

National Security

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It's a pleasure for me to be speaking to such a group of high ranking EPA officials on the linkage between endangered species and national security. The United States Senate voted unanimously to declare last Friday, May 21 as National Endangered Species Day. This shows that a significant majority of the people in this nation are supportive of the on-going efforts to manage the long standing problem of extinction of species. The Environmental Protection Agency in its "Endangerment Finding"¹ presents scientifically convincing evidence linking extinction of species with global climate change. I strongly agree with the conclusions of the "Endangerment Finding"; however, I believe that it does not spell out a crucial factor, i.e., the linkage between global warming and national security. I will make the case for that linkage during this presentation.

Presbyterian Church's Call to Halt Mass Extinction

Current extinction rates are greater than anything the planet has seen in 65 million years, when a large meteor slammed into the Earth and ended the reign of the dinosaurs. The noted Harvard professor, E. O. Wilson, has estimated conservatively that "Human activity has increased extinction between 1,000 and 10,000 times over this level [the normal rate] in the rain forest by reduction of area alone. Clearly we are in the midst of one of the great extinction spasms in geological history."²

In response to this crisis, the Presbyterian Church(USA) has taken a formal position on the importance of protecting endangered species in its 2001 policy - "A Call to Halt Mass Extinction".³ This "Call" states that:

"The Creator-Deliverer calls human communities to work with God to rectify the abuses whereby human impacts upon the earth are leading to a mass extinction of living species. This mass extinction would fundamentally alter and undermine the life and well-being of the human and other creatures that survive. It would rob all future generations of the gifts of wholeness and diversity that God intends."

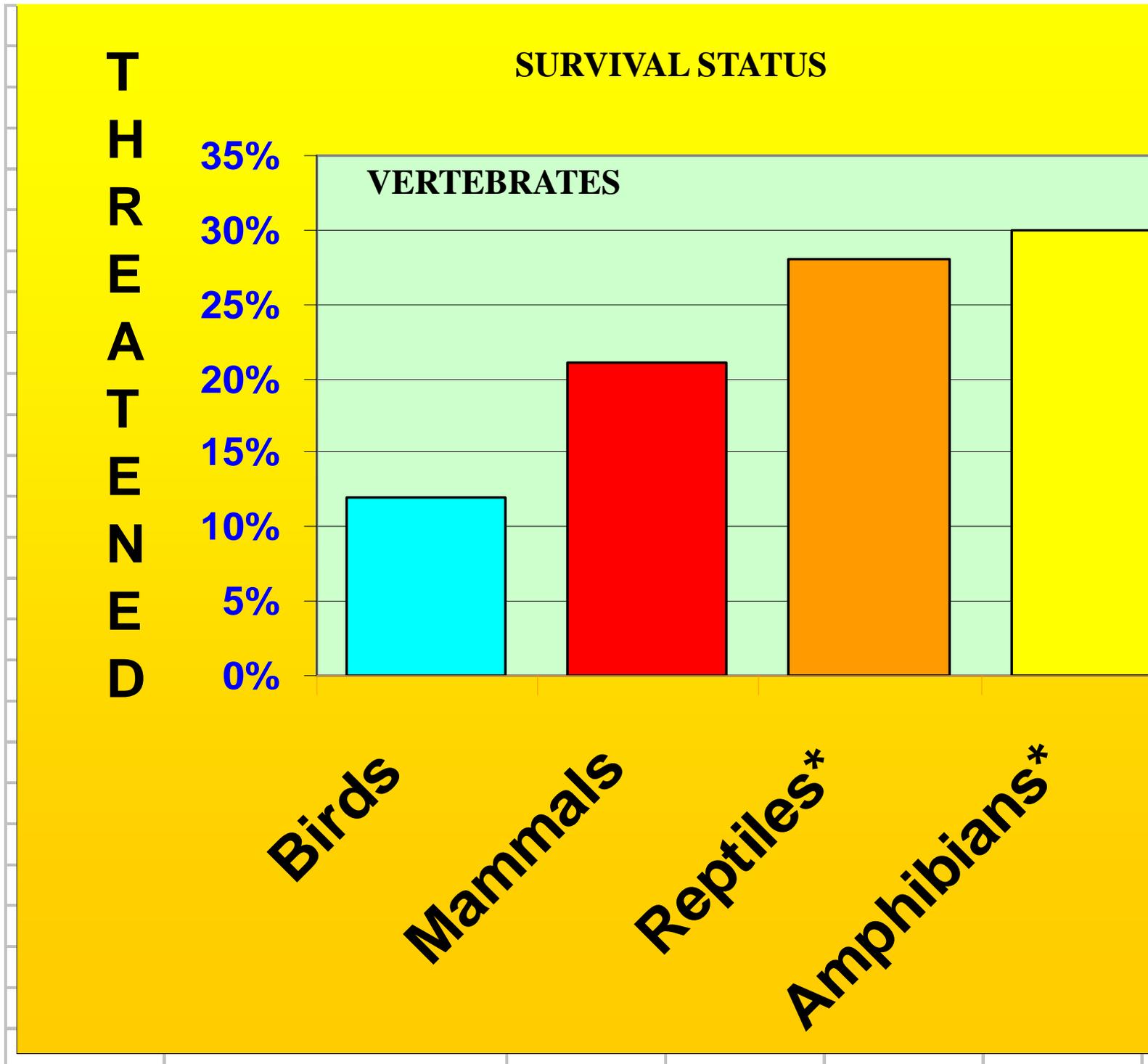
¹ Technical Support document for "Endangerment and Causes or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act, December 7, 2009, USEPA

² E.O. Wilson, *The Diversity of Life*, 1992, p. 280.

³ Presbyterian Church (USA) 201st General Assembly, 2001, Minutes, Part 1, p. 473

Many individual churches are working hard to prevent environmental catastrophes. For example, my church, Solana Beach Presbyterian Church, was very active in the formulation of the Presbyterian Church's "A Call to Halt Mass Extinction." It also won the Coveted "EPA Energy Star for Congregations Award" for its outstanding energy conservation program. In order to illustrate the urgency of today's extinction crisis, I will present a brief summary of our understanding of the current science.

Background Science The International Union for the Conservation of Nature (IUCN)



serves as a global tracker of the extinction status of a wide variety of species.⁴ "The IUCN Red List of Threatened Species™ is widely recognized as the most comprehensive, objective global approach for evaluating the conservation status of plant and animal species." As an example of today's situation, consider the survival status of invertebrates shown in fig. 1. Worldwide 11 percent of birds, 21 percent of mammals, 28 percent of reptiles, 30 percent of amphibians, and 32 percent of fish are currently threatened with extinction.

The planet hasn't seen extinction rates this high in 65 million years, when a large rock from space about the size of the Himalayan Mountains slammed into the Earth. The resultant global devastation wiped out the dinosaurs along with about 60% of all the other species.

The current spasm of extinction of species is due primarily to 5 factors that are summed up by the acronym HIPPO:

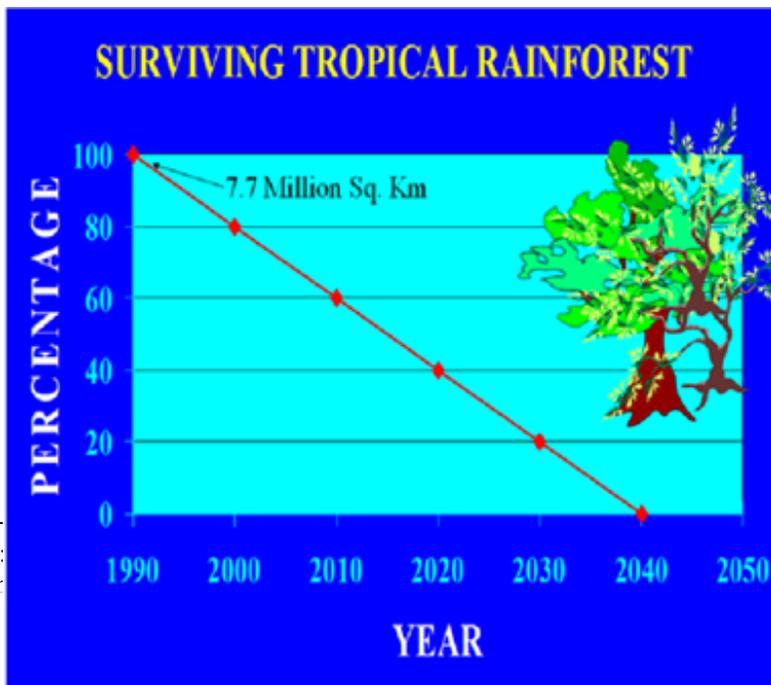
Fig.1 Current data on vertebrates threatened with extinction according to the International Union for the Conservation of Nature.

- **H**abitat destruction,
- **I**nvasive species,
- **P**ollution,
- **P**opulation increase, and
- **O**verharvesting.

In my presentation today, I am going to focus on two of these factors - habitat destruction, and pollution. In particular, I'll be speaking about two very important factors that could lead to a mass extinction during the 21st century - tropical rainforest destruction, and global warming.

Tropical Rainforest Destruction and Extinction

During the 20th century humanity engaged in a massive effort to change the nature of the Earth's tropical rainforests. They were destroyed to harvest the wood, to convert the land to



agriculture, and to convert the land to grazing.⁵ Reports of the annual rate of destruction typically range from 1 to 3 percent per year. If we take the middle of this range, i.e., 2 percent decrease per year and treat this as a linear rate, we arrive at the projections shown in fig. 2. These indicate that tropical rainforests will be gone from this planet by the middle of the 21st century. If other assumptions are used, such as a

⁴ <http://www.iucn.org>
⁵ John

1 percent per year decrease, the tropical rainforests may continue in existence until the end of the 21st century.

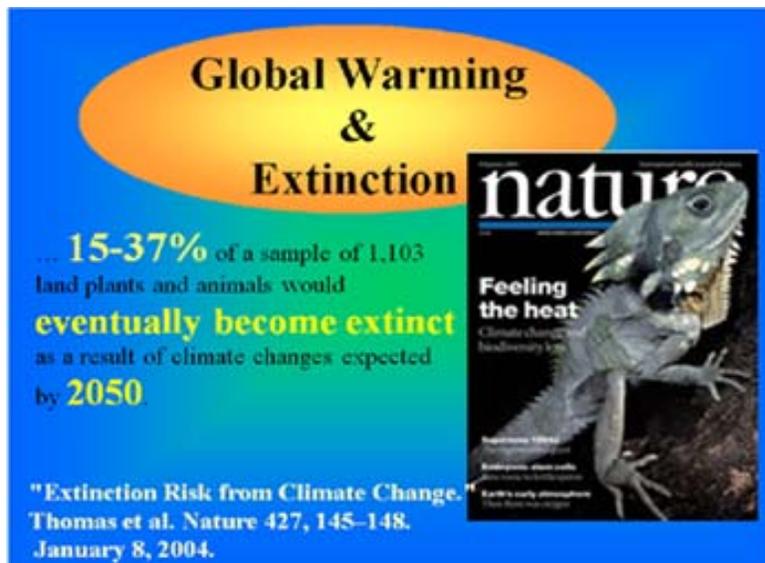
This destruction is critically important to endangered species since more than half of all species live in the tropical rainforest.⁶ More than half of the species in the tropical rainforest are endemic to the tropical rainforest. Hence, approximately 25 percent of the Earth's species are endemic to the tropical rainforest. If the tropical rainforests are destroyed, these endemic species no longer have a home, and hence they are driven to extinction.

Fig. 2 Projections of the decline of tropical rainforests during the 21st century

This single phenomenon could bring about the extinction of 25 percent of all of the species on the Earth during the 21st century!

Global Warming and Extinction

It was thought by most experts that habitat destruction was the principle driver behind the current epidemic of extinction.⁷ However, in their landmark paper, "Extinction Risk from Climate Change"⁸, Thomas et al show that Global Climate Change is having a similar impact on extinction of species as the destruction of tropical rainforests.



"...we predict, on the basis of mid-range climate-warming scenarios for 2050, that 15–37% of species in our sample of regions and taxa will be "committed to extinction." When the average of the three methods and two dispersal scenarios is taken, minimal climate-warming scenarios produce lower projections of species committed to extinction (18%) than mid-range (24%) and maximum change (35%) scenarios. These estimates show the importance of rapid implementation of clean energy technologies to decrease greenhouse gas emissions and strategies for carbon sequestration."

Fig. 3 Thomas et al demonstrate that the effects of global warming on extinction of species are comparable to those of habitat destruction

This work strongly supports EPA's Endangerment Finding.

⁶ E.O. Wilson, *The Diversity of Life*, 1992, p. 277.

⁷ E.O. Wilson, *The Diversity of Life*, 1992,

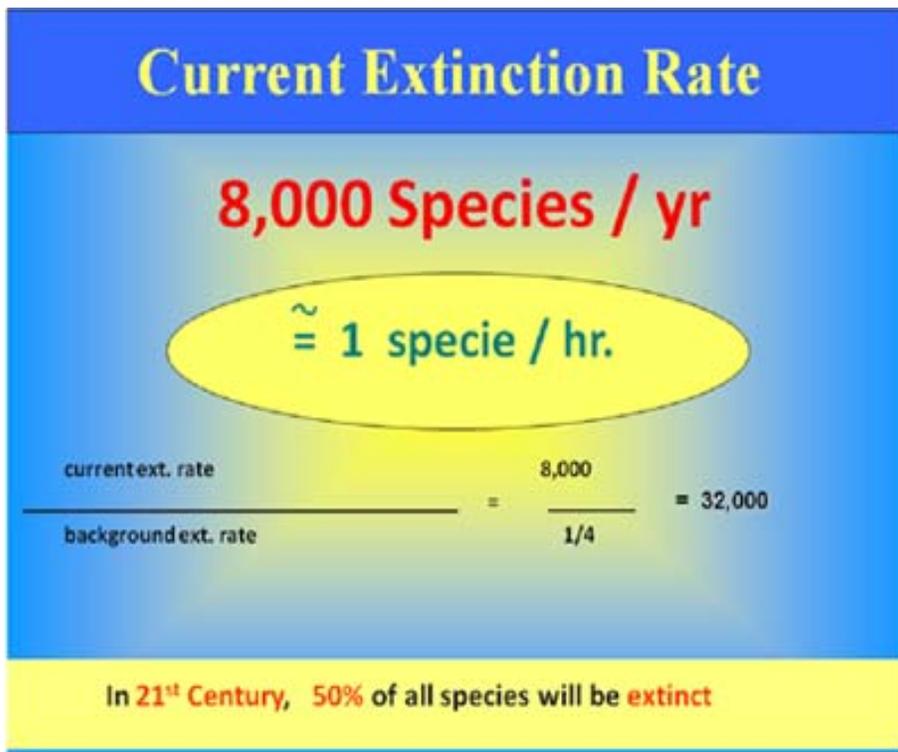
⁸ Thomas et al. *Nature* 427, 145–148. January 8, 2004.

It represents a remarkable change to our understanding of the causes of the current wave of extinctions. It demonstrates that the temperature increases caused by the mid-range predictions of global warming models would be sufficient to make major increases in the rate of extinction. This finding is summarized in Fig.3.

Combined Impacts of Global Warming and Tropical Rainforest Destruction

If the extinction effects of tropical rainforest destruction and those of global warming are combined, species would be driven to extinction at a rate of about 8,000 species per year. This compares to the average extinction rate over the last 500 million years of about one specie in four years. Fig. 4 shows that the current extinction rate is about 32,000 times greater than the background extinction rate.

It appears that over 50 percent of the plant and animal species of the Earth will be committed to extinction by the middle to the end of the 21st century. This would be the Earth's 6th mass extinction!



If we allow this mass extinction to occur, it will not be the result of some unchangeable force of nature such as a large meteor hitting the Earth. It will be the result of humanity collectively making a series of choices not to prevent this catastrophe. It will be the result of our individual choices. In order to get some idea of the impact of a mass extinction on our way of life, let's examine its impact on food supply.

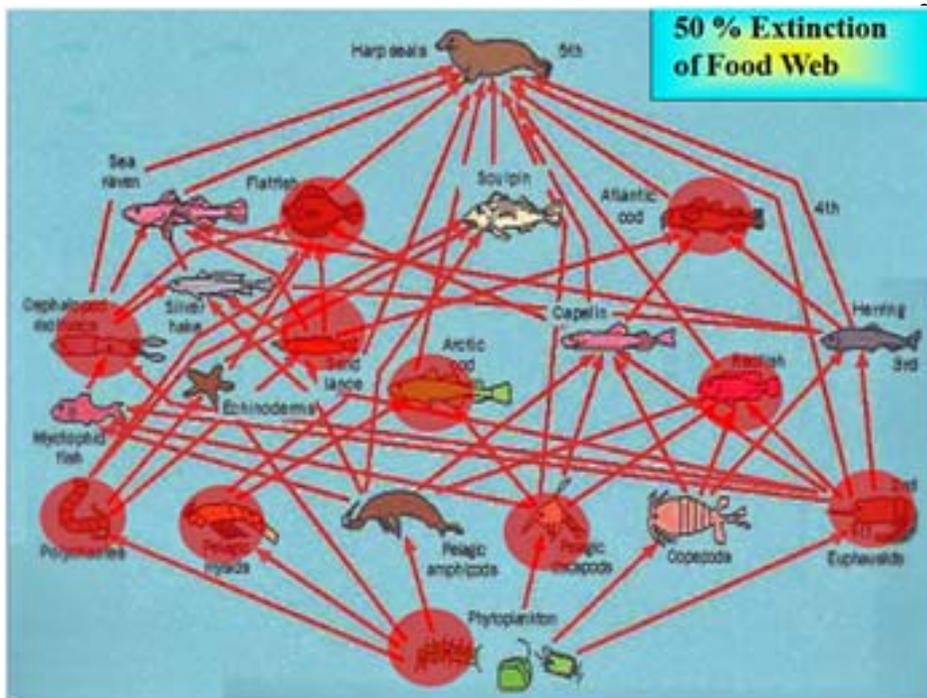
Fig. 4 Combined Extinction impacts of global warming and tropical rainforest destruction

Food Supply Impact and National Security

One way to obtain insight on the impact of a mass extinction on human food supply is to examine a typical food web such as that shown in Fig. 5. The top level predator of the food web is shown on the top of the diagram. He survives by eating the species that are connected to him by arrows. Those species in turn eat the species that are connected to them by arrows. Organisms in a food chain are grouped into trophic levels, based on how many links they are removed from the primary producers. In trophic levels there may be one species or a group of species with the same predators and prey.⁹

If a single species in the food web becomes extinct, it generally has a relatively small impact on the ability of the food web to produce food for the top level predator. The reason for this is that the food webs generally have multiple species at any given trophic level that essentially perform the same ecological functions. This redundancy provides stability to the food web in the event of a single extinction. Keystone species are the exception to this rule, since their function is not replicated.

However, if half of the individual species in a food web are driven to extinction, the food web loses its redundancy and is no longer able to provide sufficient energy to maintain the population of the top level predator. Hence the population of the top level predator is severely



decreased or in some cases it is driven to extinction.

As we all know that humans are the top-level predator of the planet today, so all of humanity will be severely impacted by a mass extinction.

Randomly losing one half of the plants and animals in humanity's food web will ruin the food supply system for people over the entire earth, leading to a collapse of the economic system of many countries. The recent near-collapse of our economic system gives us a rough idea of how

Fig. 5 A typical food web. The species removed by a mass extinction are covered with red circles.

unprepared we are for a catastrophe of this magnitude. Since we simply don't know how to

⁹ Jerry Bobrow, Ph.D.; Stephen Fisher (2009). *CliffsNotes CSET: Multiple Subjects* (2nd ed.). John Wiley and Sons. p. 283.

handle crisis of this magnitude, it is simply better to take preventative action to prevent it from happening.

If humanity's food supply collapses due to a mass extinction, people will attempt to ease their suffering by migration to other countries. This global migration would be by far the largest in recorded history. This massive migration would dramatically increase international tensions, and ultimately lead nations to war with one another. We can certainly avoid this type of dark future if "...human communities work with God to rectify the abuses whereby human impacts upon the Earth are leading to a mass extinction of living species." This potential catastrophe can be avoided by adopting international energy and environmental policies that both prevent devastating changes to our climate, and stop the destruction of our rainforests. Let's use our intelligence"...to serve and keep the garden..."¹⁰ and thereby create a much better future for our children and future generations.

Conclusion

In an address given by the first administrator of the Environmental Protection agency, William D. Ruckelshaus, it was stated that:

"If every one of us will adopt the simple truth that "I can save the earth," we will realize how much we can achieve together."¹¹

The problems that I have described are certainly monumental; however, I believe that they are well within our collective abilities to solve. We can prevent a mass extinction, and do it in a way that allows humanity to actually improve its current situation. However, to do this we will have to bring about a coalescence of values so that we effectively work together. The statements that we have given you from the major religious groups of America show that the religious community is beginning to come together on the need for effective care of God's creation. I believe that the religious community is ready to work with governmental organizations such as the Environmental Protection agency to bring about this reality.

I'm reminded of the last line from the movie "Casablanca" where Humphrey Bogart and Claude Rains are walking together into the fog:

"This could be the beginning of a beautiful friendship."

By working effectively together, I do believe that "We can save the Earth." Thank you very much for your attention.

¹⁰ Genesis 2:15

¹¹ From Awareness to Action, by William D. Ruckelshaus, [EPA speech - April 22, 1971]