### 1AC Plan

#### Plan: The United States Federal Government should offer substantial competitive power purchase agreements for electricity from small modular nuclear reactors for military installations in the United States.

### Contention 1

#### No disads- Obama’s already pushing SMRs- DOE incentives now- other nuclear fights inevitable too

Ervin 12/28 (Dan Ervin, professor of finance at Salisbury University, “Dan Ervin: Modular reactors are the future of nuclear energy,” delmarvaNow, http://www.delmarvanow.com/article/20121230/OPINION03/312300005)

The Obama administration’s decision to kick-start commercial use of small modular reactors has made one thing clear: The notion that nuclear power is slipping away is wrong. Although nuclear power faces difficult challenges, industry and government are working together to forge a new path.¶ The Department of Energy has earmarked funds for a new public-private partnership to help develop innovative small reactors that are about one-third the size of those in large conventional nuclear plants. These small reactors are modular, meaning they will be built in factories before they are shipped and installed at nuclear sites. This production method has the potential to reduce the cost of nuclear power significantly.¶ Southern Co. has begun building two new nuclear plants in Georgia using new construction techniques that could convince other companies nuclear plants are easier to build than otherwise thought.¶ Congress is planning to take up comprehensive legislation on nuclear waste next year using a “consent-based approach” to finding a site for a deep-geologic repository or an interim storage facility. Both would hold high-level waste and used fuel. Such an approach was recommended earlier in the year by a high-level blue-ribbon commission.

**But the DOD’s key- Only way to solve barriers and achieve commercialization**

Andres and Breetz 2011 (Richard B. Andres, Professor of national Security Strategy at the national War College and a Senior fellow and energy and environmental Security and Policy Chair in the Center for Strategic research, institute for national Strategic Studies, at the national Defense University, and Hanna L. Breetz, doctoral candidate in the Department of Political Science at the Massachusetts institute of technology, February 2011, “Small Nuclear Reactors for Military Installations: Capabilities, Costs, and Technological Implications,” National Defense University Strategic Forum, http://www.ndu.edu/press/lib/pdf/strforum/sf-262.pdf)

The preceding analysis suggests that DOD should seriously consider taking a leadership role on small reactors. This new technology has the potential to solve two of the most serious energy-related problems faced by the department today. Small reactors could island domestic military bases and nearby communities, thereby protect- ing them from grid outages. They could also drastically reduce the need for the highly vulnerable fuel convoys used to supply forward operating bases abroad.¶ The technology being proposed for small reactors (much of which was originally developed in U.S. Gov- ernment labs) is promising. A number of the planned designs are self-contained and highly mobile, and could meet the needs of either domestic or forward bases. Some promise to be virtually impervious to accidents, with design characteristics that might allow them to beused even in active operational environments. These re- actors are potentially safer than conventional light wa- ter reactors. The argument that this technology could be useful at domestic bases is virtually unassailable. The argument for using this technology in operational units abroad is less conclusive; however, because of its poten- tial to save lives, it warrants serious investigation.¶ Unfortunately, the technology for these reactors is, for the most part, caught between the drawing board and production. Claims regarding the field utility and safety of various reactors are plausible, but authoritative evalu- ation will require substantial investment and technology demonstration. In the U.S. market, DOD could play an important role in this area. In the event that the U.S. small reactor industry succeeds without DOD support, the types of designs that emerge might not be useful for the department since some of the larger, more efficient designs that have greater appeal to private industry would not fit the department’s needs. Thus, there is significant incentive for DOD to intervene to provide a market, both to help the industry survive and to shape its direction.¶ Since the 1970s, in the **U**nited **S**tates, **only the military** has overcome the considerable barriers to building nuclear reactors. This will probably be the case with small reactors as well. If DOD leads as a first mover in this market—initially by providing analysis of costs, staffing, reactor lines, and security, and, when possible, by moving forward with a pilot installation—the new technology will likely survive and be applicable to DOD needs. If DOD does not, it is possible the tech- nology will be unavailable in the future for either U.S. military or commercial use.

#### Only PPAs solve-

#### Incentivizes production- R&D projects don’t commercialize

Madia 2012 (William Madia, Chairman of the Board of Overseers and Vice President for the SLAC National Accelerator Laboratory at Stanford University, previously the Laboratory Director at the Oak Ridge National Laboratory, Spring 2012, “SMALL MODULAR REACTORS: A POTENTIAL GAME-CHANGING TECHNOLOGY,” Stanford Energy Club, http://energyclub.stanford.edu/index.php/Journal/Small\_Modular\_Reactors\_by\_William\_Madia)

Throughout the history of NPP development, plants grew in size based on classic “economies of scale” considerations. Bigger was cheaper when viewed on a cost per installed kilowatt basis. The drivers that caused the industry to build bigger and bigger NPPs are being offset today by various considerations that make this new breed of SMRs viable. ¶ ¶ Factory manufacturing is one of these considerations. Most SMRs are small enough to allow them to be factory built and shipped by rail or barge to the power plant sites. Numerous industry “rules of thumb” for factory manufacturing show dramatic savings as compared to “on-site” outdoor building methods. Significant schedule advantages are also available because weather delay considerations are reduced. Of course, from a total cost perspective, some of these savings will be offset by the capital costs associated with building multiple modules to get the same total power output. Based on analyses I have seen, overnight costs in the range of $5000 to $8000 per installed kilowatt are achievable. If these analyses are correct, it means that the economies of scale arguments that drove current designs to GW scales could be countered by the simplicity and factory-build possibilities of SMRs.¶ ¶ No one has yet obtained a design certification from the Nuclear Regulatory Commission (NRC) for an SMR, so we must consider licensing to be one of the largest unknowns facing these new designs. Nevertheless, since the most developed of the SMRs are mostly based on proven and licensed components and are configured at power levels that are passively safe, we should not expect many new significant licensing issues to be raised for this class of reactor. Still, the NRC will need to address issues uniquely associated with SMRs, such as the number of reactor modules any one reactor operator can safely operate and the size of the emergency planning zone for SMRs.¶ ¶ To determine if SMRs hold the potential for changing the game in carbon-free power generation, it is imperative that we test the design, engineering, licensing, and economic assumptions with some sort of public-private development and demonstration program. Instead of having government simply invest in research and development to “buy down” the risks associated with SMRs, I propose a more novel approach. Since the federal government is a major power consumer, it should commit to being the “first mover” of SMRs. This means purchasing the first few hundred MWs of SMR generation capacity and dedicating it to federal use. The advantages of this approach are straightforward. The government would both reduce licensing and economic risks to the point where utilities might invest in subsequent units, thus jumpstarting the SMR industry. It would then also be the recipient of additional carbon-free energy generation capacity. This seems like a very sensible role for government to play without getting into the heavy politics of nuclear waste, corporate welfare, or carbon taxes.

**Certainty- PPAs vital to investment and financing**

Hinckley 2012 (Elias Hinckley, Energy Attorney and leader of the clean energy practice at Kilpatrick Townsend, August 29, 2012, “5 Reasons Why Good Energy Projects Don’t Get Financed,” [www.consumerenergyreport.com/2012/08/29/5-reasons-why-good-energy-projects-dont-get-financed/](http://www.consumerenergyreport.com/2012/08/29/5-reasons-why-good-energy-projects-dont-get-financed/))

Much of the market uncertainties in a typical energy project can be partially managed by a long-term fixed price off-take contract (such as a power purchase agreement), which shields an investor from most price volatility risk. For example, a solar developer can assume payment, at a known price, for electricity it generates if that electricity is sold under a solid long-term power purchase agreement. The project will receive the expected revenue regardless of the price movement of electricity, which allows for revenue certainty and protection for the project in the event prices drop below levels used to calculate project returns. Where a long term contract is not available, an alternative strategy is to add a hedge (which is an instrument that acts as an offset or guarantee against the price going up or down). However, hedging is generally difficult to do beyond a few years, and since project performance is often measured over 10 to 20 years it often only manages price risk during the early operation of a project. When building a typical energy project, at least in the current market, a long-term contract for electricity is assumed. Without that long-term contract, securing financing for a power project would be virtually impossible. Long-term contracts for natural gas, crude derivatives, and biomass feedstock are generally not available. Projects subject to markets for these commodities, therefore generally have to have higher margins to provide comfort to investors.

**SMRS are extremely safe**

**Kessides 2010** (Ioannis N. Kessides, Lead Economist in the World Bank's Development Research Group, June 2012, “The Future of the Nuclear Industry Reconsidered Risks, Uncertainties, and Continued Potential,” The World Bank Development Research Group Environment and Energy Team, http://www-wds.worldbank.org/external/default/WDSContentServer/IW3P/IB/2012/06/29/000158349\_20120629130837/Rendered/INDEX/WPS6112.txt)

Most SMR concepts envision widespread deployment of a large number of small nuclear plants sited in diverse environments and frequently in close proximity to users. These considerations place very stringent requirements on reliability and safety performance—arguably even more exacting relative to traditional large-scale nuclear plants. The need for enhanced levels of safety has led to design options that maximize the use of inherent and passive safety features and incorporate additional layers of defense in depth (IAEA, 2009).18 These safety features can be more easily and effectively implemented in SMRs because of their larger surface- to-volume ratio, reduced core power density, lower source term, and less frequent (multi-year) refueling. For example, large surface-to-volume ratios facilitate the passive (with no external source of electrical power or stored energy) removal of decay heat.¶ SMRs employ an enveloping design approach that seeks to eliminate or prevent as many accident initiators and accident consequences as possible. Any remaining plausible accident initiators and consequences are dealt with appropriate combinations of active and passive safety systems. In water-cooled SMRs, the integration of steam generators and pressurizers within the reactor vessel eliminates large-diameter pipes and penetrations in the reactor vessel, thereby reducing substantially the risk of LOCAs. Moreover, in some designs the application of in- vessel control rod drives eliminates the risk of inadvertent control rod ejections that lead to reactivity insertion accidents. Loss of coolant accidents may also be prevented with compact loop designs that employ short piping and fewer connections between components (Kuznetsov, 2009).¶ In HTGRs, the fuel particles consist of fissionable fuel kernels with tri-structural isotropic (TRISO) coating.19 The TRISO coating system constitutes a miniature pressure vessel that is capable of containing the readionuclides and gases generated by fission of the nuclear material in the kernel. One of the coating layers consists of silicon carbide (a strong refractory material) which can retain radionuclides at extremely high temperatures under all accident conditions—temperatures can remain at 1600°C for several hundred hours without loss of particle coating integrity. Furthermore, the graphite holding the TRISO-coated particles together can withstand even higher temperatures without structural damage.20 And the massive graphite structures in the core create an extremely large heat capacity. The combination of large thermal margins, low power density of the core, and relatively large length-to-diameter ratio of the core, allow for very slow and stable response to transients caused by initiating events and for passive heat removal (INL, 2011).¶ The effectiveness of passive safety features can be illustrated by comparing outcomes from probabilistic risk analysis (PRA). In 1991, a Level-2 PRA was developed for the EBR-II fast neutron spectrum experimental breeder reactor—a 21 MWe plant—to compare its operational risk to that of commercial LWR‘s for which PRA‘s were available. EBR-II employs an extensive array of passive and inherent safety measures to back up traditional active safety systems. This PRA exercise showed that for EBR-II the risk of simply violating a fuel pin technical specification (with no core damage) is less than the risk of significant core disruption for the LWRs of the time. The point of the PRA comparisons is that application of passive and inherent safety measures as incorporated in SMRs can help to overcome the increase in numbers of SMRs needed to deliver the same societal energy provided by a smaller number of large-sized LWRs. Similarly, preliminary Level-1 PRA results for the NuScale Power Reactor indicate a total single-module mean CDF of 2.8x10-8/reactor-year, well below that of existing nuclear plants. And for the VK-300, the probability of severe core damage has been estimated to be less than 2.0x10-8/reactor-year (Hill et al, 1998; Kuznetsov and Gabaraev, 2007; Modarres, 2010).¶ SMRs have a smaller fuel inventory and thus a reduced source term. So on top of reduced hazard of core damage, the hazard attendant to release of radioactivity is also reduced per deployed SMR. The combination of reduced probability of core damage failure, a reduced source term, and additional fission product release barriers, could offer major advantages for emergency planning and response.

**SMRs are good to go- Plan quickly resolves any remaining issues**

Adams 2010 (Rod Adams, nuclear power expert with experience designing and operating small nuclear reactors and a former Submarine Engineer Officer, March 23, 2010, “Small Modular Reactors Could Be An American Export – But We Need to Move Faster,” Atomic Insights, http://atomicinsights.com/2010/03/small-modular-reactors-could-be-an-american-export-but-we-need-to-move-faster.html)

In the March 23, 2010 issue of the Wall Street Journal, Dr. Steven Chu published an op-ed piece titled America’sNew Nuclear Option that describes the Administration’s growing interest in smaller nuclear energy systems that can be produced in factories and delivered nearly complete to sites around the country and around the world. Here is a quote from that editorial:¶ As this paper recently reported, one of the most promising areas is small modular reactors (SMRs). If we can develop this technology in the U.S. and build these reactors with American workers, we will have a key competitive edge.¶ Small modular reactors would be less than one-third the size of current plants. They have compact designs and could be made in factories and transported to sites by truck or rail. SMRs would be ready to “plug and play” upon arrival.¶ If commercially successful, SMRs would significantly expand the options for nuclear power and its applications. Their small size makes them suitable to small electric grids so they are a good option for locations that cannot accommodate large-scale plants. The modular construction process would make them more affordable by reducing capital costs and construction times.¶ Their size would also increase flexibility for utilities since they could add units as demand changes, or use them for on-site replacement of aging fossil fuel plants.¶ Those are some terrific words, but the message loses some of its impact when the numbers are revealed later down the page. In the 2011 budget, the Administration requested just $39 million for a program aimed specifically at small reactors. That amount of money would not even pay for the Nuclear Regulatory Commission costs of reviewing the license for a single nuclear energy system design certification. In an agency whose total budget request is in excess of $28,000 million ($28 billion), a $39 million line item gets lost in the decimal dust.¶ There is an old saying that is appropriate here – “For where your treasure is, there your heart will be also”. The effort by Dr. Chu to publish a piece favorable to small nuclear energy systems in the Wall Street Journal is commendable, but the tiny slice of resource support indicates that there is still a lot of work to be done to enable the technology to reach the market, especially when compared to the massive number of dollars available for industrial wind deployment as a gift from taxpayers to companies like BP, Chevron, GE, FPL, and Siemens.¶ It is beyond comprehension to me that it will take us “about 10 years” (in Dr. Chu’s words) to license and deploy smaller, light water reactors that use essentially the same technology that we have been using successfully for nearly 60 years. We have the knowledge base and the manufacturing capability now; we should build several plants in controlled locations so we can show the regulators how their safety systems work to keep the public protected.¶ Dr. Chu’s op-ed piece concludes with some additional good words about the future potential of systems using high temperature gas – one of my favorites – and fast neutrons for better fuel economy plus the use of modern modeling and simulation techniquest. Dr. Chu’s head is in the right place, but he could use some encouragement to move more aggressively to take advantage of what is currently an American strong suit.¶ There are some Americans who know more than anyone else about what it takes to build durable, safe, secure, small reactors that use light water as a heat transfer and moderating fluid and steam as the power section working fluid. We can improve the economics through well understood principles of series production. The Department of Energy’s budget request for FY2011 currently includes more than $1,000 million for small, light water reactors whose allowed market is limited to military vessels. It would seem that technologies used in that program could be used as the basis for prototype licenses for systems like the mPowerTM and NuScale in a process that could take far less than 10 years.¶ There are several places in the US (Hawaii, Guam, Puerto Rico and Alaska) where early adoption of such systems could dramatically reduce the cost of electricity, reduce the dependence on a fragile fossil fuel tether, and improve its production cleanliness. Success in those locations could lead to successes in similar markets around the world and perhaps even in system refinements allow competitive costs in more traditional electrical power production markets. What are we waiting for?

### Contention 2

#### Dependence on coal and other fossil fuels is pushing the earth to the brink of extinction- nuclear power is the only option

Comby 2006 (Bruno Comby, founder and president of the International Association of Environmentalists, May 2006, “The benefits of nuclear energy,” Ecolo, http://www.sustainablenuclear.org/PADs/pad0506comby.pdf)

We are burning in just 50 years the oil that nature took¶ 100 million years to fabricate. If we wanted this to be¶ sustainable, we need 2 million planets like the Earth.¶ But we have only one fragile planet to live on. If we want it to remain livable and in order to ensure not¶ just the comfort of our modern lives but, in the close future, the continuation of our civilization, it is therefore urgent to move very rapidly to new lifestyles¶ and other energy sources.¶ It should be understood in this regard, that converting¶ the energy infrastructures takes at least 15 years (if not¶ more), and we already know that great tensions on our¶ supplies of oil and gas will come long before then. It¶ is therefore VERY URGENT to act in this regard, and¶ it is already too late to avoid a world major energy¶ crisis—it is now inevitable and will lead to homelessness and starvation for a large portion of¶ humanity, and not just in those countries who are¶ poorer today. But it is still time to anticipate it and¶ soften its consequences.¶ We are very lucky that in fact there are solutions to¶ global warming and the end of oil, as we will see. And¶ we should seize this chance before it is too late, or¶ nature and history will wipe us out of the scene in a¶ few years if we aren't clever enough to see what's¶ ahead of us and to take the right decisions.¶ Until now, energy consumption has continuously¶ increased almost everywhere on the planet, and most¶ politicians continue to base their current predictions¶ on eternal growth. However, in a finite world (we¶ have only one planet) growth cannot go on forever.¶ Energy efficiency and other sources of energy can and¶ should urgently be developed. Efficient light bulbs¶ produce the same amount of lighting with 3 to 8 times¶ less energy. Heat pumps can produce the same amount¶ of heat with 2 to 5 times less energy. Solar heat and¶ geothermal energy can and should be developed to a¶ much greater extent than they are today.¶ There are those who have fallen in love with the¶ simplicity of solar cells and the pristine elegance of wind turbines but who refuse to accept that they are¶ quantitatively incapable of supplying the energy required by an industrial civilization. I do not mean to¶ say that these renewable energies should be excluded;¶ they are useful and have important niche roles to play¶ in remote locations and under special circumstances,¶ but they can make only a marginal contribution to the¶ energy demands of an industrial civilization. The¶ entire cultivable surfaces on Earth would not suffice¶ to produce enough biofuels to replace oil, and¶ obviously these surfaces are also needed to produce¶ the food we eat.¶ To replace just one nuclear reactor such as the new¶ EPR reactor that France is now building in Normandy¶ with the most modern windmills (each of them being¶ twice as high as Notre-Dame, the Cathedral of Paris),¶ they would have to be lined up all the way from¶ Genoa in Italy, to Barcelona in Spain. And, even so,¶ the electricity would be available only when the wind¶ blows (i.e. one day in three).¶ It is clear that we need another major energy source to¶ replace oil and gas and to power our cars and the large¶ cities, to run our factories and to produce our foods.¶ With oil and natural gas reserves soon to be¶ exhausted, we are left with coal, which unfortunately¶ is an even greater contributor to global warming, or nuclear energy. As an environmentalist the idea of developing coal,¶ the most polluting energy source, and the greatest¶ contributor to global warming, more than it already is,¶ is simply not acceptable, and would of course greatly¶ worsen the global warming trend. The sequestration of¶ carbon dioxide is nothing but a pleasant dream, quite¶ impossible to put in practice. It certainly isn't an easy¶ program to sequestrate billions of tons of CO2, and in¶ any case, this could not reasonably be applied to¶ individual transportation (cars)in a feasible manner.¶ In all cases another clean and massively available¶ energy source is needed to avoid (or soften) a major¶ crash of our civilization in the years to come.¶ Nuclear power consumes only very little amounts of¶ uranium (and thorium in the future), which is (unlike¶ oil and gas) abundant everywhere in the Earth's crust,¶ and especially abundant in Canada and Australia.¶ Nuclear energy produces (almost) no carbon dioxide¶ and no sulfur dioxide or nitrogen oxides. On the¶ contrary, these gases are produced in vast quantities¶ when fossil fuels are burned.¶ Unlike solar cells, wind turbine farms and growing¶ biomass, all of which cover large areas of land and are¶ intermittent, a nuclear power station is very compact;¶ it occupies typically the area of a football stadium and¶ its surrounding parking lots and it produces the energy¶ continuously, when it is needed.

#### It’s not just electricity generation- Every step of the coal lifecycle is devastating to the biosphere

Bjureby et al 2010 (Dr. Erika Bjureby, Political Advisor on Forests and Climate at Greenpeace, Mareike Britten,¶ Irish Cheng, Marta Kaźmierska,¶ Ernest Mezak, Victor Munnik, Jayashree¶ Nandi, Sara Pennington, Emily Rochon,¶ Nina Schulz, Nabiha Shahab, Julien Vincent¶ and Meng Wei, “The True Cost of Coal,” Greenpeace, http://www.greenpeace.org/israel/Global/israel/report/2010/7/the-true-cost-of-coal.pdf)

Coal’s journey from the ground to the waste heap is often¶ called its chain of custody. The chain has three main links – mining coal, burning coal and disposing of coal’s waste. When you look at the facts, one thing very quickly¶ becomes obvious: each part of the chain causes¶ irreparable damage to our planet and the health of the¶ people on it. In the next section, Coal first hand, we¶ share the stories of people who are feeling these effects¶ of coal today.¶ Mining coal¶ Mining causes widespread deforestation, soil erosion, water shortages and pollution, smouldering coal fires and the emission of greenhouse gases. Massive¶ excavation operations strip land bare, lower water tables,¶ generate huge waste mountains and blanket surrounding¶ communities with dust particles and debris. Mining leads to the loss of fertile soils through erosion, while runoff into¶ nearby water bodies clogs rivers and smothers aquatic life. It kills miners quickly through accidents, or more¶ slowly with black lung disease. And it also displaces¶ whole communities, forced to abandon their homes¶ because of coal mines, coal fires, landslides and¶ contaminated water supplies.¶ Burning coal¶ Coal combustion leaves a similar trail of destruction in its¶ wake. The huge volumes of water needed to “wash” coal¶ and cool operating power stations cause water¶ shortages in many areas. Pollutants spewed from¶ smokestacks threaten public health and the environment¶ – fine dust particles are a major cause of pulmonary¶ (lung) disease; mercury harms neurological development¶ in children and the unborn; and coal-fired power plants¶ are the biggest single source of polluting emissions,¶ such as carbon dioxide, sulphur dioxide, nitrogen oxides¶ and methane, contributing to climate change and¶ causing acid rain and smog.¶ Coal’s legacy¶ The damage caused by coal doesn’t end once it’s burnt. At¶ the end of the chain are coal combustion wastes (known¶ collectively as CCW), abandoned mines, devastated¶ communities and ravaged landscapes. CCWs are toxic¶ and often laced with lead, arsenic and cadmium that can¶ cause poisoning, kidney diseases and cancer respectively.¶ Acid mine drainage (AMD) damages soils and makes¶ water unsafe for consumption. Collapsing mines cause land to subside, resulting in structural damage to homes¶ and buildings and infrastructure like highways, buildings¶ and bridges. Attempts to mitigate the devastation left once¶ coal is removed are inadequate at best. “Reclaimed” land¶ never quite recovers; poisoned communities remain¶ contaminated; and no matter how hard you scrub,¶ the social fabric of human societies is forever dirtied with¶ coal dust.¶ Every link in the chain of custody contributes to the¶ overall damage caused by coal – each in its own¶ particular way. This damage is real. It will only get worse¶ in the future if nothing is done. And it all forms part of the¶ true cost of coal.

#### Soil erosion causes extinction

Ikerd 1999 (John E- Professor Emeritus of Agricultural Economics at University of Missouri, “Foundational Principles: Soils. Stewardship, and Sustainability,” Sep 22, <http://www.ssu.missouri.edu/faculty/jikerd/papers/NCSOILS.html>]

A foundation is "the basis upon which something stands or is supported" (Webster). The basic premises of this discourse on "foundational principles" is that soil is the foundation for all of life, including humanity, that stewardship of soil is the foundation for agricultural sustainability, and that sustainability is the conceptualfoundation for wise soil management. All living things require food of one kind or another to keep them alive. Life also requires air and water, but nothing livesfrom air and water alone. Things that are not directly rooted in the soil -- that live in the sea, on rocks, or on trees, for example -- still require minerals that come from the earth. They must have soil from somewhere. Living things other than plants get their food from plants, or from other living things that feed on plants, and plants feed on the soil. All life may not seem to have roots in the soil, but soil is still at the root of all life. First, Iam not a soil scientist. I took a class in soils as an undergraduate and have learned a good bit about soils from reading and listening to other people over the years. But, I make no claim to beingan expert. So I will try to stick to the things that almost anyone might know or at least understand about soil. As I was doing some reading on the subject, I ran across a delightful little bookcalled, "The Great World’s Farm," written by an English author, Selina Gaye, somewhere around the turn of the century. The copyrights apparently had run out, since the book didn’t have acopyright date. Back then people didn’t know so much about everything, so they could get more of what they knew about a lot more things in a little book. The book starts off explaining howsoil is formed from rock, proceeds through growth and reproduction of plants and animals, and concludes with cycles of life and the balance of nature. But, it stresses that all life is rooted in thesoil. Initially molten lava covered all of the earth’s crust. So, all soil started out as rock. Most plants have to wait until rock is pulverized into small particles before they can feed on theminerals contained in the rock. Chemical reaction with oxygen and carbon dioxide, wearing away by wind and water, expansion and contraction from heating and cooling, and rock slides andglaciers have all played important roles in transforming the earth’s crust from rock into soil. However, living things also help create soil for other living things. Lichens are a unique sort ofplant that can grow directly on rock. Their spores settle on rock and begin to grow. They extract their food by secreting acids, which dissolve the minerals contained in the rock. As lichensgrow and die, minerals are left in their remains to provide food for other types of plants. Some plants which feed on dead lichens put down roots, which penetrate crevices in rocks previouslycaused by mechanical weathering. Growth or roots can split and crumble rock further, exposing more surfaces to weathering and accelerating the process of soil making. Specific types of rockcontain limited varieties of minerals and will feed limited varieties of plants – even when pulverized into dust. Many plants require more complex combinations of minerals than are availablefrom any single type of rock. So the soils made from various types of rocks had to be mixed with other types before they would support the variety and complexity of plant life that we havecome to associate with nature. Sand and dust can be carried from one place to another by wind and water, mixing with sand and dust from other rocks along the way. Glaciers have also beenimportant actors in mixing soil. Some of the richest soils in the world are fertile bottomlands along flooding streams and rivers, loess hills that were blown and dropped by the wind, and soildeposits left behind by retreating glaciers. Quoting from the "Great World’s Farm," "No soil is really fertile, whatever the mineral matter composing it, unless it also contains some amount oforganic matter – matter derived from organized, living things, whether animal or vegetable. Organic matter alone is not enough to make a fertile soil; but with less than one-half percent oforganic matter, no soil can be cultivated to much purpose." After the mixed soil minerals are bound in place by plants, and successions of plants and animals added organic matter and tilth, themixtures became what we generally refer to as soils. The first stages of soil formation are distinguished from the latter stages by at least one important characteristic. The dissolving, grinding,and mixing required millions of years, whereas, soil binding and adding organic matter can be accomplished in a matter of decades. Thus, the mineral fraction of soil is a "non-renewable"resource – it cannot be recreated or renewed within any realistic future timeframe. Whereas, the organic fraction is a renewable or regenerative resource that can be recreated or renewed overdecades, or at least over a few generations. Misuse can displace, degrade, or destroyed the productivity of both fractions of soils within a matter of years. And, once the mineral fraction of soilis lost, its productivity is lost forever. If there are to be productive soils in the future, we must conserve and make wise use of the soils we have today. The soil that washes down our rivers tothe sea is no more renewable than are the fossil fuels that we are mining from ancient deposit within the earth. In spite of our best efforts, some quantity of soil will be lost – at least lost to ouruse. Thus, our only hope for sustaining soil productivity is to conserve as much soil as we can and to build up soil organic matter and enhance the productivity of the soil that remains. In times not too long past, the connection between soil and human life was clear and ever present. Little more than a century ago, most people werefarmers and those who were not lived close enough to a farm to know that the food that gave them life came from the soil. They knew that when the soil was rich, the rains came, and thetemperature was hospitable to plants and animals, food was bountiful and there was plenty to eat. They knew that when droughts came, plants dried out and died, and the soil was bare, therewas little to eat. They knew when the floods came, plants were covered with water and died, and the soil was bare; there was little to eat. They knew very well that their physical well being, ifnot their lives, depended on the things that lived from the soil. William Albrecht, a well known soil scientist at the University of Missouri during the middle of this century, hypothesized thatpeople from different parts of the country had distinctive physical characteristics linked to the soils of the area where they grew up. He attributed those physical distinctions to differences innutrient values of the foods they eat, which in turn depended on the make-up of the soils on which their foodstuffs were grown. Albrecht’s hypothesis was never fully tested. As people began tomove from one place to another throughout their lives, and as more and more foodstuffs were shipped from one region of production to another for consumption, people no longer ate foodfrom any one region or soil type. But it’s quite possible that when people lived most of their lives in one place, and ate mostly food produced locally, their physical makeup was significantlylinked to the make up of local soils. Today, we eat from many soils, from all around the world. Even today there is a common saying that "we are what we eat." If so, "we actually are the soilfrom which we eat." The connection between soil and life is no longer so direct or so clear, but it is still there. Most urban dwellers also have lost all senseof personal connection to the farm or the soil. During most of this century many people living in cities either had lived on a farm at one time or knew someone, usually a close relative, who stilllived on a farm -- which gave them some tangible connection with the soil. At least they knew that "land" meant something more than just a place to play or space to be filled with some formof "development." But these personal connections have been lost with the aging of urbanization. One of the most common laments among farmers today is that "people no longer know wheretheir food comes from." For most, any real understanding of the direct connection between soil and life has been lost. It ‘s sad but true. What’s even sadder is that many farmers don’t realizethe dependence of their own farming operation on the health and natural productivity of their soil. They have been told by the experts that soil is little more than a medium for propping up theplants so they can be fed with commercial fertilizers and protected by commercial pesticides until they produce a bountiful harvest. In the short run, this illusion of production without naturalsoil fertility appears real. As long as the soil has a residue of minerals and organic matter from times past, annual amendments of a few basic nutrients – nitrogen, phosphorus, and potash, beingthe most common – crop yields can be maintained. Over time, however, as organic matter becomes depleted, production problems appear and it becomes increasingly expensive to maintainproductivity. As additional "trace elements" are depleted, soil management problems become more complex. Eventually, it will become apparent that it would have been far easier and lesscostly in the long run to have maintained the natural fertility of the soil. But, by then much of the natural productivity will be gone -- forever. In the meantime, many farmers will have littlesense of their ultimate dependence on the soil. Still, all of life depends upon soil. All life requires food and there is simply no other source of food except living things that depend directly or indirectly on the soil. This is a foundational principle of natural science, of human health, and ofsocial studies that should be taught at every level in every school in the world -- beginning in kindergarten and continuing through college. That we must have soil to live is as fundamental as the fact that we must have air to breath, water to drink, and food to eat. It’s just less obvious.

#### So does deforestation

Hussain 2009 (Ashiq Hussain, Bhalessa, Doda,Assistant professor in Chemistry, Associated with EESS & C society a Registered NGO, March 30, 2009, Merinews, http://www.merinews.com/article/deforestation-a-threat-to-life-on-earth/15764026.shtml)

Forests are widely called as Earth's lungs, but rapid growth of human population has forced the lungs to reduce to half of its original size. Alarming rate of deforestation, if continued, will soon bring life to an end on the Earth¶ 'WHERE THERE are trees, there exists life', a well known quote to be remembered all the way by everyone. Human beings and forests have always have a complex relationship. It will not be wrong to quote here that plants and trees (forests) have played a key role to flourish life on this globe. Although the ocean was the original home of all life on Earth, forests, as they themselves evolved, quickly became home to a vast majority of land based creatures including early man. Concrete jungles, factories spewing smoke, crowded roads crammed with traffic - certainly, humankind have come a long way from its humble beginnings. Plants themselves have been around for over 450 million years, starting with simple forms of single - layers of cells. But today they are among the most complex of life systems and also the oldest and most successful. Imagine that the first plants stood upright about 420 million years before the first animals could.¶ It is widely believed that early human species evolved in and around the African rainforests between four and six million years ago. Even today, our closest relatives, the great apes, live there. We have depended on forests as long as we have inhabited the planet - getting clean air to breathe, food and water from it, fuel, shade and shelter, and now we need it for economic gain as well.¶ A forest is home to many types of plants, which are the food source for many types of animals, which are, in their turn, also sources of food for other animals. And as these animals and plants die, they in turn become food sources for the plants that again become food sources for the animals. This circle of life, the linkages between all animals and all plants, is often referred to as 'the web of life' - a reference to the common dependencies between all life in an ecosystem.¶ It is incredibly difficult to sum up the importance of forests in a few words. Just think of how forests have affected your life today by just answering the following few questions. Have you had your breakfast? Read a newspaper? Switched on a light? Traveled to work in a bus or car? Signed a cheque? Made a shopping list? Got a parking ticket? Blown your nose into a tissue? All these and many more activities directly or indirectly involve forests. Some are easy to figure out - fruits, paper and wood come from trees; others are more difficult - by-products that lead to the manufacture of other everyday items like medicines, detergents, etc.

#### Biodiversity key to survival.

Young, 10, Dr Ruth Young, PhD specialising in coastal marine ecology. 2-9-2010, “Biodiversity: what it is and why it’s important”, http://www.talkingnature.com/2010/02/biodiversity/biodiversity-what-and-why/

Different species within ecosystems fill particular roles, they all have a function, they all have a niche. They interact with each other and the physical environment to provide ecosystem services that are vital for our survival. For example plant species convert carbon dioxide (CO2) from the atmosphere and energy from the sun into useful things such as food, medicines and timber. A bee pollinating a flower (Image: ClearlyAmbiguous Flickr) Pollination carried out by insects such as bees enables the production of ⅓ of our food crops. Diverse mangrove and coral reef ecosystems provide a wide variety of habitats that are essential for many fishery species. To make it simpler for economists to comprehend the magnitude of services offered by biodiversity, a team of researchers estimated their value – it amounted to $US33 trillion per year. “By protecting biodiversity we maintain ecosystem services” Certain species play a “keystone” role in maintaining ecosystem services. Similar to the removal of a keystone from an arch, the removal of these species can result in the collapse of an ecosystem and the subsequent removal of ecosystem services. The most well known example of this occurred during the 19th century when sea otters were almost hunted to extinction by fur traders along the west coast of the USA. This led to a population explosion in the sea otters’ main source of prey, sea urchins. Because the urchins graze on kelp their booming population decimated the underwater kelp forests. This loss of habitat led to declines in local fish populations. Sea otters are a keystone species once hunted for their fur (Image: Mike Baird) Eventually a treaty protecting sea otters allowed the numbers of otters to increase which inturn controlled the urchin population, leading to the recovery of the kelp forests and fish stocks. In other cases, ecosystem services are maintained by entire functional groups, such as apex predators (See Jeremy Hance’s post at Mongabay). During the last 35 years, over fishing of large shark species along the US Atlantic coast has led to a population explosion of skates and rays. These skates and rays eat bay scallops and their out of control population has led to the closure of a century long scallop fishery. These are just two examples demonstrating how biodiversity can maintain the services that ecosystems provide for us, such as fisheries. One could argue that to maintain ecosystem services we don’t need to protect biodiversity but rather, we only need to protect the species and functional groups that fill the keystone roles. However, there are a couple of problems with this idea. First of all, for most ecosystems we don’t know which species are the keystones! Ecosystems are so complex that we are still discovering which species play vital roles in maintaining them. In some cases its groups of species not just one species that are vital for the ecosystem. Second, even if we did complete the enormous task of identifying and protecting all keystone species, what back-up plan would we have if an unforseen event (e.g. pollution or disease) led to the demise of these ‘keystone’ species? Would there be another species to save the day and take over this role? Classifying some species as ‘keystone’ implies that the others are not important. This may lead to the non-keystone species being considered ecologically worthless and subsequently over-exploited. Sometimes we may not even know which species are likely to fill the keystone roles. An example of this was discovered on Australia’s Great Barrier Reef. This research examined what would happen to a coral reef if it were over-fished. The “over-fishing” was simulated by fencing off coral bommies thereby excluding and removing fish from them for three years. By the end of the experiment, the reefs had changed from a coral to an algae dominated ecosystem – the coral became overgrown with algae. When the time came to remove the fences the researchers expected herbivorous species of fish like the parrot fish (Scarus spp.) to eat the algae and enable the reef to switch back to a coral dominated ecosystem. But, surprisingly, the shift back to coral was driven by a supposed ‘unimportant’ species – the bat fish (Platax pinnatus). The bat fish was previously thought to feed on invertebrates – small crabs and shrimp, but when offered a big patch of algae it turned into a hungry herbivore – a cow of the sea – grazing the algae in no time. So a fish previously thought to be ‘unimportant’ is actually a keystone species in the recovery of coral reefs overgrown by algae! Who knows how many other species are out there with unknown ecosystem roles! In some cases it’s easy to see who the keystone species are but in many ecosystems seemingly unimportant or redundant species are also capable of changing niches and maintaining ecosystems. The more biodiverse an ecosystem is, the more likely these species will be present and the more resilient an ecosystem is to future impacts. Presently we’re only scratching the surface of understanding the full importance of biodiversity and how it helps maintain ecosystem function. The scope of this task is immense. In the meantime, a wise insurance policy for maintaining ecosystem services would be to conserve biodiversity. In doing so, we increase the chance of maintaining our ecosystem services in the event of future impacts such as disease, invasive species and of course, climate change. This is the international year of biodiversity – a time to recognize that biodiversity makes our survival on this planet possible and that our protection of biodiversity maintains this service.

#### Natural gas is not an improvement- Tons of studies prove gas development is really bad for the environment

Brasch 2012 (Walter Brasch, Ph.D., American social issues journalist and university professor of journalism, March 19, 2012, “Fracking's Health and Environmental Impacts Greater Than Claimed,” Truthout, http://truth-out.org/news/item/7349:frackings-health-and-environmental-impacts-greater-than-claimed)

The natural gas industry defends hydraulic fracturing, better known as fracking, as safe and efficient. Thomas J. Pyle, president of the Institute for Energy Research, a pro-industry non-profit organization, claims fracking has been “a widely deployed as safe extraction technique,” dating back to 1949. What he doesn’t say is that until recently energy companies had used low-pressure methods to extract natural gas from fields closer to the surface than the current high-pressure technology that extracts more gas, but uses significantly more water, chemicals, and elements.¶ The industry claims well drilling in the Marcellus Shale will bring several hundred thousand jobs, and has minimal health and environmental risk. President Barack Obama in his January 2012 State of the Union, said he believes the development of natural gas as an energy source to replace fossil fuels could generate 600,000 jobs.¶ However, research studies by economists Dr. Jannette M. Barth, Dr. Deborah Rogers, and others debunk the idea of significant job creation.¶ Barry Russell, president of the Independent Petroleum Association of America, says “no evidence directly connects injection of fracking fluid into shale with aquifer contamination.” Fracking “has never been found to contaminate a water well,” says Christine Cronkright, communications director for the Pennsylvania Department of Health.¶ Research studies and numerous incidents of water contamination prove otherwise.¶ In late 2010, equipment failure may have led to toxic levels of chemicals in the well water of at least a dozen families in Conoquenessing Twp. in Bradford County. Township officials and Rex Energy, although acknowledging that two of the drilling wells had problems with the casings, claimed there were pollutants in the drinking water before Rex moved into the area. John Fair disagrees. “Everybody had good water a year ago,” Fair told environmental writer and activist Iris Marie Bloom in February 2012. Bloom says residents told her the color of water changed (to red, orange, and gray) after Rex began drilling. Among chemicals detected in the well water, in addition to methane gas, were ammonia, arsenic, chloromethane, iron, manganese, t-butyl alcohol, and toluene. While not acknowledging that its actions could have caused the pollution, Rex did provide fresh water to the residents, but then stopped doing so on Feb. 29, 2012, after the Pennsylvania Department of Environmental Protection (DEP) said the well water was safe. The residents vigorously disagreed and staged protests against Rex; environmental activists and other residents trucked in portable water jugs to help the affected families. The Marcellus Outreach Butler blog (MOB) declared that residents’ “lives have been severely disrupted and their health has been severely impacted. To unceremoniously ‘close the book’ on investigations into their troubles when so many indicators point to the culpability of the gas industry for the disruption of their lives is unconscionable.”¶ In April 2011, near Towanda, Pa., seven families were evacuated after about 10,000 gallons of wastewater contaminated an agricultural field and a stream that flows into the Susquehanna River, the result of an equipment failure, according to the Bradford County Emergency Management Agency.¶ The following month, DEP fined Chesapeake Energy $900,000, the largest amount in the state’s history, for allowing methane gas to pollute the drinking water of 16 families in Bradford County during the previous year. The DEP noted there may have been toxic methane emissions from as many as six wells in five towns. The DEP also fined Chesapeake $188,000 for a fire at a well in Washington County that injured three workers.¶ In January 2012, an equipment failure at a drill site in Susquehanna County led to a spill of several thousand gallons of fluid for almost a half-hour, causing “potential pollution,” according to the DEP. In its citation to Carizzo Oil and Gas, the DEP “strongly” recommended that the company cease drilling at all 67 wells “until the cause of this problem and a solution are identified.”¶ In December 2011, the federal Environmental Protection Agency concluded that fracking operations could be responsible for groundwater pollution.¶ “Today’s methods make gas drilling a filthy business. You know it’s bad when nearby residents can light the water coming out of their tap on fire,” says Larry Schweiger, president of the National Wildlife Federation. What’s causing the fire is the methane from the drilling operations. A ProPublica investigation in 2009 revealed methane contamination was widespread in drinking water in areas around fracking operations in Colorado, Texas, Wyoming, and Pennsylvania. The presence of methane in drinking water in Dimock, Pa., had become the focal point for Josh Fox’s investigative documentary, Gasland, which received an Academy Award nomination in 2011 for Outstanding Documentary; Fox also received an Emmy for non-fiction directing. Fox’s interest in fracking intensified when a natural gas company offered $100,000 for mineral rights on property his family owned in Milanville, in the extreme northeast part of Pennsylvania, about 60 miles east of Dimock.¶ Research by a team of scientists from Duke University revealed “methane contamination of shallow drinking water systems [that is] associated with shale-gas extraction.” The data and conclusions, published in the May 2011 issue of the prestigious Proceedings of the National Academy of Sciences, noted that not only did most drinking wells near drilling sites have methane, but those closest to the drilling wells, about a half-mile, had an average of 17 times the methane of those of other wells.¶ “Some of the chemicals used in hydraulic fracturing—or liberated by it—are carcinogens,” Dr. Sandra Steingraber told members of the Environmental Conservation and Health committee of the New York State Assembly. Dr. Steingraber, a biologist and distinguished scholar in residence at Ithaca College, pointed out that some of the chemicals “are neurological poisons with suspected links to learning deficits in children,” while others “are asthma triggers. Some, especially the radioactive ones, are known to bioaccumulate in milk. Others are reproductive toxicants that can contribute to pregnancy loss.”¶ An investigation by New York Times reporter Ian Urbina, based upon thousands of unreported EPA documents and a confidential study by the natural gas industry, concluded, “Radioactivity in drilling waste cannot be fully diluted in rivers and other waterways.” Urbina learned that wastewater from fracking operations was about 100 times more toxic than federal drinking water standards; 15 wells had readings about 1,000 times higher than standards.¶ Research by Dr. Ronald Bishop, a biochemist at SUNY/Oneonta, suggests that fracking to extract methane gas “is highly likely to degrade air, surface water and ground-water quality, to harm humans, and to negatively impact aquatic and forest ecosystems.” He notes that “potential exposure effects for humans will include poisoning of susceptible tissues, endocrine disruption syndromes, and elevated risk for certain cancers.” Every well, says Dr. Bishop, “will generate a sediment discharge of approximately eight tons per year into local waterways, further threatening federally endangered mollusks and other aquatic organisms.” In addition to the environmental pollution by the fracking process, Dr. Bishop believes “intensive use of diesel-fuel equipment will degrade air quality [that could affect] humans, livestock, and crops.”¶ Equally important are questions about the impact of as many as 200 diesel-fueled trucks each day bringing water to the site and then removing the waste water. In addition to the normal diesel emissions of trucks, there are also problems of leaks of the contaminated water.¶ “We need to know how diesel fuel got into our water supply,” says Diane Siegmund, a clinical psychologist from Towanda, Pa. “It wasn’t there before the companies drilled wells; it’s here now,” she says. Siegmund is also concerned about contaminated dust and mud. “There is no oversight on these,” she says, “but those trucks are muddy when they leave the well sites, and dust may have impact miles from the well sites.”¶ Research “strongly implicates exposure to gas drilling operations in serious health effects on humans, companion animals, livestock, horses, and wildlife,” according to Dr. Michelle Bamberger, a veterinarian, and Dr. Robert E. Oswald, a biochemist and professor of molecular medicine at Cornell University. Their study, published in New Solutions, an academic journal in environmental health, documents evidence of milk contamination, breeding problems, and cow mortality in areas near fracking operations as higher than in areas where no fracking occurred. Drs. Bamberger and Oswald noted that some of the symptoms present in humans from what may be polluted water from fracking operations include rashes, headaches, dizziness, vomiting, and severe irritation of the eyes, nose, and throat. For animals, the symptoms often led to reproductive problems and death.¶ Significant impact upon wildlife is also noted in a 900-page Environmental Impact Statement (EIS) conducted by New York’s Department of Environmental Conservation, and filed in September 2011. According to the EIS, “In addition to loss of habitat, other potential direct impacts on wildlife from drilling in the Marcellus Shale include increased mortality . . . altered microclimates, and increased traffic, noise, lighting, and well flares.” The impact, according to the report, “may include a loss of genetic diversity, species isolation, population declines . . . increased predation, and an increase of invasive species.” The report concludes that because of fracking, there is “little to no place in the study areas where wildlife would not be impacted, [leading to] serious cascading ecological consequences.” The impact, of course, affects the quality of milk and meat production as animals drink and graze near areas that have been taken over by the natural gas industry.¶ Christopher Portier, director of the National Center for Environmental Health, calls for more research studies that “include all the ways people can be exposed [to health hazards], such as through air, water, soil, plants and animals.”¶ The response by the industry and its political allies to the scientific studies of the health and environmental effects of fracking “has approached the issue in a manner similar to the tobacco industry that for many years rejected the link between smoking and cancer,” say Drs. Bamberger and Oswald. Not only do they call for “full disclosure and testing of air, water, soil, animals, and humans,” but point out that with lax oversight, “the gas drilling boom . . . will remain an uncontrolled health experiment on an enormous scale.”¶ Dr. Helen Podgainy, a pediatrician in Coraopolis, Pa., says she doesn’t want her patients “to be guinea pigs who provide the next generation the statistical proof of health problems as in what happened with those exposed to asbestos or to cigarette smoke.”

#### Even if natural gas is good, it can’t replace coal on its own

Perry 2012 (Mark J. Perry, professor of economics at the Flint campus of The University of Michigan and a scholar at The American Enterprise Institute, September 26, 2012, “Natural gas and nuclear power need to share the lead in power generation for the future,” AEI, http://www.aei.org/article/natural-gas-and-nuclear-power-need-to-share-the-lead-in-power-generation-for-the-future/)

Recent advances in drilling technologies have unleashed a boom in domestic natural gas production. The United States may have more than 100 years' worth of gas reserves, and perhaps much more, including large untapped resources in Michigan.¶ Policy makers are increasingly looking to natural gas as the locomotive of economic growth. A striking example is the increasing use of gas in electricity production. For the last several years, natural gas has accounted for more than 80% of new electric generating capacity in the United States. It now provides 32% of total electricity generation, up from 25% just two years ago, and its share could reach 50% by 2030.¶ Natural gas, of course, has many virtues as a fuel. Its carbon content is less than half that of coal and it emits no mercury or other toxic particulates.¶ But natural gas is needed for much more than electricity generation. In addition to residential and commercial heating, gas accounts for the bulk of the fuel used by the petrochemical industry. Manufacturing relies on the availability of cheap gas, and its use in transportation is increasing. Additionally, gas producers are gearing up to export some of the gas to markets in Europe and Asia, where gas costs up to five times more than it does in the United States. A dozen or more U.S. companies have applied for licenses to export liquefied natural gas from terminals, mainly on the Gulf of Mexico.¶ Because of its multiple uses and rising popularity, the demand for natural gas is starting to increase, and its price could rise significantly. That is a real possibility, and would be consistent with its long history of price volatility. If we hope to maintain the security of our energy supply, we will need to expand the use of other energy sources, including nuclear power, which is also environmentally attractive and affordable.¶ Although the capital cost of building a nuclear plant is high, the average price of nuclear-generated electricity is lower than power produced from natural gas. In 2011, the production cost of nuclear power was 2.19 cents per kilowatt-hour, compared to 4.51 cents for natural gas and 3.23 cents for coal.¶ Today about 20% of America’s electricity comes from nuclear power. But demand for electricity is growing steadily and that trend will continue in the future. Without building new nuclear plants, pressure will build to use even more natural gas for electricity generation, making less available for manufacturing and transportation.¶ As an important part of America’s energy future, building a new generation of nuclear plants using advanced technologies should be considered by policy makers. To be sure, increasing the use of nuclear power certainly has its challenges. Electricity companies must cooperate to facilitate the investments that are essential for new construction.¶ Several other key ingredients are needed: recognition that the potential for long-term profits exists due to nuclear power’s lower fuel costs; a shift in the mindset to allow for the application of innovative technologies such as small modular reactors that can be built in a factory for a fraction of the cost of large power plants; and an awareness that nuclear power can produce a huge amount of clean energy for economic growth in the United States and worldwide.¶ Because they are both critically important economic drivers, natural gas and nuclear power need to share the lead in power generation for the future. Both are cleaner and more secure than the fuels they have replaced, and fostering their use is in our national and economic interest.

#### No turns- nuclear lifecycle is significantly and comparatively better than all fossil fuels

Hinkle 2012 (A. Barton Hinkle, journalist, July 2, 2012, “Don’t Judge Uranium Mining in a Vacuum,” Reason, http://reason.com/archives/2012/07/02/dont-judge-uranium-mining-in-a-vacuum)

Should Virginia lift its ban on uranium mining? The question has generated a lot of heat, but not much light. Last week, this column looked at uranium mining in isolation, and made three points: ¶ The recent report by the National Academy of Sciences was too vague to be of much use, and the use to which it has been put by opponents is misleading.¶ Opponents of lifting the moratorium throw around a lot of numbers that sound scary but mean little.¶ The uranium industry in Canada, where more uranium has been produced than in any other country on the planet, has an excellent environmental, health, and safety record, according to a review of the literature by the Canadian government.¶ That last point is worth dwelling on. Among many other things, the Canadian government – not the industry, the government—says “uranium mining and processing workers were as healthy as the general Canadian male population.” And: “Radon exposure to members of the public from [government]-regulated [mining] activities is virtually zero.” And: "Do uranium mines and mills increase radon levels in the environment? No." And: "Studies and monitoring have shown that there are no significant impacts to the health of the public living near uranium mines and mills." ¶ Also: "Studies carried out over several decades have repeatedly demonstrated that people who live near [uranium mines and processing facilities] are as healthy as the rest of the general population." And: “It is completely safe to consume fish, game and fruit from regions near operating uranium mines and mills.” And just for good measure: “No increased risk to children living near nuclear power plants or uranium mining, milling, and refining sites was detected.”¶ In short, then, there is very little to fear from uranium mining or nuclear power when considered in isolation. But we must not consider the issue in isolation – because the fossil-fuel alternatives are, in fact, considerably worse.¶ Just ask Joseph Romm, who studies energy issues at the Center for American Progress – a liberal think tank founded and run by former Clinton and Obama staffers. “There is no question,” Romm has said, that “nothing is worse than fossil fuels for killing people.”¶ He is not alone. In 2010 – admittedly, before the tsunami-caused disaster at the Fukushima Daiichi nuclear plant in Japan – the OECD’s Nuclear Energy Agency produced a report comparing the risks from nuclear power with those from other energy sources. It found that, “contrary to many people’s perception, nuclear energy presents very much lower risks. For example, more than 2,500 people are killed every year in severe energy-related accidents…. In contrast, there has only been one severe accident in nuclear power plants over this period of time (Chernobyl) resulting in 31 [direct and nearly immediate] fatalities.” ¶ The OECD says the total number of Chernobyl-related fatalities could rise as high as 33,000 over the next seven decades, “but we note that the OECD Environment Directorate estimates that 960,000 premature deaths resulted from levels of particulates in the air in the year 2000 alone, of which energy sources accounted for about 30 percent.” That works out to a 9:1 ratio in nuclear power’s favor. ¶ Then there’s The Washington Post, which reported – after Fukushima – that “making electricity from nuclear power turns out to be far less damaging to human health than making it from coal, oil, or even clean-burning natural gas, according to numerous analyses. That’s even more true if the predicted effects of climate change are thrown in.” ¶ How much less damaging? This much: “Compared with nuclear power, coal is responsible for five times as many worker deaths from accidents, 470 times as many deaths due to air pollution among members of the public, and more than 1,000 times as many cases of serious illness, according to a study of the health effects of electricity generation in Europe.” ¶ But what about radiation? Well. According to a 2007 piece in Scientific American, “Coal Ash Is More Radioactive than Nuclear Waste.” In fact, “the fly ash emitted by a power plant – a by-product of burning coal for electricity – carries into the surrounding environment 100 times more radiation than a nuclear power plant producing the same amount of energy.” ¶ Gerald Marsh concurs. Two years ago the retired nuclear physicist told Popular Mechanics, “The amount of radiation put out by a coal plant far exceeds that of a nuclear power plant, even if you use scrubbers.”¶ And again, remember: All these effects are in addition to anthropogenic climate change, which environmentalists insist is the greatest existential threat facing humanity – at least when they are not ignoring the issue in order to frighten people about the supposed perils of uranium mining.

#### No resilience- we’re on the brink of ecological tipping points that will cause an unpredictable cascade of environmental failures

Vince 2012 (Gaia Vince, science writer and broadcaster, June 15, 2012, “Earth: Have we reached an environmental tipping point?,” BBC, http://www.bbc.com/future/story/20120615-global-tipping-point)

If there’s one thing I hope this column achieves, it’s illustrating just how pivotal a point this is in human history. We are now living in the Anthropocene: humans are the main driver of planetary change. We're pushing global temperatures, land and water use beyond anything our species has experienced before. We’re polluting the biosphere, acidifying the oceans, and reducing biodiversity. At the same time, our global population will grow from seven billion to nine billion by 2050, and all will need food, water and clean air.¶ As if to illustrate the point further, last month Arctic monitors showed the concentration of carbon dioxide in the atmosphere has passed 400 parts per million (before the Industrial Age, carbon dioxide levels were 275 ppm). New data shows the rate of climate change could be even faster than thought.¶ Perhaps most worryingly of all, 22 scientists warned last week we are approaching a planetary tipping point, beyond which environmental changes will be rapid and unpredictable. Basing their alarming conclusion on studies of ecological markers from species extinction rates (currently 1,000 times the usual rate, and comparable to those experienced during the demise of the dinosaurs) to changes in land use (more than 40% of land is dominated by humans and we affect a further 40%), these scientists fear we will enter a new, unknown state, and one which threatens us all.

#### Global development is inevitable- expansion of nuke power is the only way to prevent that from destroying the environment

Nordhaus and Shellenberger 2011 (Ted Nordhaus, chairman of the Breakthrough Instiute, and Michael Shellenberger, president of the Breakthrough Insitute, MA cultural anthropology from University of California, Santa Cruz, February 25, 2011, http://thebreakthrough.org/archive/the\_long\_death\_of\_environmenta)

Tenth, we are going to have to get over our suspicion of technology, especially nuclear power. There is no credible path to reducing global carbon emissions without an enormous expansion of nuclear power. It is the only low carbon technology we have today with the demonstrated capability to generate large quantities of centrally generated electrtic power. It is the low carbon of technology of choice for much of the rest of the world. Even uber-green nations, like Germany and Sweden, have reversed plans to phase out nuclear power as they have begun to reconcile their energy needs with their climate commitments.¶ Eleventh, we will need to embrace again the role of the state as a direct provider of public goods. The modern environmental movement, borne of the new left rejection of social authority of all sorts, has embraced the notion of state regulation and even creation of private markets while largely rejecting the generative role of the state. In the modern environmental imagination, government promotion of technology - whether nuclear power, the green revolution, synfuels, or ethanol - almost always ends badly.¶ Never mind that virtually the entire history of American industrialization and technological innovation is the story of government investments in the development and commercialization of new technologies. Think of a transformative technology over the last century - computers, the Internet, pharmaceutical drugs, jet turbines, cellular telephones, nuclear power - and what you will find is government investing in those technologies at a scale that private firms simply cannot replicate.¶ Twelveth, big is beautiful. The rising economies of the developing world will continue to develop whether we want them to or not. The solution to the ecological crises wrought by modernity, technology, and progress will be more modernity, technology, and progress. The solutions to the ecological challenges faced by a planet of 6 billion going on 9 billion will not be decentralized energy technologies like solar panels, small scale organic agriculture, and a drawing of unenforceable boundaries around what remains of our ecological inheritance, be it the rainforests of the Amazon or the chemical composition of the atmosphere. Rather, these solutions will be: large central station power technologies that can meet the energy needs of billions of people increasingly living in the dense mega-cities of the global south without emitting carbon dioxide, further intensification of industrial scale agriculture to meet the nutritional needs of a population that is not only growing but eating higher up the food chain, and a whole suite of new agricultural, desalinization and other technologies for gardening planet Earth that might allow us not only to pull back from forests and other threatened ecosystems but also to create new ones.¶ The New Ecological Politics¶ The great ecological challenges that our generation faces demands an ecological politics that is generative, not restrictive. An ecological politics capable of addressing global warming will require us to reexamine virtually every prominent strand of post-war green ideology.¶ From Paul Erlich's warnings of a population bomb to The Club of Rome's "Limits to Growth," contemporary ecological politics have consistently embraced green Malthusianism despite the fact that the Malthusian premise has persistently failed for the better part of three centuries. Indeed, the green revolution was exponentially increasing agricultural yields at the very moment that Erlich was predicting mass starvation and the serial predictions of peak oil and various others resource collapses that have followed have continue to fail.¶ This does not mean that Malthusian outcomes are impossible, but neither are they inevitable. We do have a choice in the matter, but it is not the choice that greens have long imagined. The choice that humanity faces is not whether to constrain our growth, development, and aspirations or die. It is whether we will continue to innovate and accelerate technological progress in order to thrive.¶ Human technology and ingenuity have repeatedly confounded Malthusian predictions yet green ideology continues to cast a suspect eye towards the very technologies that have allowed us to avoid resource and ecological catastrophes. But such solutions will require environmentalists to abandon the "small is beautiful" ethic that has also characterized environmental thought since the 1960's. We, the most secure, affluent, and thoroughly modern human beings to have ever lived upon the planet, must abandon both the dark, zero-sum Malthusian visions and the idealized and nostalgic fantasies for a simpler, more bucolic past in which humans lived in harmony with Nature.

#### The only way out is through- the alternative is environment collapse and wars that cause extinction

Barnhizer 2006 (David Barnhizer, Professor of Law at Cleveland State University, “Waking from Sustainability's ‘Impossible Dream’,” Georgetown International Environmental Law Review, Lexis)

The scale of social needs, including the need for expanded productive activity, has grown so large that it cannot be shut off at all, and certainly not abruptly. It cannot even be ratcheted down in any significant fashion without producing serious harms to human societies and hundreds of millions of people. Even if it were possible to shift back to systems of local self-sufficiency, the consequences of the transition process would be catastrophic for many people and even deadly to the point of continual conflict, resource wars, increased poverty, and strife. What are needed are concrete, workable, and pragmatic strategies that produce effective and intelligently designed economic activity in specific contexts and, while seeking efficiency and conservation, place economic and social justice high on a list of priorities. 60¶ The imperative of economic growth applies not only to the needs and expectations of people in economically developed societies but also to people living in nations that are currently economically underdeveloped. Opportunities must be created, jobs must be generated in huge numbers, and economic resources expanded to address the tragedies of poverty and inequality. Unfortunately, natural systems must be exploited to achieve this; we cannot return to Eden. The question is not how to achieve a static state but how to achieve what is needed to advance social justice while avoiding and mitigating the most destructive consequences of our behavior.po

#### Plan causes exports that solve globally

Rosner and Goldberg 2011 (Robert Rosner, astrophysicist and founding director of the Energy Policy Institute at Chicago, and Stephen Goldberg, Special Assistant to the Director at the Argonne National Laboratory, Energy Policy Institute at Chicago, “Small Modular Reactors – Key to Future Nuclear Power Generation in the U.S.”, Technical Paper, Revision 1, November 2011)

As stated earlier, SMRs have the potential to achieve significant greenhouse gas emission reductions. They could provide alternative baseload power generation to facilitate the retirement of older, smaller, and less efficient coal generation plants that would, otherwise, not be good candidates for retrofitting carbon capture and storage technology. They could be deployed in regions of the U.S. and the world that have less potential for other forms of carbon-free electricity, such as solar or wind energy. There may be technical or market constraints, such as projected electricity demand growth and transmission capacity, which would support SMR deployment but not GW-scale LWRs. From the on-shore manufacturing perspective, a key point is that the manufacturing base needed for SMRs can be developed domestically. Thus, while the large commercial LWR industry is seeking to transplant portions of its supply chain from current foreign sources to the U.S., the SMR industry offers the potential to establish a large domestic manufacturing base building upon already existing U.S. manufacturing infrastructure and capability, including the Naval shipbuilding and underutilized domestic nuclear component and equipment plants. The study team learned that a number of sustainable domestic jobs could be created – that is, the full panoply of design, manufacturing, supplier, and construction activities – if the U.S. can establish itself as a credible and substantial designer and manufacturer of SMRs. While many SMR technologies are being studied around the world, a strong U.S. commercialization program can enable U.S. industry to be first to market SMRs, thereby serving as a fulcrum for export growth as well as a lever in influencing international decisions on deploying both nuclear reactor and nuclear fuel cycle technology. A viable U.S.-centric SMR industry would enable the U.S. to recapture technological leadership in commercial nuclear technology, which has been lost to suppliers in France, Japan, Korea, Russia, and, now rapidly emerging, China.

### Contention 3

#### No more great power wars- realism was wrong

Christoph Bluth School of Politics and International Studies, University of Leeds POLIS Working Paper No. 12 February 2004 “Norms and International Relations: The anachronistic nature of neo-realist approaches” http://www.polis.leeds.ac.uk/assets/files/research/working-papers/wp12bluth.pdf

However, the interpretation of the nature of the Cold War by neorealists is open to question. 6 In particular the timing and manner in which the Cold War ended is a problem for the neorealist approach. A different interpretation of the nature of the Cold War and the reasons for its end leads to a completely different characterisation of the system of states in Europe after the Cold War. The potential for inter-state conflict predicted by John Mearsheimer is nowhere apparent in Europe except on the territory of states which have now fallen apart, such as certain parts of the former Soviet Union and the former Republic of Yugoslavia. 7 These conflicts can be interpreted either as civil conflicts or post-colonial conflicts. What we are witnessing in Europe are the consequences the collapse of the Soviet Union and the Yugoslav state, which created stability on their territories by the constant threat of force has resulted in instability and conflict. 8 More importantly, the post-Cold War conflicts that involved significant outbreaks of violence were not inter-state conflicts (such as predicted by Mearsheimer), but rather intra-state conflicts. Generally speaking post-ColdWar European states do not seem to be naturally prone to military conflict. Quite the opposite appears to be the case: the principal objective of virtually all Central and Eastern European states is to join various Western multilateral organisations such as NATO and the European Union and thereby accept international norms with regard to the use and the threat of the use of force and other consequent constraints on their foreign and domestic policies. Whereas for neo-realists the principal consequence for the international system of the end of the Cold War is the collapse of the bipolar structure of power and the reemergence of a regional multipolarity (accompanied by the emergence of the United States as the only state with global power projection capabilities), other perspectives provide a sense of a deeper change. These range from Samuel Huntingdon’s Clash of Civilisations, which sees the bipolar global power struggle replaced by new patterns of conflict and cooperation emerging along cultural lines, 9 to Francis Fukuyama’s belief in the final triumph of Western liberalism and the end of history. 10 It is not necessary to accept the whole of Fukuyama’s framework or the triumphalism of some of his adherents to conclude that a major paradigm shift has occurred with regard to the role of military force in the international system and that we are indeed in a new era in which war between the major powers has become unlikely, or, as some would say, obsolete. 11 There are several developments through the 20 th century that point in this direction. 12 The first is that the cost of war has dramatically increased to the point of rendering war unprofitable. The last major systemic conflict between major powers was a cold war precisely for that reason. The destructive power of nuclear weapons was such that their large-scale use would threaten the very existence of the societies that would engage in such a conflict. But the destructive power of conventional forces is now such that an all-out conflict between major powers would result in unacceptable losses on both sides. This is illustrated by the fact that during the 1980s the Soviet leadership concluded that any war in Europe would be literally impossible because attacks on nuclear power stations would render Europe uninhabitable. 13 The vulnerability of high-technology societies and their high standard of living has resulted an unwillingness to support the costs of war, both in terms of casualties and damage to the society itself. The second factor is that the currency of power in the security space occupied by the Western powers and to some extent also Russia and China has changed. 14 The collapse of an empire controlled by a nuclear superpower with the military capacity to destroy every country on earth is a powerful symbol of this trend. During the 1970s and 1980s it was already observable that economic capacity and commercial competitiveness were becoming more important. These trends accelerated as the Cold War ended, both in the West, and also now in the East where the survival of the post-Communist states was not endangered by external military threat but internal societal and economic collapse. 15 Another aspect of this is what is a phenomenon referred to as globalisation. 16 There is now a high degree of global economic interdependence. Financial collapse in one country can affect the wealth of people, companies and societies on the other side of the globe. The abandonment of the centrally planned command economy by the former Communist countries is of major significance for international security. Russia and China are no longer attempting to develop autonomous, socialist economies. Instead both countries have committed themselves to develop market economies, as a consequence of which their wellbeing depends on the well-being of other major powers, especially the United States and the European Union.. Wealth is no longer dependent on the possession of land or natural resources, but on the intellectual capital and social organisation to produce high quality, high technology products. Such wealth cannot be efficiently acquired by war or conquest.

#### Permanent shift away from great power war

Goldstein 2011 (Joshua S. Goldstein, professor emeritus of international relations at American University, September/October 2011, “Think Again: War,” Foreign Policy, http://www.foreignpolicy.com/articles/2011/08/15/think\_again\_war?page=0,6)

So far they haven't even been close. In fact, the last decade has seen fewer war deaths than any decade in the past 100 years, based on data compiled by researchers Bethany Lacina and Nils Petter Gleditsch of the Peace Research Institute Oslo. Worldwide, deaths caused directly by war-related violence in the new century have averaged about 55,000 per year, just over half of what they were in the 1990s (100,000 a year), a third of what they were during the Cold War (180,000 a year from 1950 to 1989), and a hundredth of what they were in World War II. If you factor in the growing global population, which has nearly quadrupled in the last century, the decrease is even sharper. Far from being an age of killer anarchy, the 20 years since the Cold War ended have been an era of rapid progress toward peace.¶ Armed conflict has declined in large part because armed conflict has fundamentally changed. Wars between big national armies all but disappeared along with the Cold War, taking with them the most horrific kinds of mass destruction. Today's asymmetrical guerrilla wars may be intractable and nasty, but they will never produce anything like the siege of Leningrad. The last conflict between two great powers, the Korean War, effectively ended nearly 60 years ago. The last sustained territorial war between two regular armies, Ethiopia and Eritrea, ended a decade ago. Even civil wars, though a persistent evil, are less common than in the past; there were about a quarter fewer in 2007 than in 1990.¶ If the world feels like a more violent place than it actually is, that's because there's more information about wars -- not more wars themselves. Once-remote battles and war crimes now regularly make it onto our TV and computer screens, and in more or less real time. Cell-phone cameras have turned citizens into reporters in many war zones. Societal norms about what to make of this information have also changed. As Harvard University psychologist Steven Pinker has noted, "The decline of violent behavior has been paralleled by a decline in attitudes that tolerate or glorify violence," so that we see today's atrocities -- though mild by historical standards -- as "signs of how low our behavior can sink, not of how high our standards have risen."

#### Zero risk of escalation even if a couple bombs are dropped

Quinlan 2009 (Michael Quinlan, former top official in the British Ministry of Defence, 2009, “Thinking About Nuclear Weapons: Principles, Problems, Prospects,”pg 63-64)

There are good reasons for fearing escalation. These include the confusion of war; its stresses, anger, hatred, and the desire for revenge; reluctance to accept the humiliation of backing down; the desire to get further blows in first. Given all this, the risks of escalation are grave in any conflict between advanced powers, and Western leaders during the cold war were rightly wont to emphasize them in the interests of deterrence. But this is not to say that they are virtually certain, or even necessarily odds-on; still less that they are so for all the assorted circumstances in which the situation might arise, in a nuclear world to which past experience is only a limited guide. It is entirely possible, for example, that the initial use of nuclear weapons, breaching a barrier that has held since 1945, might so horrify both sides in a conflict that they recognized an overwhelming common interest in composing their differences. The human pressures in that direction would be very great.¶ Even if initial nuclear use did not quickly end the fighting, the supposition of inexorable momentum in a developing exchange, with each side rushing to overreaction amid confusion and uncertainty, is implausible. It fails to consider what the situation of the decision- makers would really be. Neither side could want escalation. Both would be appalled at what was going on. Both would be desperately looking for signs that the other was ready to call a halt. Both, given the capacity for evasion or concealment which modern delivery platforms and vehicles can possess, could have in reserve significant forces invulnerable enough not to entail use-or-lose pressures. (It may be more open to question, as noted earlier, whether newer nuclear- weapon possessors can be immediately in that position; but it is within reach of any substantial state with advanced technological capabilities, and attaining it is certain to be a high priority in the development of forces.) As a result, neither side can have any predisposition to suppose, in an ambiguous situation of fearful risk, that the right course when in doubt is to go on copiously launching weapons. And none of this analysis rests on any presumption of highly subtle or pre-concerted rationality. The rationality required is plain.¶ The argument is reinforced if we consider the possible reasoning of an aggressor at a more dispassionate level. Any substantial nuclear armoury can inflict destruction outweighing any possible prize that aggression could hope to seize. A state attacking the possessor of such an armoury must therefore be doing so (once given that it cannot count upon destroying the armoury pre-emptively) on a judgement that the possessor would be found lacking in the will to use it. If the attacked possessor used nuclear weapons, whether first or in response to the aggressor’s own first use, this judgement would begin to look dangerously precarious. There must be at least a substantial possibility of the aggressor leaders’ concluding that their initial judgement had been mistaken—that the risks were after all greater than whatever prize they had been seeking, and that for their own country’s survival they must call off the aggression. Deterrence planning such as that of NATO was directed in the first place to preventing the initial misjudgement and in the second, if it were nevertheless made, to compelling such a reappraisal. The former aim had to have primacy, because it could not be taken for granted that the latter was certain to work. But there was no ground for assuming in advance, for all possible scenarios, that the chance of its working must be negligible. An aggressor state would itself be at huge risk if nuclear war developed, as its leaders would know.

#### Counterforce strike means no impact

Mueller 2009 (John Mueller Woody Hayes Chair of National Security Studies and Professor of Political Science @ Ohio State University 2009 Atomic Obsession: Nuclear Alarmism from Hiroshima to Al-Qaeada pg 8)

To begin to approach a condition that can credibly justify applying such extreme characterizations as societal annihilation, a full-out attack with hundreds, probably thousands, of thermonuclear bombs would be required. Even in such extreme cases, the area actually devastated by the bombs’ blast and thermal pulse effects would be limited: 2,000 I-MT explosions with a destructive radius of 5 miles each would directly demolish less than 5 percent of the territory of the United States, for example. Obviously, if major population centers were targeted, this attack could inflict massive casualties. Back in the Cold War day, when such devastating events sometimes seemed uncomfortable likely, a number of studies were conducted toestimate the consequences of massive thermonuclear attacks. One of the most prominent of these considered several possibilities. The most likely scenario- one that could be perhaps be considered at least to begin to approach the rational- was a “counterforce” strike in which well over 1,000 thermonuclear weapons would be targeted at America’s ballistic missile silos, strategic airfields, and nuclear submarine bases in an effort to destroy the country’s strategic ability to retaliate. Since the attack would not directly target population centers, most of the ensuing deaths would be from radioactive fallout, and the study estimates that from 2 to 20 million, depending mostly on wind, weather, and sheltering, would perish during the first month.

#### Political and military crises do not escalate to full-blown war

Lambakis 2001 (Steven Lambakis, senior defense analyst at the National Institute for Public Policy, February 1, 2001, “Space Weapons: Refuting the Critics,” Hoover Institution, Stanford University, Policy Review, google)

The case against deploying weapons in space rests on a number of assumptions, often unstated. A careful look at the validity of these assumptions reveals serious problems — in many cases undermining the conclusions the critics draw.¶ One such assumption is that military developments over the past 50 years have created a security environment in which certain tactical events or localized crises run an unacceptably high risk of triggering a general, possibly even nuclear, war. We are therefore more secure when we do nothing to upset the global military balance, especially in space — where we station key stabilizing assets.¶ Yet we have little experience in reality to ground this freely wielded and rather academic assumption. By definition, anything that causes instability in armed relationships is to be avoided. But would "shots" in space, any more than shots on the ground, be that cause?¶ When we look at what incites war, history instructs us that what matter most are the character and motivation of the states involved, along with the general balance of power (i.e., are we in the world of 1914, 1945, or 2001?). Fluctuations in national arsenals, be they based on earth or in space, do not determine, but rather more accurately are a reflection of, the course of politics among nations. In other words, it matters not so much that there are nuclear weapons, but rather whether Saddam Hussein or Tony Blair controls them and in what security context. The same may be said for space weapons.¶ The sway of major powers historically has regulated world stability. It follows that influential countries that support the rule of law and the right of all states to use orbits for nonaggressive purposes would help ensure stability in the age of satellites. The world is not more stable, in other words, if countries like the United States, a standard-bearer for such ideas, "do nothing." Washington’s deterrence and engagement strategies would assume new dimensions with the added influence of space weapons, the presence of which could help bolster peacemaking diplomacy and prevent aggression on earth or in space.¶ Insofar as we have no experience in space warfare, no cases exist to justify what is in essence a theoretically derived conclusion — that space combat must be destabilizing. We do know, however, that the causes of war are rarely so uncomplicated. Small events, by themselves, seldom ever explain large-scale events. When ardent Israeli nationalist Ariel Sharon visited this past fall the holy site around the Al Aksa Mosque at Jerusalem’s Temple Mount, his arrival fired up a series of riots among impassioned Palestinians and so widened the scale of violence that it kicked up the embers of regional war yet again. Yet the visit itself would have been inconsequential were it not for the inveterate hostility underlying Israeli-Palestinian relations.¶ Likewise, World War I may have symbolically begun with the assassination of Archduke Ferdinand in Sarajevo. Yet a serious student of history would note that the alliances, the national goals and military plans, and the political, diplomatic, and military decisions of the major European powers during the preceding years and months were the true causes of the erosion in global strategic stability. By extension, if decisions to go to war are set on a hair-trigger, the reasons for the precarious circumstances extend far beyond whether a communications or imaging platform is destroyed in space rather than on earth.¶ Those who believe we run extraordinary risks stemming from clouded perceptions and misunderstandings in an age of computerized space warfare might want to take a look at some real-world situations of high volatility in which potentially provocative actions took place. Take, for example, the tragedies involving the USS Stark and USS Vincennes. In May 1987, an Iraqi F-1 Mirage jet fighter attacked the Stark on patrol to protect neutral shipping in the Persian Gulf, killing 37 sailors. Iraq, a "near-ally" of the United States at the time, had never before attacked a U.S. ship. Analysts concluded that misperception and faulty assumptions led to Iraq’s errant attack.¶ The memory of the USS Stark no doubt preoccupied the crew of the USS Vincennes, which little over a year later, in July 1988, was also on patrol in hostile Persian Gulf waters. The Vincennes crew was involved in a "half war" against Iran, and at the time was fending off surface attacks from small Iranian gunboats. Operating sophisticated technical systems under high stress and rules of engagement that allowed for anticipatory self-defense, the advanced Aegis cruiser fired anti-aircraft missiles at what it believed to be an Iranian military aircraft set on an attack course. The aircraft turned out to be a commercial Iran Air flight, and 290 people perished owing to mistakes in identification and communications.¶ To these examples we may add a long list of tactical blunders growing out of ambiguous circumstances and faulty intelligence, including the U.S. bombing in 1999 of the Chinese Embassy in Belgrade during Kosovo operations. Yet though these tragic actions occurred in near-war or tinderbox situations, they did not escalate or exacerbate local instability. The world also survived U.S.-Soviet "near encounters" during the 1948 Berlin crisis, the 1961 Cuban missile crisis, and the 1967 and 1973 Arab-Israeli wars. Guarded diplomacy won the day in all cases. Why would disputes affecting space be any different?¶ In other words, it is not at all self-evident that a sudden loss of a communications satellite, for example, would precipitate a wider-scale war or make warfare termination impossible. In the context of U.S.-Russian relations, communications systems to command authorities and forces are redundant. Urgent communications may be routed through land lines or the airwaves. Other means are also available to perform special reconnaissance missions for monitoring a crisis or compliance with an armistice. While improvements are needed, our ability to know what transpires in space is growing — so we are not always in the dark.¶ The burden is on the critics, therefore, to present convincing analogical evidence to support the notion that, in wartime or peacetime, attempts by the United States to control space or exploit orbits for defensive or offensive purposes would increase significantly the chances for crisis instability or nuclear war. In Washington and other capitals, the historical pattern is to use every available means to clarify perceptions and to consider decisions that might lead to war or escalation with care, not dispatch.

#### Prefer our impacts-

#### Impacts previously underestimated

Science Daily, 11, 8-19-2011, “Biodiversity Critical for Maintaining Multiple 'Ecosystem Services'“, http://www.sciencedaily.com/releases/2011/08/110819155422.htm

By combining data from 17 of the largest and longest-running biodiversity experiments, scientists from universities across North America and Europe have found that previous studies have underestimated the importance of biodiversity for maintaining multiple ecosystem services across many years and places. "Most previous studies considered only the number of species needed to provide one service under one set of environmental conditions," says Prof. Michel Loreau from McGill University's biology department who supervised the study. "These studies found that many species appeared redundant. That is, it appeared that the extinction of many species would not affect the functioning of the ecosystem because other species could compensate for their loss." Now, by looking at grassland plant species, investigators have found that most of the studied species were important at least once for the maintenance of ecosystem services, because different sets of species were important during different years, at different places, for different services, and under different global change (e.g., climate or land-use change) scenarios. Furthermore, the species needed to provide one service during multiple years were not the same as those needed to provide multiple services during one year. "This means that biodiversity is even more important for maintaining ecosystem services than was previously thought," says Dr. Forest Isbell, the lead author and investigator of this study. "Our results indicate that many species are needed to maintain ecosystem services at multiple times and places in a changing world, and that species are less redundant than was previously thought." The scientists involved in the study also offer recommendations for using these results to prioritize conservation efforts and predict consequences of species extinctions. "It is nice to know which groups of species promoted ecosystem functioning under hundreds of sets of environmental conditions," says Isbell, "because this will allow us to determine whether some species often provide ecosystem services under environmental conditions that are currently common, or under conditions that will become increasingly common in the future." But Michel Loreau, of McGill, adds au cautionary note: "We should be careful when making predictions. The uncertainty over future environmental changes means that conserving as much biodiversity as possible could be a good precautionary approach."

#### Reversibility

Cass R. Sunstein () 2007 “WORST-CASE SCENARIOS” p. 176-7, Harry Kalven Visitng Professor, Professor of Law at Harvard Law School but is currently on leave to serve as the Administrator of the White House Office of Information and Regulatory Affairs in the Obama administration, and

In ordinary life, our judgments about worst-case scenarios have everything to do with irreversibility. Of course an action may be hard but not impossible to undo, and so there may be a continuum of cases, with different degrees of difficulty in reversing. A marriage can be reversed, but divorce is rarely easy; having a child is very close to irreversible; moving from New York to Paris is reversible, but moving back may be difficult. People often take steps to avoid courses of action that are burdensome rather than literally impossible to reverse. In this light,we might identify an Irreversible Harm Precautionary Principle, applicable to a subset of risks.3 As a rough first approximation, the principle says this: Special steps should be taken to avoid irreversible harms, through precautions that go well beyond those that would be taken if irreversibility were not a problem. The general attitude here is “act, then learn,” as opposed to the tempting alternative of “wait and learn.” In the case of climate change, some people believe that research should be our first line of defense. In their view, we should refuse to commit substantial resources to the problem until evidence of serious harm is unmistakably clear.4 But even assuming that the evidence is not so clear, research without action allows greenhouse gas emissions to continue, which might produce risks that are irreversible, or at best difficult and expensive to reverse. For this reason, the best course of action might well be to take precautions now as a way of preserving flexibility for future generations. In the environmental context in general, this principle suggests that regulators should proceed with far more aggressive measures than would otherwise seem justified.5

#### Invisible tipping point

Science Daily 2011, 3-3-2011, “Loss of Plant Diversity Threatens Earth's Life-Support Systems, Experts Say”, http://www.sciencedaily.com/releases/2011/03/110303153116.htm

Biodiversity loss in the real world Recognizing that their findings mostly rest on analysis of short-term experiments (generally a few days, weeks, or months) in relatively small settings, the researchers also attempted to determine how diversity effects "scale-up" to longer time scales, bigger areas, or both. The authors note that these are the real-world scales "at which species extinctions actually matter and at which conservation and management efforts take place." The team's findings suggest that scale does indeed matter, and that small laboratory and field experiments typically underestimate the effects of biodiversity loss. In the researchers' own words, "Data are generally consistent with the idea that the strength of diversity effects are stronger in experiments that run longer, and in experiments performed at larger spatial scales." Duffy is now further testing this scaling issue with a 3-year grant from the U.S. National Science Foundation. He is using the grant to establish a global experimental network for studying how nutrient pollution and changes in biodiversity impact seagrass beds. Study co-author Jarrett Byrnes, of the National Center for Ecological Analyses and Synthesis, says "Species extinction is happening now, and it's happening quickly. And unfortunately, our resources are limited. This means we're going to have to prioritize our conservation efforts, and to do that, scientists have to start providing concrete answers about the numbers and types of species that are needed to sustain human life. If we don't produce these estimates quickly, then we risk crossing a threshold that we can't come back from."