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#### Massive decline in global yields are inevitable – investment in biotech now is key to prevent billions from starving to death.

**Noyes 10** Katherine Noyes, staff writer, 2/11/2010, “Biotech Push Needed to Avert Global Food Crisis, Scientists Warn” Tech News World,http://www.technewsworld.com/rsstory/69321.html?wlc=1284092034

World leaders must embrace agricultural biotechnology if they are to cope with the severe food shortages likely to result from global warming in the coming decades, warns a group of scientists. Yields from some of the most important crops for human consumption begin to decline sharply when average temperatures exceed about 30 degrees Celsius, or 86 Fahrenheit, they explain in an article that will appear Friday in the journal Science. As a result, "you're looking at a 20 percent to 30 percent decline in production yields in the next 50 years for major crops between the latitudes of southern California or southern Europe to South Africa," said David Battisti, a University of Washington atmospheric sciences professor and coauthor of the article. Countries around the globe, then, need to "get beyond popular biases against the use of agricultural biotechnology," particularly crops genetically modified to produce greater yields in harsher conditions, the scientists said. 9 Billion by 2050 Even without climate change, feeding the world's population will be increasingly difficult as that population increases -- likely by more than 30 percent to 9 billion people in 2050. That alone would require doubling grain production in the tropics, Battisti said. A warmer climate, however, will reduce yields at a time when they're needed most, because many temperatures will be too high to achieve the most efficient photosynthesis. For every temperature increase of one degree Celsius, in fact, yields tend to go down by 10 percent, Battisti told TechNewsWorld. "The projected changes in temperature due to global warming will put a lot of really basic stresses on plants," he said. 'Further Stress on Plants' In the tropics and subtropics, in fact -- between roughly 30 degrees North and 30 degrees South -- the optimal temperatures for photosynthesis are already exceeded, explained Battisti. "If you add global warming on top of that, you find that it puts further stress on plants," he pointed out. Even if emissions were reduced dramatically in the coming years, it would still result in yield reductions of at least 20 percent by midcentury, he asserted, with further reductions due to increasing pressure from pests and pathogens. 'Already Taking Its Toll' "We are well aware through our emergency work responding to drought/famine/flood that climate change is already taking its toll on agricultural yields in many parts of the developing world," Jennifer Parmelee, senior spokesperson with the United Nations World Food Program (WFP), told TechNewsWorld. The WFP works to address the impact of climate change through food-for-work programs "that include agricultural rehabilitation such as building of microdams, terraces and other water catchments, and replanting of trees and shrubs to prevent further erosion and loss of precious topsoil," Parmelee explained. Places including Ethiopia and Haiti, for example, are both "massively deforested," she noted. A 'Major Starvation Catastrophe' So far, there hasn't been much attempt to breed crops resistant to heat stress, Battisti noted. The result of all these increasing pressures could lead to a "major starvation catastrophe" by the end of this century among the more than 3 billion people who live relatively close to the equator, along with a plethora of food shortages elsewhere, the report's authors warn. "I grow increasingly concerned that we have not yet understood what it will take to feed a growing population on a warming planet," said lead author Nina Federoff, who is science and technology adviser to Secretary of State Hillary Rodham Clinton and biology professor at Pennsylvania State University. What's needed are systems that have the potential to decrease the land, energy and fresh water needed for agriculture while reducing the pollution associated with agricultural chemicals and animal waste, the authors wrote. The Green Revolution The so-called Green Revolution in agriculture produced a 2 percent increase in yields per year for 20 years, Battisti noted, primarily through development of new grain varieties along with fertilizer and irrigation. "We're really asking for yield gains comparable to those at the peak of the Green Revolution, but sustained for an unprecedented length of time -- 40 years -- and at a time when climate change is acting against us," he said. Also complicating matters is that many of the institutions involved do not work together closely enough to succeed, the authors charged. Then, too, there's the continued resistance to crops such as corn and soybeans that have been genetically modified to be insect resistant and tolerant of herbicides. No Silver Bullet "There has to be a lot of creative thinking, a greater blending of biotechnology and agriculture, and better coordination between private and public research efforts throughout the world for us to keep pace with the increasing demand for food," Battisti said. "We need to be thinking about the long-term demands for food and the environmental and social ramifications of how we will produce it." There is no "silver bullet," Battisti added; rather, the solution will have to involve a combination of things. Specifically, it will mean changing agronomy, or the way humans farm, and in some cases, it will be a matter of changing varieties to more heat-tolerant versions. "That's a time-consuming process," Battisti noted. "We'll have maybe three shots before mid-century to make current varieties more resilient to heat." Sugar Cane and Teff There will also be the need for better education and irrigation, he pointed out, and "in some cases, there will have to be changes in the kinds of crops we grow." The major grains that are grown today -- including wheat, corn, soy and rice -- don't tend to do well in high heats, Battisti explained. Sorghum and sugar cane, on the other hand, tend to do pretty well if they get enough water. Teff -- a crop that's grown in parts of Africa -- is another promising candidate, he pointed out. 'Yields Will Go Down, and Soon' Reactions to the report's recommendations have generally been positive, particularly in the agricultural community, Battisti told TechNewsWorld. "Occasionally we hear from a farmer up in Canada," he noted. Even there, though, "by the time we get to the end of the century, they will have those reductions in yields too." Meanwhile, "anywhere south of San Francisco," he concluded -- "including Africa and most of Asia -- yields will go down, and soon."

#### Cuban biotech is a key model for food security

Aerni 2001, Phillip. "Aquatic Resources and Technology: Evolutionary, Environmental, Legal and Development Aspects." *Center for International Development*. Harvard University, 2001. Web. <http://www.cid.harvard.edu/archive/biotech/papers/discussion13\_aerni.pdf>.

In Cuba and China, where biotechnology is pursued as an important option in addressing food security, precaution seems to be more applied to the uncertainty regarding future adequate food supply rather than uncertain environmental risks. At the same time, these countries represent unique incubators where innovative and unorthodox domestic approaches in agriculture and aquaculture are applied. In these countries, research and development in agriculture and aquaculture are driven by the public rather than the private sector and products are not primarily designed for export markets but domestic self-sufficiency. Cuba represents a particularly interesting case: since the end of the Cold War, Cuba could no more rely on trade with other communist countries but was neither willing to join the capitalist world. In the search for a strategy to overcome food insecurity and dependence on food imports, the government launched a National Food Programme in 1989 that represents an approach, which combines the promotion of biotechnology with traditional conservation methods and with local low-input practices. In the meantime transgenic varieties of all important food crops are currently under development in Cuba. The first transgenic product that has become available as food for consumers in 2000 is a genetically modified Tilapia, a transgenic fish that grows faster [64]. It is still too early too to judge the success of Cuba’s approach but it is certain that lessons drawn from their experience will help to design appropriate strategies for other regions, which are interested in adopting a similar strategy.

#### Global food shortages risk extinction from starvation and war

Julian Cribb, Professor in Science Communication at the University of Technology Sydney, 2010

(Julian, principal of JCA, fellow of the Australian Academy

of Technological Sciences and Engineering, “The Coming Famine: The

Global Food Crisis and What We Can Do to Avoid It”, pg 10

The character of human conflict has also changed: since the early 1990s, more wars have been triggered by disputes over food, land, and water than over mere political or ethnic differences. This should not surprise us: people have fought over the means of survival for most of history. But in the abbreviated reports on the nightly media, and even in the rarefied realms of government policy, the focus is almost invariably on the players—the warring national, ethnic, or religious factions—rather than on the play, the deeper subplots building the tensions that ignite conflict. Caught up in these are groups of ordinary, desperate people fearful that there is no longer sufficient food, land, and water to feed their children—and believing that they must fight "the others" to secure them. At the same time, the number of refugees in the world doubled, many of them escaping from conflicts and famines precipitated by food and re- source shortages. Governments in troubled regions tottered and fell. The coming famine is planetary because it involves both the immediate effects of hunger on directly affected populations in heavily populated regions of the world in the next forty years—and also the impacts of war, government failure, refugee crises, shortages, and food price spikes that will affect all human beings, no matter who they are or where they live. It is an emergency because unless it is solved, billions will experience great hardship, and not only in the poorer regions. Mike Murphy, one of the world's most progressive dairy farmers, with operations in Ireland, New Zealand, and North and South America, succinctly summed it all up: "Global warming gets all the publicity but the real imminent threat to the human race is starvation on a massive scale. Taking a 10-30 year view, I believe that food shortages, famine and huge social unrest are probably the greatest threat the human race has ever faced. I believe future food shortages are a far bigger world threat than global warming."

#### Plan key to switchgrass utilization

**Kausch 10** (Albert P., Ph.D in Molecular, Cellular and Development Biology at Iowa State University and Professor in the Department of Cell and Molecular Biology @ the University of Rhode Island. Published May 29, 2010 in Environmental Management. <http://plantsciences.utk.edu/pdf/stewart_moon_env_man.pdf>)

If bioenergy platforms such as switchgrass-to-cellulosic ethanol are to be economically viable, improved feedstocks must be developed that have high yield and decreased recalcitrance for the conversion of cell walls to fermentable sugars. To attain these goals, biotechnology will likely be needed to make improvements in feedstock (Gressel 2008). Several feedstock candidates, such as Panicum virgatum (switchgrass) have a number of wild traits and are not very domesticated compared with current row crops. This being the case, rapid gains should be attainable with plant breeding, especially for traits that are based on endogenous genetic variation. These traits include yield and dwarfism, which were foundational to the Green Revolution (Fernandez and others 2009). In contrast, other traits, such those related to recalcitrance, improved processing, and introduced bioproducts might be more readily conferred by biotechnology (Jacob and others 2009; Sainz 2009). In another example where biotechnology could be revolutionary, switchgrass or other C4 grasses could receive a large biomass boost from adding a single Miscanthus gene to increase cold temperature photosynthesis. The putative mechanism by which Miscanthus 9 giganteus maintains photosynthetic efficiency at cool temperatures is the result of the expression patterns and activity of a single C4pathway enzyme, pyruvate phosphate dikinase (PPDK) (Wang and others 2008; Dohleman and Long 2009). Thus, by simply increasing the expression of the PPDK gene in switchgrass, this crop could conceivably add significant biomass at early and late stages of the plant’s growing season (Stewart and others, unpublished). Regulatory costs and concerns are important considerations that must be made when transgenic plants are released into the environment, especially for commercialization. Both process and product of transgenic plants is regulated by most governments throughout the world, including the United States and China. Therefore, one important facet regarding sustainability of growing any transgenic biomass crop, such as switchgrass, is of a regulatory nature. Therefore, when we refer to sustainability in this paper—in the context of releasing transgenic plants— we explicitly consider that there should be an absence of negative environmental or regulatory events directly associated with transgenic plants. This absence is required for them to be usable over a number of years or decades. Regulators make decisions using risk assessment, which, in general, and specifically for biotechnology, is well developed (see Wolt and others 2009).We realize that sustainability is a complex concept that is not usually applied with regards to the regulatory durability of plants derived from biotechnology, but we would like to propose that promise of regulatory-driven sustainability is a prerequisite for the release of any transgenic plants. First, without the reasonable assurance of sustained compliance to regulations, a company will likely not invest funds to protect and implement the intellectual property required in biotechnology. Secondly, and related, biotechnology would likely not be deployed if there were a reasonable chance that a transgenic plant would be deemed environmentally hazardous and not approved by regulatory officials. Two important aspects of regulation and biosafety will be addressed here, and additional regulatory and risk assessment issues of bioenergy plants are discussed elsewhere (Wolt 2009). First, increasing yield, stress tolerance and other traits could conceivably also increase invasiveness or weediness of the transgenic crop itself (Warwick and Stewart 2005). Thus, whether introduced via breeding or biotechnology, new traits must be analyzed a priori for their potential to increase invasiveness, and then, critical field experiments must be performed prior to commercialization (e.g., Halfhill and others 2005). Second, gene flow from transgenic feedstocks to non-transgenic relatives, either crop or wild (Stewart and others 2003), must be prevented or mitigated (Stewart 2007; Kausch and others 2010). In this Forum, we give an overview of several biotechnology tools that could be useful for controlling transgene flow in perennial biomass grasses. Prevention of transgene flow is especially important when species or genera are indigenous to the region of intended cultivation, such as switchgrass in the US and Miscanthus in China (Stewart and others 2003; Stewart 2007). Transgenic crops have been grown commercially for 15 years, but no transgenic dedicated bioenergy feedstocks have yet to be commercialized. It will be important to rationally design transgenic feedstocks for environmental and regulatory-driven sustainability, as well as for bioenergy goals. It is doubtful we will get a second chance to get these things right if we get them wrong the first time. It is interesting to note that environmental sustainability is a major driver for the creation of the new bioeconomy. Everyone agrees that petroleum will eventually run out, and even if that were not the case, there are dire concerns over carbon emissions. Energy derived from perennial herbaceous grass biomass promises to actually sequester more carbon than emitted (Yuan and others 2008). Thus, if biotechnology can improve a plant so that it produces more biomass without invasiveness or compromising ecological functions, then environmental sustainability of a new industry can be facilitated by biotechnology. One large impediment to this realization is that biotechnology is specifically regulated as a mode to plant improvement. In some extreme cases, transgenic plants are totally banned from being grown in some regions, especially in Europe.

#### Switchgrass reduces CO2

**Prasifka 9.** (J.R., USDA-ARS, Corn Insects and Crop Genetics Research Unit, Genetics Laboratory c/o Insectary, Iowa State University and Richard L. Hellmich, Ph.D. from Ohio State, Assistant Professor of Entomology at Iowa State and Michael J. Weiss. “Role of Biotechnology in sustainable agriculture.” Published by Cambridge University Presse in 2009. https://netfiles.uiuc.edu/prasifka/www/othpub/2008%20Role%20of%20biotechnology%20%28Radcliffe%29.pdf)

The development of alternatives to petroleumbased fuels is one of the best-known biotechnology projects. Currently most farmers are dependent on diesel and gasoline to power agricultural equipment. This makes them reliant on a resource that is (1) non-renewable, (2) environmentally detrimental and (3) subject to price fluctuations arguably manipulated by petroleumexporting countries. The substitution of biologically based fuels (biofuels) such as ethanol or biodiesel may help to insulate farmers from price increases or price instability, and provide an additional source of revenue if maize, soybean or other crops are used to produce biofuels. Biotechnology is being used to more effectively produce ethanol from cellulose by the use of GM yeasts and bacteria. Similarly, genetic engineering is helping create plants that yield greater energy returns than currently available varieties. Applications of biotechnology also may allow fuels to be produced from by-products of agriculture otherwise considered waste. The benefits to the environment may increase as methods and technology related to biofuels advance. Non-food crops, including native perennial grasses, may offer the benefits of biofuels produced from maize or soybean, but with further advantages of reduced fertilizer, pesticide and energy inputs and helping to mitigate carbon dioxide emissions.

#### Warming is anthropogenic and THE ONLY existential risk

Warrants: sci consensus, disease, ice caps, shorter winters, sea temp, NASA measurent, runaway

Deibel 7 (Terry L, Professor of IR @ National War College, “Foreign Affairs Strategy: Logic for American Statecraft”, Conclusion: American Foreign Affairs Strategy Today)

Finally, there is one major existential threat to American security (as well as prosperity) of a nonviolent nature, which, though far in the future, demands urgent action. It is the threat of global warming to the stability of the climate upon which all earthly life depends. Scientists worldwide have been observing the gathering of this threat for three decades now, and what was once a mere possibility has passed through probability to near certainty. Indeed not one of more than 900 articles on climate change published in refereed scientific journals from 1993 to 2003 doubted that anthropogenic warming is occurring. “In legitimate scientific circles,” writes Elizabeth Kolbert, “it is virtually impossible to find evidence of disagreement over the fundamentals of global warming.” Evidence from a vast international scientific monitoring effort accumulates almost weekly, as this sample of newspaper reports shows: an international panel predicts “brutal droughts, floods and violent storms across the planet over the next century”; climate change could “literally alter ocean currents, wipe away huge portions of Alpine Snowcaps and aid the spread of cholera and malaria”; “glaciers in the Antarctic and in Greenland are melting much faster than expected, and…worldwide, plants are blooming several days earlier than a decade ago”; “rising sea temperatures have been accompanied by a significant global increase in the most destructive hurricanes”; “NASA scientists have concluded from direct temperature measurements that 2005 was the hottest year on record, with 1998 a close second”; “Earth’s warming climate is estimated to contribute to more than 150,000 deaths and 5 million illnesses each year” as disease spreads; “widespread bleaching from Texas to Trinidad…killed broad swaths of corals” due to a 2-degree rise in sea temperatures. “The world is slowly disintegrating,” concluded Inuit hunter Noah Metuq, who lives 30 miles from the Arctic Circle. “They call it climate change…but we just call it breaking up.” From the founding of the first cities some 6,000 years ago until the beginning of the industrial revolution, carbon dioxide levels in the atmosphere remained relatively constant at about 280 parts per million (ppm). At present they are accelerating toward 400 ppm, and by 2050 they will reach 500 ppm, about double pre-industrial levels. Unfortunately, atmospheric CO2 lasts about a century, so there is no way immediately to reduce levels, only to slow their increase, we are thus in for significant global warming; the only debate is how much and how serious the effects will be. As the newspaper stories quoted above show, we are already experiencing the effects of 1-2 degree warming in more violent storms, spread of disease, mass die offs of plants and animals, species extinction, and threatened inundation of low-lying countries like the Pacific nation of Kiribati and the Netherlands at a warming of 5 degrees or less the Greenland and West Antarctic ice sheets could disintegrate, leading to a sea level of rise of 20 feet that would cover North Carolina’s outer banks, swamp the southern third of Florida, and inundate Manhattan up to the middle of Greenwich Village. Another catastrophic effect would be the collapse of the Atlantic thermohaline circulation that keeps the winter weather in Europe far warmer than its latitude would otherwise allow. Economist William Cline once estimated the damage to the United States alone from moderate levels of warming at 1-6 percent of GDP annually; severe warming could cost 13-26 percent of GDP. But the most frightening scenario is runaway greenhouse warming, based on positive feedback from the buildup of water vapor in the atmosphere that is both caused by and causes hotter surface temperatures. Past ice age transitions, associated with only 5-10 degree changes in average global temperatures, took place in just decades, even though no one was then pouring ever-increasing amounts of carbon into the atmosphere. Faced with this specter, the best one can conclude is that “humankind’s continuing enhancement of the natural greenhouse effect is akin to playing Russian roulette with the earth’s climate and humanity’s life support system. At worst, says physics professor Marty Hoffert of New York University, “we’re just going to burn everything up; we’re going to heat the atmosphere to the temperature it was in the Cretaceous when there were crocodiles at the poles, and then everything will collapse.” During the Cold War, astronomer Carl Sagan popularized a theory of nuclear winter to describe how a thermonuclear war between the Untied States and the Soviet Union would not only destroy both countries but possibly end life on this planet. Global warming is the post-Cold War era’s equivalent of nuclear winter at least as serious and considerably better supported scientifically. Over the long run it puts dangers from terrorism and traditional military challenges to shame. It is a threat not only to the security and prosperity to the United States, but potentially to the continued existence of life on this planet.

#### Biotech key to nanotech

**Henley 2k,** “The RMA After Next,” Paramaters, Winter 99-00, pg. 46-57 “Advances in molecular…conventional mechanics.” <http://www.carlisle.army.mil/usawc/parameters/articles/99winter/henley.htm>)

Advances in molecular biology are not limited to genetic expression and immunology; some researchers are delving into the physical, mechanical processes by which living cells function. How meter-long neurons move signal molecules from one end to the other in a few milliseconds; how enzyme molecules rip apart the two halves of a DNA strand to permit cell reproduction; how bacteria propel themselves using structures that are only a few molecules in size; these are essentially mechanical questions, and Steven Block at Princeton is developing tools to measure and understand the processes involved.[10] In the case of neurons, for instance, the answer turns out to be a rail-like structure running from one end of the cell to the other, and another molecule that functions as a fast locomotive to haul the signal molecule along the rail at high speed and deliver it to the other end. This field of molecular biomechanics points toward a different approach to nanotechnology. The "traditional" approach, if one can use that term in so futuristic a field, seeks to build molecular structures modeled on the wheels, gears, levers, and electronics of the everyday world. Some refer to this as "dry" nanotechnology, because it shuns the biological approach and the water-filled environment in which biological molecules function. It remains to be seen whether the dry approach will yield useful machines any time soon. The molecular-scale world is a whole new environment for designers, with many novel problems including quantum effects, thermal vibration, and chemical reactions with the surrounding environment. But "wet" nano-devices are the very fabric of life, and it is likely that molecular biology will be a fruitful source of proven successful designs, based on markedly different principles than the gears-and-levers approach of conventional mechanics.

#### Nanosats solve ozone – German research studies prove

**Kaulaugher 3** Liz, editor of Environmental Research Web, an Institute of Physics publication that keeps its readers up to date on a range of environmental topics from around the globe (“Nanotechnology could save the ozone layer,” 1/30/03, <http://nanotechweb.org/cws/article/tech/16789>)

Whilst experimenting with nanospheres and perfluorodecalin, a liquid used in the production of synthetic blood, researchers at Germany's University of Ulm have stumbled across a phenomenon that could ultimately help remove ozone-harming chemicals from the atmosphere. The perfluorodecalin, against all expectations, was taken up by a water-based suspension of 60 nm diameter polystyrene particles. The scientists believe that this occurred because nanoscopic perfluorodecalin droplets became encapsulated by self-assembled polystyrene nanospheres. Perfluorodecalin has very similar properties to chlorofluorocarbons (CFCs), the inert liquids that are known to destroy the Earth's protective ozone layer. And the Ulm team reckons that aerosol particle-carrying water droplets or ice crystals in clouds may be able to collect up chlorofluorocarbons in the same way, eventually returning them harmlessly to Earth as rain, hail or snow. "I realized that I had developed a useful model system for the simulation of microphysical processes in the stratosphere," Andrei Sommer of the University of Ulm told nanotechweb.org. "In particular, for [simulating] the very complicated interplay between cloud droplets, nanoscopic aerosols emitted by man-made and natural sources, and chlorofluorocarbons - the principal ozone killers." The solid aerosols that arise from urban and industrial sources, for example petrol and diesel particles, are roughly the same size as the polystyrene nanospheres used in this experiment. "Nanoscale aerosols - which are also accused of suppressing rain and reducing the amount of sun reaching the Earth's surface - could in fact be helpful in reducing the stratospheric concentrations of ozone killers," added Sommer. Sommer says that if tests confirm the predictions from the simple model system, the result could be a practical strategy to stop, or possibly even repair, one of the two potentially most destructive global problems caused by mankind. He reckons scientists could use space technology to carry large amounts of specially designed non-toxic nanoscale particles into the heart of the ozone hole. In the short term, Sommer says it's worth optimizing the properties of such nanoscale particles - for example, aerosol size, chemical composition and solubility - while reducing the cost. Then it's a case of encouraging international space agencies to begin airborne experiments. Back on Earth, meanwhile, the perfluorodecalin-based nanosphere suspension research could also have applications in nanopatterning and biofunctionalization techniques for biomaterials. The scientists reported their work in Nano Letters.

#### No ozone means no ocean biodiversity

EPA 11 (January 1/13/2011, “Health and Environmental Effects of Ozone Layer Depletion”, <http://www.epa.gov/ozone/science/effects/index.html> TC, EA)

The Connection Between Ozone Layer Depletion and UVB Radiation Reductions in stratospheric ozone levels will lead to higher levels of UVB reaching the Earth's surface. The sun's output of UVB does not change; rather, less ozone means less protection, and hence more UVB reaches the Earth. Studies have shown that in the Antarctic, the amount of UVB measured at the surface can double during the annual ozone hole. Another study confirmed the relationship between reduced ozone and increased UVB levels in Canada during the past several years. Effects on Human Health Laboratory and epidemiological studies demonstrate that UVB causes nonmelanoma skin cancer and plays a major role in malignant melanoma development. In addition, UVB has been linked to cataracts -- a clouding of the eye’s lens. All sunlight contains some UVB, even with normal stratospheric ozone levels. It is always important to protect your skin and eyes from the sun. Ozone layer depletion increases the amount of UVB and the risk of health effects. EPA uses the Atmospheric and Health Effects Framework (AHEF) model, developed in the mid 1980s, to estimate the health benefits of stronger ozone layer protection policies under the Montreal Protocol. EPA estimates avoided skin cancer cases, skin cancer deaths, and cataract cases in the United States. Protecting the Ozone Layer Protects Eyesight – A Report on Cataract Incidence in the United States Using the Atmospheric and Health Effects Framework Model (68 pp, 1.52 MB, About PDF) This 2010 peer-reviewed EPA report shows the AHEF model’s capability to estimate avoided cataract incidence, due to improved spatial resolution and information on the biological effects of UV radiation. A one page fact sheet summarizes the background, key findings, and future research topics for the AHEF model on UV radiation and cataracts. Human Health Benefits of Stratospheric Ozone Protection (PDF) (83 pp, 1.2 MB, About PDF) This 2006 peer-reviewed report describes the analytical and empirical methodologies used by the AHEF model. Effects on Plants Physiological and developmental processes of plants are affected by UVB radiation, even by the amount of UVB in present-day sunlight. Despite mechanisms to reduce or repair these effects and a limited ability to adapt to increased levels of UVB, plant growth can be directly affected by UVB radiation. Indirect changes caused by UVB (such as changes in plant form, how nutrients are distributed within the plant, timing of developmental phases and secondary metabolism) may be equally, or sometimes more, important than damaging effects of UVB. These changes can have important implications for plant competitive balance, herbivory, plant diseases, and biogeochemical cycles. Effects on Marine Ecosystems Phytoplankton form the foundation of aquatic food webs. Phytoplankton productivity is limited to the eup**h**otic zone, the upper layer of the water column in which there is sufficient sunlight to support net productivity. The position of the organisms in the euphotic zone is influenced by the action of wind and waves. In addition, many phytoplankton are capable of active movements that enhance their productivity and, therefore, their survival. Exposure to solar UVB radiation has been shown to affect both orientation mechanisms and motility in phytoplankton, resulting in reduced survival rates for these organisms. Scientists have demonstrated a direct reduction in phytoplankton production due to ozone depletion-related increases in UVB. One study has indicated a 6-12% reduction in the marginal ice zone. Solar UVB radiation has been found to cause damage to early developmental stages of fish, shrimp, crab, amphibians and other animals. The most severe effects are decreased reproductive capacity and impaired larval development. Even at current levels, solar UVB radiation is a limiting factor, and small increases in UVB exposure could result in significant reduction in the size of the population of animals that eat these smaller creatures. Effects on Biogeochemical Cycles Increases in solar UV radiation could affect terrestrial and aquatic biogeochemical cycles, thus altering both sources and sinks of greenhouse and chemically-important trace gases e.g., carbon dioxide (CO2), carbon monoxide (CO), carbonyl sulfide (COS) and possibly other gases, including ozone. These potential changes would contribute to biosphere-atmosphere feedbacks that attenuate or reinforce the atmospheric buildup of these gases. Effects on Materials Synthetic polymers, naturally occurring biopolymers, as well as some other materials of commercial interest are adversely affected by solar UV radiation. Today's materials are somewhat protected from UVB by special additives. Therefore, any increase in solar UVB levels will therefore accelerate their breakdown, limiting the length of time for which they are useful outdoors.

**Aquatic biodiversity checks extinction**

**Craig 3**, Associate Prof Law, Indiana U School Law, 2003(McGeorge Law Review, 34 McGeorge L. Rev. 155 Lexis)

Biodiversity and ecosystem function arguments for conserving marine ecosystems also exist, just as they do for terrestrial ecosystems, but these arguments have thus far rarely been raised in political debates. For example, besides significant tourism values - the most economically valuable ecosystem service coral reefs provide, worldwide - coral reefs protect against storms and dampen other environmental fluctuations, services worth more than ten times the reefs' value for food production. n856 Waste treatment is another significant, non-extractive ecosystem function that intact coral reef ecosystems provide. n857 More generally, **"ocean ecosystems play a major role in the global geochemical cycling of all the elements that represent the basic building blocks of living organisms, carbon, nitrogen, oxygen, phosphorus, and sulfur, as well as other less abundant but necessary elements."** n858 In a very real and direct sense, therefore, **human degradation of marine ecosystems impairs the planet's ability to support life. Maintaining biodiversity is often critical to maintaining the functions of marine ecosystems.** Current evidence shows that, in general, **an ecosystem's ability to keep functioning in the face of disturbance is strongly dependent on its biodiversity, "indicating that more diverse ecosystems are more stable**." n859 Coral reef ecosystems are particularly dependent on their biodiversity.  [\*265]   Most ecologists agree that the complexity of interactions and degree of interrelatedness among component species is higher on coral reefs than in any other marine environment. This implies that the ecosystem functioning that produces the most highly valued components is also complex and that many otherwise insignificant species have strong effects on sustaining the rest of the reef system. n860 **Thus, maintaining and restoring the biodiversity of marine ecosystems is critical to maintaining and restoring the ecosystem services that they provide.** Non-use biodiversity values for marine ecosystems have been calculated in the wake of marine disasters, like the Exxon Valdez oil spill in Alaska. n861 Similar calculations could derive preservation values for marine wilderness. However, economic value, or economic value equivalents, should not be "the sole or even primary justification for conservation of ocean ecosystems. Ethical arguments also have considerable force and merit." n862 At the forefront of such arguments should be a recognition of how little we know about the sea - and about the actual effect of human activities on marine ecosystems. The United States has traditionally failed to protect marine ecosystems because it was difficult to detect anthropogenic harm to the oceans, but we now know that such harm is occurring - even though we are not completely sure about causation or about how to fix every problem. Ecosystems like the NWHI coral reef ecosystem should inspire lawmakers and policymakers to admit that most of the time we really do not know what we are doing to the sea and hence should be preserving marine wilderness whenever we can - especially when the United States has within its territory relatively pristine marine ecosystems that may be unique in the world. We may not know much about the sea, but we do know this much: **if we kill the ocean we kill ourselves, and we will take most of the biosphere with us.**

### Plan: The United States Federal Government should substantially increase its economic engagement toward Cuba by signing a biotechnology science and technology agreement with the Republic of Cuba.

## Contention 3 Solvency

#### **Cuba Says yes- he wants a western party**

Starr 04, Douglas. co-director of the Center for Science and Medical Journalism at Boston University "The Cuban Biotech Revolution - New York Latino Journal." The Cuban Biotech Revolution - New York Latino Journal. New York Latino Journal, 2004. Web. 21 Oct. 2013. <http://nylatinojournal.com/home/business\_economics/med\_biotech/the\_cuban\_biotech\_revolution.html>.

Today the country is the largest medicine exporter in Latin America and has more than 50 nations on its client list. Cuban meds cost far less than their first-world counterparts, and Fidel Castro's government has helped China, Malaysia, India, and Iran set up their own factories: "south-to-south technology transfer." Yet at the same time as they were selling generics, the science-heroes of the Cuban Revolution were inventing. Castro made biotechnology one of the building blocks of the economy, and that has opened the door - just a crack - to intellectual property. To date his researchers have been granted more than 100 patents, 26 of them in the US. Now they"re setting their sights on the markets of the West.

#### **US legislation blocks biotech industry now**

Fienberg 12, Robert E. "The New Cuban Economy What Roles for Foreign Investment?" Latin America Initiative at Brookings. The Brookings Institute, Dec. 2012. Web. <http://www.brookings.edu/~/media/research/files/papers/2012/12/cuba%20economy%20feinberg/cuba%20economy%20feinberg%209.pdf>.

Law 77 (Chapter IV, Article 10) allows for FDI in all sectors except health, education, and “the armed forces institutions, with the exception of the latter’s commercial system .” In practice, JVs have also been largely excluded from two sectors where foreign investors could make a huge contribution: sugar and biotechnology . 41 In the case of sugar production, the obstacles appear to be rooted in revolutionary history . The expropriations of the large, often foreign-owned estates were a hallmark of the revolution; to return the land to foreign hands might seem an inglorious retreat . There is also the unresolved question of compensation to the former owners, necessary to free the lands from potential legal challenges by claimants and U .S . sanctions . Today, as officials reconsider FDI within the context of economic reforms, there is a sharp debate over whether and to what degree to further open food processing and agro-industry, including sugar-based biomass, to external capital . In an apparent victory for more favorable treatment for FDI, in late 2012 and after lengthy negotiations, the Cuban government approved a joint venture, Biopower, S .A ., with British investors, to generate biomass from sugar derivatives; the roughly $50 million investment is to construct a 30 megawatt power plant . Billed as a pilot project, the British firm, Havana Power, hopes that other biomass energy projects will follow.

#### Pressure to lift now- cancervax checks da links

Wylie 10, Lana. Dr. Lana Wylie, an Associate Professor in Political Science at McMaster University, received her Doctorate in cPolitical Science from University of Massachusetts, Amherst in 2003. She held a Postdoctoral fellowship at the Institution for Social and Policy Studies at Yale University in 2003-2004."Reassessing Canada’s Relationship with Cuba in an Era of Change." Canadian International Council. CIC, Oct. 2010. Web. <http://www.opencanada.org/wp-content/uploads/2011/05/Reassessing-Canada%E2%80%99s-Relationship-with-Cuba-in-an-Era-of-Change-Lana-Wylie1.pdf>.

The biotechnology sector benefits from an exceptionally well-educated population and a concerted effort by the state to support the industry even in times of great difficulty. Cuba is best known for its innovative vaccine research; it produces vaccines for everything from flu to lung cancer. Furthermore, Cuban scientists are conducting promising research in other areas of biotechnology and medical sciences. A conservative estimate indicates that Cuban scientific institutes have at least 100 products in their drug pipeline. Biotech and pharmaceutical companies from many countries have invested in this sector through joint venture agreements. For example, Beckpharma, a British pharmaceutical company, is collaborating with Cuban research institutes to engineer drugs that Beckpharma will make available worldwide.76American policy-makers have felt pressured to make an exception to the embargo in this area because of the ability of the Cubans to advance medical treatments for many diseases.77 Indeed, given the advances in Cuban research, exceptions have already been made to the embargo in the area of biotechnology. In 2004 the California company CancerVax received approval to develop three Cuban cancer drugs. Although CancerVax was required to pay Cuba in medicine or food, it was a historic deal since this was the first deal approved to develop drugs between a US biotech company and Cuba.78 If Cuban biotechnology continues to produce successful medical treatments and pharmaceutcals, the pressure on American policy-makers to normalize relations will likely become even more intense.

#### Hard for international companies to invest now and no politics link

Wylie 10, Lana. Dr. Lana Wylie, an Associate Professor in Political Science at McMaster University, received her Doctorate in cPolitical Science from University of Massachusetts, Amherst in 2003. She held a Postdoctoral fellowship at the Institution for Social and Policy Studies at Yale University in 2003-2004."Reassessing Canada’s Relationship with Cuba in an Era of Change." Canadian International Council. CIC, Oct. 2010. Web. <http://www.opencanada.org/wp-content/uploads/2011/05/Reassessing-Canada%E2%80%99s-Relationship-with-Cuba-in-an-Era-of-Change-Lana-Wylie1.pdf>.

Yet companies like YM Biosciences recognize that Cuban ventures carry additional risks, most significantly because of opposition from the United States. David Allen, chief executive of the company, explains, “Developing a product that originates in Cuba is definitely a greater challenge than developing a product that originates elsewhere.”79 Working with Cuban partners makes it difficult to market drugs in the United States and greatly complicates the already tricky process of gaining approval from the American Food and Drug Administration. Although there are serious drawbacks to these projects, companies can overcome the hurdles. For example, the partnership between YM Biosciences and Cuba’s CIM was able to expand in 2004 to include the American corporation CancerVax. YM Biosciences was further encouraged by early signals from the Obama administration. In an April 2009 update for its investors, the company reported that “the enlightened approach demonstrably being adopted toward Cuba matters, consistent with the stated position of senior members of the current US administration (including President Obama), holds out the prospect for positive consequences for our drug which will benefit both our stakeholders and cancer patients in the US.”80

# 2ac

#### Cuban biotechnology is key to ag and aquaculture

**Haseltine 12**, Bill. "The Cuban Biotechnology Industry." Brookings. Brookings Institute, 2012. Web. <http://www.brookings.edu/~/media/newsletters/pres\_letter/052012/cuba\_biotech\_report>.

**The industry’s initial products were targeted to fight diseases of children and mothers**. **The results have been spectacular. Cuba has one of the lowest rates of infant and maternal mortality. Polio, neonatal tetanus, diphtheria, measles, rabies, mumps, whooping cough, and congenital rubella have been eradicated**. **Hepatitis B in the adult population is on the verge of eradication**. **Additionally, the rates of bacterial meningitis are amongst the lowest in the world.** **Cuba has recently embarked on a program to diagnose rare, inherited neurologic diseases. They have implemented a universal screening program for infants for congenital hypothyroidism, phenylketonurea, congenital adrenal hyperplasia, biotindase deficiency and galactosemia, the only such comprehensive program of which I am aware. Cuba has also begun providing cochlear implants to all infants born deaf and blind and is planning to expand this coverage to all Cuban children in need**. The list of drugs under development is impressive**. One such drug, for the treatment of diabetic foot ulcers, is of special interest to me as we at Human Genome Sciences tried without success to develop a similar drug. Diabetic ulcers are a large and growing problem globally**; **they often result in a successive series of amputations**. **By developing a new method of administration (direct injection of the epidermal growth factor into the wound), the Cubans seem to be succeeding in finding a treatment**. The results of a global human trial are impressive, and such results would add substantial value to any other company. **Another drug of interest is a vaccine for the cure of hepatitis B**. This new drug is a novel formulation of the Hepatitis B vaccines they had previously developed—**it is prepared as micro particles and administered as a nasal spray.** They report that in this form, the vaccine is sufficiently potent toeliminate chronic Hepatitis B infection. Gilead, a U.S. based anti-viral company, recently purchased a U.S. biotech company for about $10 billion in order to acquire a drug at the same stage of testing with similar potential. **Other innovative approaches to cancer therapy, and heart disease, would, I believe, be proud additions to the development pipeline at any pharmaceutical company**. **The industry has also produced agricultural sector products, including a vaccine that reduces bovine tick-borne diseases (the vaccines produces antibodies that, when ingested by the tick, weaken it and reduce its ability to reproduce), a fish food supplement suitable for enhancing the growth of both fish and shrimp, and what I believe is an organic anti-nematode product suitable for use in intensive truck farming**. Cuba is a poor country undergoing the demographic crises of wealthy nations. The birthrate is well below the country’s replacement rate. The demographic problem is exacerbated by massive immigration of young men and women who see no viable future for themselves in Cuba. **Economic reforms are underway, but they are small and their implementation is very slow**. **The intention of the reforms seems to be to preserve, not change the political system**. The type of success enjoyed by the Cuban biotechnology industry does make the point that some state-run enterprises can be successful and meet demanding goals. The defense industry of the former Soviet Union and, to a large extent, the defense research establishment in the U.S. are other examples of successful state-run businesses.

### Dipcap updates

#### Julani visit and Pakistan talks

AP Pakistan 1/4. "Jilani Emphasises Diplomatic Outreach to Boost Pak-US Ties." *Business Recorder*. Business Recorder, 4 Jan. 2013. Web. 03 Jan. 2014. <http://www.brecorder.com/business-a-economy/189/1140210/>.

Pakistan's new ambassador to the United States Jalil Abbas Jilani has said he is in Washington with a 'positive message' to promote Pakistan-US relations and an emphasis on expanding trade and economic co-operation. Ambassador Jilani, who started functioning fully as Pakistan's top diplomat in Washington after presenting his credentials to the US State Department on Thursday, also discussed ways to enhance wide-ranging relationship in a meeting with US Special Representative James Dobbins. "We discussed bilateral relations, our perspective with regard to Afghanistan and the need to cooperate and co-ordinate," Jilani said in an interaction with Washington-based Pakistani journalists. Jilani's priorities include strengthening bilateral co-operation in trade, economic, energy and defence fields as well as other areas covered under the Pakistan-US Strategic Partnership Dialogue. "Pakistan-US dialogue is going on well, we have covered a lot of ground in Pakistan-US relations," he emphasised, contrasting the current improved state of relations with strains of recent years. In line with the Pakistani leadership's directives, he will advise all consul generals serving in the United States to dedicate efforts towards promoting trade, economic and investment relations between the two countries. The ambassador's diplomatic outreach in Washington will include deepening engagement with members of US Congress and think tank community. On carrying forward Islamabad-Washington ties, he particularly noted that Prime Minister Nawaz Sharif's visit to Washington in October 2013 generated a lot of goodwill and helped set a positive momentum in the important bilateral relationship.

#### Asia rebalancing link triggers

BPA 12/16. "The East Asia-Pacific Rebalance: Expanding U.S. Engagement." *BUREAU OF PUBLIC AFFAIRS*. U.S. Department of State, 16 Dec. 2013. Web. 03 Jan. 2014. <http://www.state.gov/r/pa/pl/2013/218776.htm>.

“As a Pacific nation that takes our Pacific partnership seriously, the United States will continue to build on our active and enduring presence.” – Secretary of State John Kerry Recognizing that America’s future prosperity and security are intertwined with the East Asia-Pacific region, President Barack Obama made a strategic commitment to rebalance our efforts and investments toward Asia. The United States will remain a strong, reliable, and active partner in the region and is investing diplomatic, public diplomacy, military, and assistance resources in a way that is commensurate with our comprehensive engagement. We continue to emphasize economic development, energy cooperation, people-to-people exchanges, youth, and education in our programs. U.S. Objectives Modernize and strengthen U.S. alliances; Develop and strengthen ties with emerging partners; Support effective regional institutions that strive to solve problems based on internationally-recognized rules and norms; Increase trade and investment and expand broad-based economic growth; Ensure our military presence in the region effectively supports the full range of our engagement; Promote democratic development, good governance, and human rights;

Expand people-to-people ties.

#### Kerry Pushing now

Blair 1/2, David. David Blair returned to the Daily Telegraph to become Chief Foreign Correspondent in November 2011. He previously worked for the paper as Diplomatic Editor, Africa Correspondent and Middle East Correspondent. "John Kerry and America to the Rescue – but Is It Too Late?" *The Telegraph*. Telegraph Media Group, 2 January 2014. Web. 03 Jan. 2014. <http://www.telegraph.co.uk/news/worldnews/northamerica/usa/10547284/John-Kerry-and-America-to-the-rescue-but-is-it-too-late.html>.

John Kerry has many faults, but poverty of ambition is not among them. In the first half of 2014, the US Secretary of State has placed two items at the top of his “to do” list. One: secure a final peace agreement between Israel and the Palestinians, preferably by April. Two: settle the confrontation over Iran’s nuclear ambitions once and for all, hopefully before August. Then, with both of those Gordian knots safely cut, Mr Kerry might turn his hand to other tasks, like curing cancer, or exploring mining opportunities on Mars. In truth, the easy jibes are unfair – for Mr Kerry really has decided that his mission is to settle the most poisonous and intractable conflicts the world has to offer. Other holders of his job, such as Colin Powell, were crippled by the follies of their presidents. Some, such as Hillary Clinton, shrank away from the thorniest problems because of their own ambitions to win the highest office. But Mr Kerry sees things differently. He believes that if the foreign minister of the world’s superpower is not going to accept responsibility for trying to solve these problems, no one else will. Having seen his presidential ambitions go up in smoke when he lost to George W Bush in 2004, Mr Kerry is now bidding for the ultimate consolation prize: to be remembered as the most significant secretary of state since George Marshall. Indeed, at the age of 70, Mr Kerry appears to have been liberated from the fear of failure. Concentrating on the Middle East is a remarkable choice in itself. We live in a world where Asia is booming, China’s rise appears unstoppable and America’s great strategic interests lie in the Pacific. Back in 2011, President Obama announced that the focus of US military and diplomatic strength would “pivot” towards Asia. Yet Mr Kerry landed in Israel yesterday, visiting the Middle East for 10th time since taking office only 11 months ago. Asked whether the Secretary of State was spending the majority of his time on the Middle East, a State Department official archly raised an eyebrow and replied: “Oh yes!” In other words, Mr Kerry is now doing exactly what European leaders have always demanded of America. Throughout the Bush era, one European foreign minister after another would lament Washington’s failure to negotiate directly with Iran, or to make a sustained push for an Israeli-Palestinian agreement. In diplomatic parlance, “American engagement” was the missing piece of the puzzle – and nothing else would work.

**2ac Asia Pivot**

1. **No way to measure diplomatic capital, perception is changing at a moments notice general consensus is horrible way to measure things- AKA once there was a thing called separate but equal and general consensus was that it was fine.**
2. **There link uniqueness is shit**
3. **Middle East**

**Despite rhetoric of pivoting to Asia, Middle East conflicts will keep the US embroiled there**

**Burns 13**

Nicholas, GlobalPost senior foreign affairs columnist, is professor of the practice of diplomacy and international politics at the Harvard Kennedy School of Government, “Why Egypt matters to the US,” http://www.globalpost.com/dispatches/globalpost-blogs/commentary/why-egypt-matters-to-united-states ///cmf

**Washington cannot focus** its energies **on all 22 Arab states** simultaneously, and **Egypt should be the overwhelming priority**. That is one reason why staying involved in Egypt, making a substantial increase in American economic aid, and resolving to make a much greater effort to support democratic forces there is so important.¶ Second, this week’s events in Egypt also remind us, once again, of the continued importance of the Middle East to American interests. The **Obama** administration **announced in 2011 a major shift in American foreign policy toward Asia**. **It was widely understood to be a pivot from our decades-long involvement in the turbulent Middle East to a priority focus on Asia**, with a rising China challenging us for global power.¶ The instinct that Asia will be the most important region for American engagement in this century is not wrong. It is just premature.¶ **Events in Egypt and** the continued challenges of the bloody civil war in **Syria, the long-standing Israeli-Palestinian struggle, and a recalcitrant Iran mean the US will be more occupied on a daily basis with the problems of the Middle East than any other region for at least the rest of the decade** — and probably well beyond. America’s vital interests are still very much on the line there. **The region’s poverty, instability, energy resources, growing Shia-Sunni divide and revolutionary ferment all point to a continuing American preoccupation. Any dream of a sharp shift of American attention away from the Middle East is illusory.**

1. **Africa**

**Recent commitment to sustained engagement in African energy thumps the DA**

**Goldman 13**

Julianna, “Obama plans $7bn African energy venture,” http://www.bdlive.co.za/africa/africanbusiness/2013/07/01/obama-plans-7bn-african-energy-venture ///cmf

US PRESIDENT Barack **Obama has plans for an initiative to enhance access to electricity across Africa** by tapping the continent’s vast energy resources and attracting international investment.¶ **The US administration said the $7bn venture, called Power Africa, will** complement an additional $9bn in private funds to **double access to power in sub-Saharan Africa**. According to the White House more than two-thirds of the population is without electricity.¶ Mr Obama unveiled the energy programme at the University of Cape Town on Sunday night.¶ "We’re looking to provide support and partnership so the lights can turn on and stay on," said Gayle Smith, National Security Council senior director for development and democracy.¶ Mr **Obama arrived in Cape Town** on Sunday morning **on the second leg of a trip to Africa where he has been promoting trade and investment, pledging sustained US engagement** and underscoring the importance of democratic values to economic growth.¶ The failing health of former president Nelson Mandela has weighed heavily on the trip and Mr Obama has spent his time, especially in the South African icon’s home country, invoking his legacy as a model for the continent’s leaders to earn international respect and credibility.¶ Mr Obama visited Robben Island, a landmark in Madiba’s life and the antiapartheid movement. Robert F Kennedy delivered his Ripple of Hope speech in 1966 at Cape Town University, shortly after Mr Mandela was jailed.¶ "It is from numberless diverse acts of courage and belief that human history is shaped," Mr Kennedy said at the time. "Each time a man stands up for an ideal, or acts to improve the lot of others, or strikes out against injustice, he sends forth a tiny ripple of hope," said the senator, then a US presidential candidate.¶ "And crossing each other from a million different centres of energy and daring those ripples build a current which can sweep down the mightiest walls of oppression and resistance."¶ Mr Obama also visited a community centre that focuses on HIV/AIDS prevention with Archbishop Emeritus Desmond Tutu.¶ "The types of countries that are part of Power Africa, for instance, are the ones who are doing the right things on governance," said deputy National Security Council director Ben Rhodes.¶ "If we’re going to get investment from international development banks, from private-sector partners, they need to have the predictability that comes with the rule of law and governance."¶ **The venture will begin in six countries** — Ethiopia, Ghana, Kenya, Liberia, Nigeria and Tanzania — to add more than 10,000MW of cleaner, more efficient electricity-generation capacity and will increase electricity access to at least 20-million new households and commercial entities, according to the US.¶ General Electric is among the companies that have contributed to the $9bn in private-sector funding for the programme’s first phase and has committed to help bring 5,000MW of new energy to Tanzania and Ghana.¶ "We are in a situation where poverty is being conquered on this continent at a speed that is unprecedented," said Ms Smith. "It’s much more targeted assistance from us than in the past."¶ Sunday’s announcement follows criticism that Mr Obama’s engagement with sub-Saharan Africa has lagged behind that of his predecessors Bill Clinton and George W Bush, creating an opening for countries such as China to tap the region’s resources.¶ Mr Bush, who took US spending on Africa to new levels, made a six-country visit in 2008 and a three-country stop in 2011 after he left the White House.¶ His Africa legacy includes the US President’s Emergency Plan for AIDS Relief (Pepfar), a $15bn commitment to prevent and treat AIDS infections, credited with saving or extending millions of lives on the continent.¶ Mr Clinton signed the African Growth and Opportunity Act, an important trade agreement with countries in sub-Saharan Africa.¶ Mr Obama was largely occupied in his first term with the US financial crisis, wars in Iraq and Afghanistan and a foreign policy pivot towards Asia.¶ A year ago**, he issued a policy directive on sub-Saharan Africa calling for expanded economic growth and pressing for stronger democratic institutions.¶** Mr Obama will travel to Tanzania on Monday for the last stop of his tour and to the country’s fast-growing Dar es Salaam to convene a roundtable of company executives and promote investments in electrification projects.

### 2ac co2 ag

**Warming kills agriculture – turns war and overcomes all defense. Adaptation can’t solve.**

**Zhang et al 07** – professor of geography at University of Hong Kong/ Peter Brecke from Sam Nunn School of International Affairs, Georgia Institute of Tech/others (David D., “Global Climate Change, War, and Population Decline in Recent Human History”, 10/23/07; < http://www.pnas.org/content/104/49/19214.full#aff-1>)//Beddow

Although scientists have warned of possible social perils resulting from climate change, the impacts of long-term climate change on social unrest and population collapse have not been quantitatively investigated. In this study, high-resolution paleo-climatic data have been used to explore at a macroscale the effects of climate change on the outbreak of war and population decline in the preindustrial era. We show that **long-term fluctuations of war frequency and population changes followed the cycles of temperature change.** Further analyses show that cooling impeded agricultural production, which brought about a series of serious social problems, including price inflation, then successively war outbreak, famine, and population decline successively. The findings suggest that worldwide and synchronistic war–peace, population, and price cycles in recent centuries have been driven mainly by long-term climate change. The findings also imply that social mechanisms that might mitigate the impact of climate change were not significantly effective during the study period. Climate change may thus have played a more important role and imposed a wider ranging effect on human civilization than has so far been suggested. Findings of this research may lend an additional dimension to the classic concepts of Malthusianism and Darwinism. Scientists have noted that social activities heavily depend on climate. They have also pointed out that temperature probably influences our lives more than any other climatic factor and **human society is especially vulnerable to large, long-term temperature changes (1)**. However, scientific research on the social effects of climate change has tended to focus on the economic costs of current and future climate change and has neglected the study of how societies have historically reacted to long-term climate change. This neglect is unfortunate because a better understanding of how past climatic changes have influenced human society may help us better understand our future prospects. Recently, important attempts have been made to use high-resolution, reconstructed paleo-climatic data to elucidate individual cases of prehistoric cultural/population collapses caused by agricultural failure in the Middle East, United States, and China (2–4). Webster (5) pointed out that warfare was an adaptive ecological choice in prehistoric societies with limited resources and growing populations, although he was not able to use systematic, scientific data to support his conclusion. The concept of environmental conflict has been suggested by several researchers, but they focus only on conflicts caused by short-term climate variations and meteorological events (6–9). Galloway (10) found that long-term climate change controlled population size in middle-latitude areas. However, his finding lacked quantitative precision because of the absence of high-resolution climate records at the time. We studied a long span of Chinese history and found that the number of war outbreaks and population collapses in China is significantly correlated with Northern Hemisphere (NH) temperature variations and that all of the periods of nationwide unrest, population collapse, and dynastic change occurred in the cold phases of this period (11–13). As a result of recent scientific breakthroughs in establishing more precise paleo-climatic records [see supporting information (SI) Text ], we extend the earlier study to the global and continental levels between A.D. 1400 and A.D. 1900, during the Little Ice Age (LIA; see SI Text ). The hypothesis we propose posits that l**ong-term climate change has significant direct effects on land-carrying capacity (as measured by agricultural production)**. Fluctuation of the carrying capacity in turn affects the food supply per capita. **A shortage of food resources in populated areas increases the likelihood of armed conflicts, famines, and epidemics, events that thus reduce population size.** As a feedback mechanism, population decline has a dominant tendency to increase the food supply per capita (seen in decreasing food prices), which results in relative peace and fast population growth. The interactions among these components in a social system create an important rhythm of macrohistory in agricultural societies. The simplified pathways of the above chain reactions and feedback loops are represented in SI Fig. 3. With respect to the character of the causal pathways, **the relation between climate and agricultural production has been demonstrated by many empirical studies (10, 14).** Under ecological stress, adaptive choices for animal species are the reduction of population size, migration, and dietary change. Depopulation typically takes place through starvation and cannibalism. **Human**s have more **pathways**, social mechanisms, **to adapt to climate change and mitigate ecological stress.** Besides migration, they **include warfare**, economic change, innovation, trade, and peaceful resource redistribution. We believe that in late agrarian society established political boundaries in populated areas limited mass migration; the result of such mass migration, when it occurred, often was war. Economic change was a costly and slow process that involved changing cultures, technologies, and habits. **When the speed of human innovation and its transfer were not fast enough to keep pace with rapid ecological change, famine and disease became difficult to avoid. Trade and redistribution under the condition of shrinking resources would not help much because the ecological stress was at a global or very large regional scale. Finally, human social development in the form of international and national institutions was not strong enough to buffer the tensions caused by food resource scarcity. Therefore, war and population decline became common consequences of climate-induced ecological stress** in the late preindustrial era. Recent developments in resource and environmental studies (e.g., refs. 8, 9, 15, and 16) suggest that limited resources and environmental degradation would have caused armed conflicts in human history. However, these perceived climate–war–population decline sequences have never been substantiated with scientific evidence consisting of long-term time series. In the following sections, we verify our hypothesis and evaluate the role of climate change on war outbreak and population decline with empirical data at global and continental scales.

**Warming kills agricultural production – CO2 fertilization is negligible by comparison.**

**Hofstrand 11** – Agricultural Economist, Co-Director Agricultural Marketing Resource Center, Iowa State University Extension (Don, “Climate Change Beginning to Impact Global Crop Production”, September 2011; < http://www.agmrc.org/renewable\_energy/climate\_change\_and\_agriculture/climate-change-beginning-to-impact-global-crop-production/>)//Beddow

The demand for world agriculture output will grow exponentially over coming decades due to world population growth and expanding world economies. At the same time, **the agriculture sector will be impacted by changes in climate that will challenge the productivity of the world’s agriculture resources.** World population will continue to grow at a rapid rate. World population in 2010 was 6.9 billion people. By 2050 it is expected to grow to 9.3 billion people. This is a 35 percent increase in just 39 years or the addition of an average of 60 million people every year. For perspective this increase is equivalent to adding the population of the United States eight times to world population by 2050. The world’s agriculture resource base will be required to increase production to meet this increase. In addition to population growth there has been an explosion of people moving out of poverty and into the middle class. This has occurred in several countries of the world but primarily in China and India that collectively make up over one-third of the world’s population. Rapid economic growth in these countries has resulted in increasing livings standards for a significant portion of their populations. **As living standards increase, people’s diets change. Diets high in meat, which usually occurs as living standards improve, increase the demands on the agriculture sector because multiple pounds of feed are required to produce a pound of meat.** At the same time, millions of people in Africa and around the world remain in poverty. These people live in an environment of food insecurity where a weather event can quickly move them to a situation of food shortages. People in these regions are very sensitive to agricultural commodity price changes. They spend a much larger percentage of their incomes on food as compared to people in the developed world. Climate change has begun to impact the agricultural landscape. The continuation of these changes due to **rising greenhouse gases will challenge the agriculture sector** to finds ways to maintain and improve productivity. Recent research has shown that **climate change is already beginning to have a negative impact on global crop production levels.** The research project, a collaborative effort by researchers at Stanford University, Columbia University and the National Bureau of Economic Research, examined the impact of climate change on the global production of maize, wheat, rice and soybeans from 1980 to 2008. These are the four largest commodity crops and represent roughly 75 percent of the calories that humans directly or indirectly consume. Access to the report can be found at Climate Trends and Global Crop Production since 1980. The research is focused on temperature and precipitation changes over this period. A database of yield response models were developed to evaluate the impact of these climate trends on crop yields over the corresponding 1980 to 2008 time period. In addition, the positive yield impact of increased carbon dioxide levels was added to the analysis. Assessing the impact of past trends on agricultural crop yields will help project the impact of future trends on yields during coming decades. It will also help identify which agricultural regions will be impacted the most. Temperature Global average temperatures have risen by about 0.13 degrees Centigrade (.23 degrees Fahrenheit) per decade since 1950. It is expected to increase to about 0.2 degrees Centigrade (.35 degrees Fahrenheit) per decade over the next two to three decades. The temperature increase in agriculture areas is expected to be substantially higher. In many agricultural locations, temperature trends increased and are more than twice the historic standard deviation, as shown in Figure 1. This includes Europe, Northern China, sub-Saharan Africa and Brazil. Sixty five percent of countries experienced temperature trends in crop production regions of at least one standard deviation for maize and rice. The corresponding percent of countries was 75 percent for wheat and 53 percent for soybeans. About a quarter of the countries experience trends of more than two standard deviations for each crop. By comparison, trends were evenly distributed about zero during the previous 20 year period (1960-1980). 1/ Linear trends for the growing season for the predominant crop in each grid cell. 2/ Trends are expressed as the ratio of the total trend for the 29 year period (1980-2008) divided by the historic standard deviation for the 1960-2000 period. 3/ Only cells with at least one percent of the area covered by either maize, wheat, rice or soybeans are shown. Precipitation Precipitation trends were less dramatic than temperature trends as shown in Figure 2. Modest increases or decreases in precipitation are evident in large parts of the world’s agricultural regions. Some parts of the world have experienced significant increases in precipitation while others have had significant decreases. However, when averaged, the effects of changes in growing season rainfall are near zero. Figure 2. Linear Trend in Precipitation, 1980-2008, measured in standard deviations 1/ 2/ 3/ 1/ Linear trends for the growing season for the predominant crop in each grid cell. 2/ Trends are expressed as the ratio of the total trend for the 29 year period (1980-2008) divided by the historic standard deviation for the 1960-2000 period. 3/ Only cells with at least one percent of the area covered by either maize, wheat, rice or soybeans are shown. Carbon Dioxide Increased levels of carbon dioxide have a positive impact on plant growth. A plant takes in atmospheric carbon dioxide (CO2) during the photosynthesis process, utilizes the carbon (C) to build the plant, and releases the oxygen (O2) back into the atmosphere. For many crops, the photosynthetic pathway allows the plant to respond to elevated levels of atmospheric CO2. These are referred to as C3 plants and include wheat, rice, soybeans and most weeds. However, **the photosynthetic pathway of C4 plants such as maize does not respond to elevated levels of CO2,** so the impact on yield is likely much smaller. Atmospheric concentrations of carbon dioxide have increased by 47 parts per million (386 ppm less 339 ppm) over the 1980 to 2008 time period (Figure 3). Experiments of the impact of elevated levels of atmospheric CO2 indicated that the 47 ppm increase would increase the yields of C3 crops by approximately three percent. Figure 3. World Atmospheric Carbon Dioxide (CO2) Levels The affect of temperature and precipitation trends on the yields of maize, rice, wheat and soybeans is shown in Table 1. The impact on yields is greater for temperature than for precipitation. The greatest yield impact of temperature was on wheat followed by maize. When the three percent yield gain from elevated CO2 levels is added to wheat, soybeans and rice, the yield response for rice and soybeans become positive but remained negative for maize and wheat. Estimated changes in yields for maize, rice, wheat and soybeans for major producing countries are shown in Figure 4. The country with the largest impact was wheat production in Russia with an estimated negative yield impact of almost 15 percent. For the U.S., yield changes due to temperature and precipitation trends are negligible for maize, wheat and soybeans. This corresponds to the small temperature and precipitation trends shown in Figures 1 and 2. Yield impacts were smaller for rice than the other crops. The confidence intervals of the yield estimates were larger for soybeans than the other crops. Figure 4. Estimated net impact of climate trends from 1980 to 2008 on crop yields for major producing countries and for global production. Values are expressed as percent of average yields. A = Maize, B = Rice, C = Wheat, D = Soybeans. \* Gray bars show median estimate and error bars show 5 percent to 95 percent confidence internal from bootstrap resampling with 500 replicates. Red and blue dots show median estimate of impact for temperature trend and precipitation trend, respectively. Note, the sum of the temperature (red dots) and precipitation (blue dots) estimates equals the total estimate shown by the gray bars. The researchers calculated the impact of the climate trends on global crop yields. Maize production would have been about six percent higher and wheat production about four percent higher had the climate trends since 1980 not existed. The effects on rice and soybeans were lower and not statistically significant. The researchers also calculated the impact of climate trends on global crop prices using price elasticities. The estimated changes in crop production excluding and including carbon dioxide fertilization resulted in commodity price increases of about 20 percent and about 5 percent respectively. The analysis does not take into account the potentially mitigating impact of crop production climate adaptation strategies currently taking place such as where crops are grown and how crops are grow (seed varieties, planting dates, etc.) Some adaptations strategies are already taking place in the U.S. Midwest. However, it also does not take into account the negative impact of the increased occurrence of extreme weather events associated with global warming. An increase in the frequency of extreme weather events has been documented in the U.S. Midwest (Climate Change in Iowa). Implications To meet this expanding world demand, agriculture must become more adept at anticipating climate trends and finding ways of adapting to these changes. The research report shows that the impact of temperature on crop yields is a larger factor than the impact of precipitation. This would indicate that adaptation strategies should focus more on temperature changes than on precipitation changes. The research report concluded that North America is the agricultural region least impacted by temperature and precipitation changes. The U.S. already accounts for about forty percent of the world’s production of corn and soybeans and a substantial portion of the world’s wheat. The U.S. share may increase if these patterns persist and the rest of the world is increasingly challenged by temperature increases. It will have significant implications for the world grain trade and the role of the U.S. in feeding the world. Most of the increase in agricultural production over the last century is the result of yield increases rather than agricultural land area expansion. However, **due to the world’s rapidly growing demand for food and the negative yield impact of climate change on food production, there will be great pressure to expand the world’s agricultural land area. Expanding the agricultural land area may significantly increase carbon dioxide emissions due to the release of carbon from converting native areas to farmland** as discussed in Agricultural Research Combats Climate Change. Increased investments in agricultural research in the U. S. and across the world is needed to meet the challenge of world food production. However, this must be combined with programs to substantially reduce greenhouse gas emissions. In the long run, agricultural research will not be able to compensate for the **devastating effects of climate change on world agricultural production.**

**Negative impacts outweigh the positive – our evidence is comparative.**

**MAFF 07** – Japanese Agriculture, Forestry, Fisheries, Research Council (Ministry of Agriculture, Forestry and Fisheries, “Impact of Global Warming on Agriculture, Forestry and Fisheries and Possible Countermeasures in Japan”, Report on Research and Development in Agriculture, Forestry and Fisheries No. 23, 2007; < http://www.s.affrc.go.jp/docs/e/pdf/no23e.pdf>)//Beddow

The report of Working Group 2 on impacts, adaptation and vulnerability reveals that global warming is having an impact on nature and society around the world, such as the melting of glaciers and frozen tundra, advancement in the springtime phenomenon in animals and plants, and habitat shifts. Global warming is expected to have a serious impact on water resources, ecosystems, food production and other aspects of life. **For agricultural production, low latitudes such as the tropics are more vulnerable than high latitudes to global warming.** The IPCC Fourth Assessment Report predicts that grain production will decrease in low latitudes and increase in middle-high latitudes if the global mean temperature increases 2 to 3°C. This means that global warming will have a greater impact on developing countries (most of which are located at low latitudes in Asia and Africa) than on developed countries such as Japan. However, a temperature increase of more than 2 to 3°C will probably result in decreased grain production in both low and high latitudes. **The negative impact of global warming will be greater than the positive impact.**