon who created remarkable images and documentation about nature, conservation, biodiversity, and global warming around the world. Gary was the first photojournalist to travel to inhabited and remote areas in the Arctic, Asia, the Pacific islands, Australia, Antarctica, the Americas, and the great mountain ranges, specifically to document climate science and climate change.

Gary Braasch's project, "World View of Global Warming," the first dedicated photo documentation of the effects of rapid, human-caused climate change, is the result of all these journeys. It began in 1999 as an extension of Gary Braasch's 40-year career in environmental photography, advocacy and conservation work.

October 24, 2016



Representatives. A follow-up children's book co-authored with Lynne Cherry, *How We Know What We Know About Our Changing Climate: Scientists and Kids Explore Global Warming*, won 16 major children's literature and science writing awards.

An exhibition of giant prints and educational images, "Climate Change in Our World," premiered at the headquarters of the American Association for the Advancement of Science (AAAS) in Washington, D.C. and was also exhibited at the Museum of Science in Boston. His exhibits on climate change have been shown at the Chicago Field Museum, the Science Museum of Minnesota, and Cornell University, with images and interactives also at the Koshland Science Museum of the National Academy of Sciences in D.C. and the North Carolina Museum of Natural Science. The United Nations used Gary's images exclusively for a set of six stamps about climate change in 2008.

Presidential Science Advisor John Holdren called Gary's work the best example of science, art and education, and he continues to use Gary's images in his presentations. Gary's notable innovations included repeat photography of active global warming changes to glaciers, coastlines and forests — which are now available in the interactive educational app for iPhone "Painting with Time: Climate Change."



Introduction

Images from World View of Global Warming have been published by the United Nations and World Meteorological Organization, featured in *The New York Times*, *Nature*, *Time*, *Newsweek*, *National Geographic*, *LIFE*, *Audubon*, *Scientific American*, *Discover*, and *Smithsonian*, and in media websites such as CBSNews, CNN, BBC, Yale Climate Connections and The Daily Climate.

For his work on conservation and natural history subjects, Gary won the Ansel Adams Award from the Sierra Club and the Outstanding Nature Photographer citation from the North American Nature Photography Association (NANPA). He was a founding member of NANPA and a founding fellow of the International League of Conservation Photographers.

Gary's comprehensive book *Earth Under Fire: How Global Warming is Changing the World* (University of California Press, 2007) was updated in a paperback edition and e-book in 2009. Praise for this book has come from Al Gore, who called it "essential reading for every citizen," members of the Nobel Prize-winning scientific community, *Nature*, *Scientific American*, *Vanity Fair*, authors Bill McKibben and Paul Hawken, and members of the U.S. Senate and House of



Gary's images continue to be requested and used in textbooks, conferences, scientific journals and exhibits world-wide. Rich resources for the public, teachers and leaders, include the websites: www.worldviewofglobalwarming.org, www.worldviewofglobalwarming.org/Gallery/Index.php (photo library) and www.braaschphotography.com.

History of Climate Change and World View of Global Warming, by Gary Braasch and Joan Rothlein (2016)

Earth's climate has varied greatly over millions of years. Climate is the long-term temperature and weather caused by the planet's axis, tilt and orbit and the interactions of its atmosphere, oceans, geology and biology. Small amounts of greenhouse gases like carbon dioxide and methane in the atmosphere naturally trapped enough heat to make a habitable planet. The past 10,000 years saw a period of relative climatic stability, and human civilization developed and thrived, creating the world of today.

Over time, but especially in the past century, human population growth, use and sources of energy, agricultural methods, and land development have all had an effect on our climate that is now measurable and strong.

Our activities have raised the amount of carbon dioxide and methane in the

atmosphere to the highest level in about three million years, at a rate of increase 10 times faster than past natural changes. This has intensified the greenhouse effect and raised global temperatures. The average Earth temperature is climbing out of the range in which living species evolved. Oceans are absorbing about half of the increased carbon dioxide and are becoming more acidic as a result.

Drastic changes that can be measured and are expected to get worse include flooding of populated lowlands, long-term drought, increasing illness, extremes of heat and storm, damage to the ocean as our source of food and oxygen, and extinctions of plants, animals and habitats. Energy use and damage from resulting climate change are unevenly distributed among people, creating a parallel crisis of national security, equity, migration and human rights.



We are beyond the point of stopping unnatural global warming, but we have many options that will slow and limit its worst possible effects. Scientific analysis reveals that we must cut all kinds of greenhouse gas emissions by more than 80 percent in only a few decades to keep temperature within the international target, 2 degrees (C) above pre-industrial

time. Scientific and final language at the 2015 United Nations COP21 climate talks in Paris considered 2 degrees (C) as too high, with a 1.5 degree limit more necessary and protective, and anything higher as too dangerous to health and Earth functions on which humans depend. Years before the recent 2015 climate agreements were signed in Paris, Gary Braasch was documenting solutions to global warming and energy issues of the day.

Rapid change is upon us. How we rise to this challenge will determine our place in history...and the history of our planet.

We can't stop all climate disruptions, but we have many options that will limit the worst possible effects. The sooner we cut carbon dioxide and other greenhouse gas emissions, the less damage they will do. The good news is that homes, cars and industry can be more efficient. Wind and solar energy, water power, and geothermal energy far exceed our needs. This positive energy transformation has already begun. We must inspire, innovate, invest and implement techniques at all scales — individual, local, state, federal and global — to answer this challenge.

The goal of World View of Global Warming is to illustrate and report on the physical changes, human cost and science of climate change. In 1999 Gary Braasch began working in the polar regions, and by 2016 Gary had photographed on seven continents, in 26 countries and in ecosystems from coral reefs, tropics, arctic tundra, and glaciers to the Himalayas, Andes and alpine summits. This work benefits from a dialogue with the world's leading scientists and research centers, observers and citizens around the world focused on climate and energy innovation.

For more information about Gary Braasch and his epic achievements and beautiful contributions to the planet Earth he so loved, see www.worldviewofglobalwarming.org and www.braaschphotography.com. Take time to look at the many online photo portfolios, Climate Photo of the Week stories (CPOW), and also revisit or find a copy of one of his nature photography books from the past: *Secrets of the Old Growth Forest* (co-authored with David Kelly), *Photographing the Patterns of Nature*, *The Northwest: Pacific Coast and Cascades* and *Entering the Grove*, (authored by Kim Stafford).



Gary Braasch, self portrait hiking above the confluence of Canning River and its Marsh Fork in Arctic National Wildlife Refuge (ANWR), Alaska. © Gary Braasch

World View of Global Warming: A Photographic Documentation Exhibit of Climate Change

Photography by Gary Braasch

Research and Text by Gary Braasch and Dr. Joan Rothlein

Above the boreal forest, sensors help understand tree ecology and ecosystem changes

Meteorologist Scott Chambers installs a solar radiation sensor on a 50-foot-high meteorological tower at the Bonanza Creek Long Term Ecological Research station, near Fairbanks, to set a baseline of how the amount of sun affects the uptake and emission of carbon dioxide and other gases in this boreal forest.



The boreal forest is the most extensive and possibly least-studied of the world's forests, and is proving to be especially susceptible to climate change. Scientists are observing that regional tree lines are moving north and fragmenting, that

forests are drying and burn more often, and that insects are proliferating.

White spruce, a major tree of the boreal forest, is reaching its biological limit as regional temperatures increase and precipitation decreases. Dr. Glenn Juday, University of Alaska, wrote, "With modest additional warming widespread tree death will be unavoidable." These same conditions across huge swaths of central Alaska have led to record wildfires, peaking in 2004 and 2015. Warmer winters also have allowed native tree beetles to proliferate beyond the natural defenses of trees, affecting tens of thousands of square miles of forest. These same changes in forests are seen down through Canada and the Western U.S.

Thawing permafrost near Denali National Park

Geophysicist Tom Osterkamp indicates where ground level was when he installed



this temperature probe pipe near Denali National Park, demonstrating that the permafrost here has been thawing and the ground subsiding over the last 30 years.

His data, gathered from 30 locations across Alaska, show that permafrost temperature has been increasing. Many of those sites show massive movements and erosion of once-frozen ground as the ice surface thaws. Serious effects include forest damage, sinking roads and buildings, eroding tundra riverbanks, changes in tundra vegetation, and — perhaps most critical — increased carbon dioxide and methane emissions from thawed peat.

Old transportation ideas provide a journey into the future

An aerial tram, or cable car, and 60 miles of light rail line through downtown give Portland, Oregon commuters attractive, even fun ways to get to work. Tramways and trolleys are 19th-century inventions now enjoying a resurgence as alternatives to fossil-fuel burning auto-commuting. Among the top five most-used light-rail systems are San Francisco and Boston lines established around the turn of the 20th century, and San Diego and Portland systems begun in the 1980s. Human-scale transportation is just one element of the "ecocity" movement, which advocates highly efficient building methods, reclaiming abandoned industrial areas,



interconnecting services, schools and residences, opening up streams long buried beneath concrete, encouraging solar and wind electrical generation, protecting nearby farmland and encouraging urban gardening, and many other sustainability actions. Cities existed for 4,500 years without cars.

Americans living in shadow of coal

Cooling stacks of the 2,900-megawatt Amos coal-fired power plant near Charleston, W.V., loom over a neighborhood. The steam from the cooling heat is benign compared to the nearly invisible but harmful coal smoke from the stacks.



Coal is the most polluting fuel, and in 2015 the U.S. generated about 33 percent of its electricity from it.

Coal smoke generated from coal-fired power plants contains not only carbon dioxide, but also nitrogen oxide, sulfur dioxide, and particulate and mercury pollution, killing 24,000 to 30,000 Americans each year, more than 22,000 in Europe, and many times more in China. Yet the world uses coal to generate about 40 percent of its electricity. Entire ecosystems are devastated by strip mining and the piles of poisonous coal ash left over after burning. Switching to natural gas as a power-generating fuel reduces these effects, but gas is also a carbon dioxide source and relies on damaging practices such as fracking and methane leaks. The world must move away from all fossil fuel energy sources.

Heat waves and increasing illness cloud the future of major cities

Chicago chokes under severe heat and air pollution in July 1995, which killed 875 people. The Chicago heat wave pales in comparison with August 2003, in Paris and across Europe, when many places had readings well over 100 degrees F (35-40 degrees C) day after day. Across 10 heat-struck European nations — all of which have modern and efficient health care systems — the estimated death toll was at least 46,000, with some estimates as high as 70,000. More recently, in 2015 heat waves caused thousands of deaths in India, Pakistan and the Middle East, where daytime temperatures were measured between 113-116 degrees F (45-47 degrees C).

Everywhere, not only in cities, warming favors disease. Malaria, asthma, hanta, West Nile and Zika viruses and dengue

fever are among the diseases that worsen or spread as global warming continues. Asthma, for example, which has quadrupled in the U.S. since 1980, appears more prevalent in step with ragweed and other pollen, which increases with higher carbon dioxide levels and longer growing seasons. Mosquitoes carry infectious pathogens, and transmit them to humans via biting. As the Earth warms due to climate change, more regions can potentially support disease-bearing mosquitoes by boosting their reproduction rates and lengthening their breeding seasons.

Worldwide, 300,000 to 400,000 people die each year from direct effects of climate change influencing food and water access, infectious and chronic disease incidence and, storm severity.



In Bangladesh, villagers on the edge of change they did not create



Villagers of Bholia Island, Bangladesh, on a road being sliced by active erosion even when there are no storms. They are among more than 16 million people living within a

few feet of the high tide in this huge delta of the Ganges and Brahmaputra rivers. Bangladesh is made up of 90 percent floodplain and faces rising sea levels, which makes flood and cyclone damage much worse. Yet, like much of the less-developed world, Bangladesh creates very little greenhouse gas. The total average carbon dioxide output of all the Bangladeshis seen here combined is little more than that of one American.

About two thirds of the world's major cities are coastal. Coastal residents, wealthy or poor, all face the same threat. Scientists predict that sea levels will rise by at least three feet before 2100, perhaps as much as six feet, inundating estuaries, harbors, and the homes of millions of people.

Mount Hood loses its mantle of glaciers

Oregon's iconic peak, Mount Hood, is usually seen in photographs completely covered in snow. However, it is losing its mantle of 11 glaciers. Mount Hood is seen here from the west in Gary Braasch's 2013 re-shoot of his August 1984 photograph from Larch Mountain. The glaciers on this 11,200-foot-high dormant volcano were first measured by scientists in 1911. Since then the ice has been shrinking, and recent surveys show that the Ladd Glacier (left side) is 37 percent smaller, the Sandy Glacier 40 percent melted, and the Reid Glacier (right side) 35 percent diminished. The entire mountain has now lost more than a third of its glacier area. Water from these glaciers is crucial to the basic Oregon industries of agriculture, fishing, domestic water supply, and alpine recreation. Range glaciers are crucial for summer water supply, especially salmon streams and irrigation in the eastern rain shadow of the

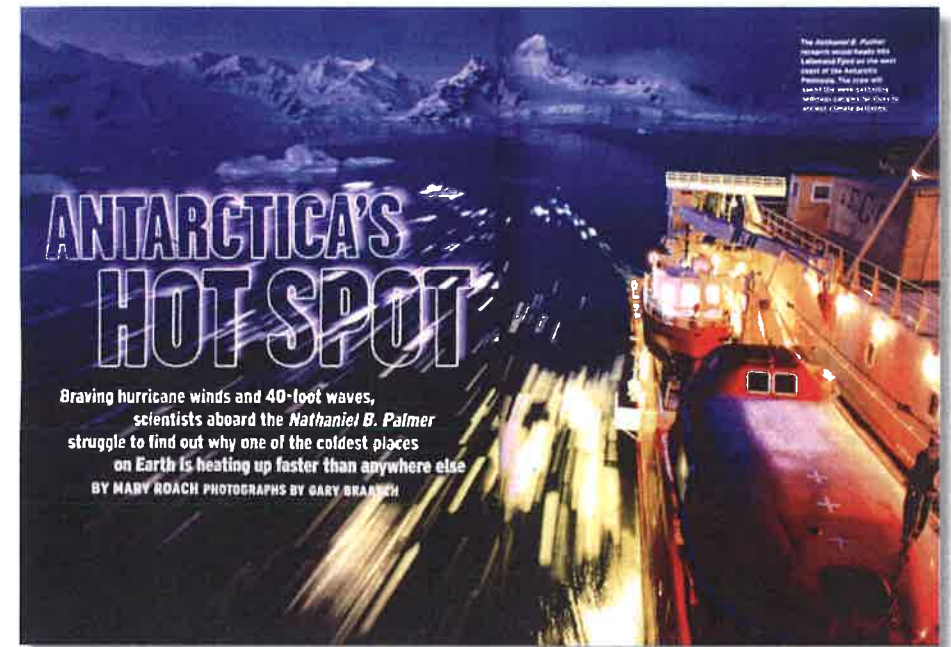
range. In U.S. western mountains, heavy snowfall is often delayed compared to decades past, and precipitation falls more often as rain at lower elevations, changing the timing of streamflow.



Intense research on Antarctic glaciers shows them moving and thinning

The Nathaniel B. Palmer National Science Foundation icebreaker cruises the Antarctic Peninsula, collecting ocean floor sediment samples, ocean chemistry and temperature readings. Research on board this ship seeks to understand the changes in Antarctica over the last glacial cycle, including ice shelf disintegration of the last decade. Hundreds of glaciers on the Antarctic Peninsula are flowing faster and calving in response to warming temperatures, often revealing rocky shorelines that had been under thick ice.

The land glaciers begin flowing up to eight times faster, dumping ice into the ocean to raise sea level. Loss of glaciers in this area will eventually cause about a two-meter sea level rise over hundreds of years. This image, made by Gary Braasch in 1999 on his first polar trip to the Antarctic with National Science Foundation researchers, was the first photo documentation for his climate change project, World View of Global Warming, and was published in *Discover* magazine.



Adelie Penguins — sensitive monitors of a warming Antarctic Peninsula

Adelie penguins (*Pygoscelis adeliae*) cluster on a rockery near Anvers Island, Antarctica, where thousands of Adelies have nested for some 600 years. Over the 30-plus years, this island has lost half of its 8,000 nesting pairs. These particular penguins are subjects of a 40-year study by ornithologist Bill Fraser, who each year counts the number of birds returning to breed and how many chicks survive. He has found that the amount of sea ice around the rookery island is crucial in the survival of the penguins. Due to 12 degrees F (6.5 degrees C) average temperature rise in the region during the past 50 years, the ice is decreasing.

Penguins have to swim farther to get food, making it harder to keep chicks well fed. Young adult birds cannot feed themselves as well, and do not return to breed each year.

The Adelies' major food is krill, a small shrimp-like creature that swims in huge schools. Other Antarctic scientists discovered that krill like to live under the ice, where they are protected and where the algae that they eat grows. Krill numbers have fallen by as much as 75 percent in the Southern Ocean near the Antarctic Peninsula.



Ethical and moral issues ride in on the flooding tides in Tuvalu

Extreme high tides and winds send waves crashing across a road in Funafuti, the main island of the tiny atoll nation, Tuvalu, 1,000 kilometers north of Fiji, which is beset by rising sea levels. This is an island that is only four meters (13 feet) above sea level. High tides splash over the roads but also percolate up through the ground to flood vegetable gardens and fields. The tiny country of about 12,500 people is one of the small island nations including Kiribati, the Maldives, Marshall Islands and

Caribbean countries, that are demanding strong global action to stem sea level rise caused by climate change. Tuvalu and Kiribati have been negotiating with Australia and New Zealand to find a way to move their populations while preserving their cultures. Climate refugees, the loss of national homelands, and the fate of the world's poor — who are not causing climate change but are the first to suffer — are major issues of human rights and ethics for the United Nations.



Ornithologist studies the life of an Arctic bird at risk from disappearing ice

Biologist George Divoky has been tracking the life cycle of the black guillemot seabird on an island in the Arctic Ocean, Alaska, for more than 40 years. During this time, sea ice extent has plummeted, with a record low reached after the summer melt in 2012. Divoky documented the birds' increasing challenge of finding adequate numbers of its preferred prey, Arctic cod — which lives under the sea ice — as ice retreats more than 300 miles from the rookeries.



This sea ice loss also means severe change in polar bear, walrus, and caribou habitats; damaging erosion along shorelines; increased precipitation and river flow; and increasingly open passage for ships and mineral exploration. The warming Arctic Ocean and shrinking amount of sunlight reflectance from the ice in summer are major factors in keeping the region cool and moderating global climate.

All these powerful effects of a warming climate on the Arctic were brought into ironic perspective by the Obama Administration's earlier permit for Shell Oil to begin drilling for petroleum for the first time offshore of Alaska's northwest coast in 2015, until Shell's decision on September 25, 2015, to cease drilling, for now.

Caribou in motion

A caribou herd migrates across the Kongakut River in the Arctic National Wildlife Refuge, Alaska. The Arctic is now warmer than it has been in more than 400 years, and scientists are seeing the effects of climate change on Arctic wildlife. These animals, which yearly migrate farther than any other land mammal, are affected by changes in weather, plant growth and seasons.



Athabasca Glacier, Canadian Rockies, retreats from 1917 to 2005

Images show Athabasca Glacier, Jasper National Park, Alberta/British Columbia, Canada, in 2005 and as it was in 1917. The most-visited glacier in Canada, the Athabasca has retreated about 1,200 meters (4,000 feet) since early in the 20th century, and is 120 meters (400 feet) thinner. There are more than 160,000 mountain glaciers in 41 nations, 46,000 of them on the Himalaya-Tibetan plateau alone. People in the Andes and Himalayas

are already affected by severe glacier change. In every mountain range, this ancient ice is withering away under assault from rising temperatures, and the meltwater is contributing to sea level rise. Glaciers hold a hundred times more water than the world's temperate and tropical rivers. Half the human population drinks water that originates in mountains, and more than a billion people depend directly on flow from glaciers and seasonal snow.

[1917 photo by A.O. Wheeler. Copyright Canadian National Archives.]



Alpine botanists track the migration of wildflowers in warming Alps

At more than 10,000 feet (3,100 meters) in the Austrian Alps, scientists count and measure alpine plants to record their reaction to a warming climate as part of a long-term study called GLORIA taking place on mountain ranges all over the world. Studies led by Dr. Harald Pauli here in Shrankogel, Austria, report that regional warming of two degrees C (3.6 degrees F) is causing cold-adapted wildflowers and grasses to grow higher on the mountainsides. The tops of mountains have less surface area and less soil, so as plants try to grow in cooler and higher elevations, they often do not find suitable habitat. Alpine ecosystems are being



disrupted. As climate change intensifies, the life zones and ecological associations — Earth's natural processes crucial to our survival — are being fragmented and rearranged. Movement has shifted more than 17 kilometers (10.5 miles) per decade towards the poles or 11 meters (36 feet) upslope. Spring events like blooming occur earlier by 2.3 days per decade, and even earlier in some places.

Haulout of walrus on Alaskan shore

During the summer of 2015, CBS news reported "25 Stunning photos of climate change," including this crucial aerial view by Gary Braasch of thousands of Pacific walrus hauling-out on an Alaskan Arctic Ocean beach, as their preferred ice flow habitat melts away. This image and story made headlines in the *Guardian*,



Washington Post, *Mashable*, CBS and ABC and was displayed by President Obama's science advisor John Holdren in briefings during the President's 2015 Alaska trip.

Mount St. Helens eruption, 1980

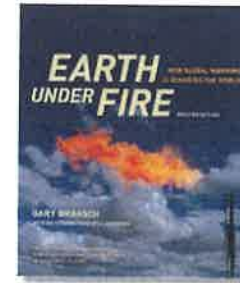
On May 18, 1980, Mount St. Helens erupted. The eruption blew 1,314 feet off the mountaintop, and 230 square miles of old growth forest was destroyed. But regrowth and return of all species

started almost immediately. Gary Braasch captured this famous image of the eruption and returned many times over the past four decades to document the science and the renewal.



How to Order

Gary Braasch's book *Earth Under Fire, How Global Warming is Changing the World* (University of California Press, updated paper edition 2009) is out of print but is sometimes available at local bookstores, and online from Amazon.



"World View of Global Warming" is a 501(c)3 project of Blue Earth Alliance, www.blueearth.org. All contributions to "World View of Global Warming" can be made to Blue Earth Alliance, Attn: World View of Global Warming, 4557 51st PI SW, Seattle, WA 98116 and are tax-deductible.



Sponsors

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Joan Rothlein and Cedar Braasch are grateful for support and information from many donors, scientists, editors, environmental leaders, and the Gary Braasch Tribute Sponsors and designers, who made this brochure and exhibit possible.

Proclamation

To recognize the achievements of Mr. Gary Braasch, Governor Kate Brown issued this proclamation on September 29, 2016.

PROCLAMATION

OF THE STATE OF OREGON

- WHEREAS:** Oregonian Gary Braasch was an internationally acclaimed environmental photojournalist whose life's work documented the science and impacts of climate change that gives Oregonians and the broader public a better understanding of the implications of a warming world, and
- WHEREAS:** Gary Braasch's images are exhibited by the organization he founded, World View of Global Warming, and have been published in major magazines and featured in his 2009 book, "Earth Under Fire: How Global Warming Is Changing the World" and
- WHEREAS:** Following Gary's untimely death in March 2016, his admirers have sought to keep his work in the public eye, and to this end will exhibit his images, with annotation, online at www.worldviewofglobalwarming.org and in the Oregon Capitol Building October 24-28, 2016, and
- WHEREAS:** Oregon has special communities, landmarks, and ecosystems that must be protected and preserved for the well-being of current and future generations, and has a legacy of action that inspires future action by individuals, organizations, and institutions.

NOW,

THEREFORE: I, Kate Brown, Governor of the State of Oregon, hereby proclaim October 24-28, 2016 to be

WORLD VIEW OF GLOBAL WARMING EXHIBIT WEEK

in Oregon and encourage all Oregonians to join in this observance.

IN WITNESS WHEREOF, I hereunto set my hand and cause the Great Seal of the State of Oregon to be affixed. Done at the Capitol in the City of Salem in the State of Oregon on this day, September 29, 2016.



Kate Brown, Governor

Jeanne P. Atkins, Secretary of State

