

are becoming more costly and scarce, plants having genetic adaptations for improved performance in adverse environments are likely to be readily accepted.

In the evolutionary struggle of native vegetation, certain traits provide an advantage over the competition. When these are understood, we will be in a position to markedly improve plant types and hence to bring about major increases in plant productivity.

References and Notes

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Declaration on Prevention of Nuclear War

On 24 September 1982, this statement was presented to His Holiness, Pope John Paul II, by an assembly of presidents of scientific academies and other scientists from all over the world convened by the Pontifical Academy of Sciences to consider the issue of nuclear warfare.

I. Preamble. Throughout its history, humankind has been confronted with war, but since 1945 the nature of warfare has changed so profoundly that the future of the human race, of generations yet unborn, is imperilled. At the same time, mutual contacts and means of understanding between peoples of the world have been increasing. This is why the yearning for peace is now stronger than ever. Mankind is confronted today with a threat unprecedented in history, arising from the massive and competitive accumulation of nuclear weapons. The existing arsenals, if employed in a major war, could result in the immediate deaths of many hundreds of millions of people, and of untold millions more later through a variety of aftereffects. For the first time, it is possible to cause damage on such a catastrophic scale as to wipe out a

large part of civilization and to endanger its very survival. The large-scale use of such weapons could trigger major and irreversible ecological and genetic changes, whose limits cannot be predicted.

Science can offer the world no real defense against the consequences of nuclear war. There is no prospect of making defenses sufficiently effective to protect cities since even a single penetrating

nuclear weapon can cause massive destruction. There is no prospect that the mass of the population could be protected against a major nuclear attack or that devastation of the cultural, economic, and industrial base of society could be prevented. The breakdown of social organization, and the magnitude of casualties, will be so large that no medical system can be expected to cope with more than a minute fraction of the victims.

There are now some 50,000 nuclear weapons, some of which have yields a thousand times greater than the bomb that destroyed Hiroshima. The total explosive content of these weapons is equivalent to a million Hiroshima bombs, which corresponds to a yield of some 3 tons of TNT for every person on earth. Yet these stockpiles continue to grow. Moreover, we face the increasing danger that many additional countries will acquire nuclear weapons or develop the capability of producing them.

There is today an almost continuous range of explosive power from the smallest battlefield nuclear weapons to the

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most destructive megaton warhead. Nuclear weapons are regarded not only as a deterrent, but there are plans for their tactical use and use in a general war under so-called controlled conditions. The immense and increasing stockpiles of nuclear weapons, and their broad dispersal in the armed forces, increase the probability of their being used through accident or miscalculation in times of heightened political or military tension. The risk is very great that any utilization of nuclear weapons, however limited, would escalate to general nuclear war.

The world situation has deteriorated. Mistrust and suspicion between nations have grown. There is a breakdown of serious dialogue between the East and West and between North and South. Serious inequities among nations and within nations, shortsighted national or partisan ambitions, and lust for power are the seeds of conflict which may lead to general and nuclear warfare. The scandal of poverty, hunger, and degradation is in itself becoming an increasing threat to peace. There appears to be a growing fatalistic acceptance that war is inevitable and that wars will be fought with nuclear weapons. In any such war there will be no winners.

Not only the potentialities of nuclear weapons, but also those of chemical, biological, and even conventional weapons are increasing by the steady accumulation of new knowledge. It is therefore to be expected that also the means of nonnuclear war, as horrible as they already are, will become more destructive if nothing is done to prevent such a war. Human wisdom, however, remains comparatively limited, in dramatic contrast with the apparently inexorable growth of the power of destruction. It is the duty of scientists to help prevent the perversion of their achievements and to stress that the future of mankind depends upon the acceptance by all nations of moral principles transcending all other considerations. Recognizing the natural rights of humans to survive and to live in dignity, science must be used to assist humankind towards a life of fulfillment and peace.

Considering these overwhelming dangers that confront all of us, it is the duty of every person of good will to face this threat. All disputes that we are concerned with today, including political, economic, ideological, and religious ones, are small compared to the hazards

of nuclear war. It is imperative to reduce distrust and to increase hope and confidence through a succession of steps to curb the development, production, testing, and deployment of nuclear weapons systems, and to reduce them to substantially lower levels with the ultimate hope of their complete elimination.

To avoid wars and achieve a meaningful peace, not only the powers of intelligence are needed, but also the powers of ethics, morality, and conviction.

The catastrophe of nuclear war can and must be prevented. Leaders and governments have a grave responsibility to fulfill in this regard. But it is humankind as a whole which must act for its survival. This is the greatest moral issue that humanity has ever faced, and there is no time to be lost.

II. In view of these threats of global nuclear catastrophe, we declare:

- Nuclear weapons are fundamentally different from conventional weapons. They must not be regarded as acceptable instruments of warfare. Nuclear warfare would be a crime against humanity.

- It is of utmost importance that there be no armed conflict between nuclear powers because of the danger that nuclear weapons would be used.

- The use of force anywhere as a method of settling international conflicts can entail the risk of military confrontation of nuclear powers.

- The proliferation of nuclear weapons to additional countries seriously increases the risk of nuclear war and could lead to nuclear terrorism.

- The current arms race increases the risk of nuclear war. The race must be stopped, the development of new, more destructive weapons must be curbed, and nuclear forces must be reduced, with the ultimate goal of complete nuclear disarmament. The sole purpose of nuclear weapons, as long as they exist, must be to deter nuclear war.

III. Recognizing that excessive conventional forces increase mistrust and could lead to confrontation with the risk of nuclear war, and that all differences and territorial disputes should be resolved by negotiation, arbitration, or other peaceful means, we call upon all nations:

- Never to be the first to use nuclear weapons;

- To seek termination of hostilities

immediately in the appalling event that nuclear weapons are ever used;

- To abide by the principle that force or the threat of force will not be used against the territorial integrity or political independence of another state;

- To renew and increase efforts to reach verifiable agreements curbing the arms race and reducing the numbers of nuclear weapons and delivery systems. These agreements should be monitored by the most effective technical means. Political differences or territorial disputes must not be allowed to interfere with this objective;

- To find more effective ways and means to prevent the further proliferation of nuclear weapons. The nuclear powers, and in particular the superpowers, have a special obligation to set an example in reducing armaments and to create a climate conducive to nonproliferation. Moreover, all nations have the duty to prevent the diversion of peaceful uses of nuclear energy to the proliferation of nuclear weapons;

- To take all practical measures that reduce the possibility of nuclear war by accident, miscalculation, or irrational action.

- To continue to observe existing arms limitation agreements while seeking to negotiate broader and more effective agreements.

IV. Finally, we appeal:

- 1) To national leaders, to take the initiative in seeking steps to reduce the risk of nuclear war, looking beyond narrow concerns for national advantage; and to reject military conflict as a means of resolving disputes.

- 2) To scientists, to use their creativity for the betterment of human life, and to apply their ingenuity in exploring means of avoiding nuclear war and developing practical methods of arms control.

- 3) To religious leaders and other custodians of moral principles, to proclaim forcefully and persistently the grave human issues at stake so that these are fully understood and appreciated by society.

- 4) To people everywhere, to reaffirm their faith in the destiny of humankind, to insist that the avoidance of war is a common responsibility, to combat the belief that nuclear conflict is unavoidable, and to labor unceasingly towards insuring the future of generations to come.