

Information Provided by Russ George, President CEO Founder Planktos Inc. and Planktos Corp., Founder Managing Director KlimaFa, Founder Haida Climate

Provided To House Select Committee on Energy Independence and Global Warming Wednesday 18 July 2007 in response to their invitation to appear before the committee.

The committee has provided the following questions for address (rough version of questions):

- 1. What is the nature and scope of business in the voluntary carbon offset market? Kinds of projects, business model for selling offsets, and scope of our offset business.*
- 2. What's our response to the recent controversy regarding your company plans to undertake marine "iron fertilization" project near the Galapagos Islands.*
- 3. What is our response to the criticism of forest-based offsets, for example based on the grounds that the permanence of carbon sequestration cannot be guaranteed or that albedo effects of reforestation in northern forests negate the carbon sequestration benefits.*
- 4. How can we ensure that individual consumers and companies that purchase carbon offsets are getting what they pay for and that offset projects have environmental integrity, with regard to both climate and non-climate effects. Are industry standard setting initiatives adequate or is there some role for government regulation. If so what form should regulation take.*
- 5. What is the future of the voluntary offset market, and how significant a contribution can that market make to mitigation of climate change.*

Introduction and Comments as to the Nature and Scope of my work and the work of the companies I am part of in the emerging Carbon Markets.

I'd like to thank the Select Committee on Energy Independence and Global Warming for inviting me to present my views on topics important to this committee, the nation and indeed the global environment. As a lifelong ecologist and businessman I am personally very concerned about the dramatic declines being observed and reported in global ecosystems, especially among plant communities, on the 28% of this planet that is land and the 72% that is ocean. I hope you will bear with me as I avoid the use of the term 'global warming' which I believe constrains and restricts important scientific considerations of other critical impacts of the modern fossil fuel age which are better described as 'climate change' and perhaps best described as 'ecosystem change'. Simply put, vast ecosystems on this planet are being dramatically altered and diminished by the influence of our CO₂ emissions and one consequence of those changes is commonly referred to as 'global warming.'

I am engaged in a number of businesses as Founder/Officer/Director/Scientist, all of which are working to develop and deliver green solutions to the environmental crises brought on by our increasing CO₂ emissions and the staggering diminishment of the natural CO₂ sequestration capacity of ecosystem CO₂ sinks most easily described as the seas and trees. These businesses include my primary company called Planktos Inc. and a public company called Planktos Corp. Both are headquartered in the San Francisco Bay area of California. A second company which was developed in parallel to and is presently a subsidiary of Planktos Inc. called KlimaFa (Climate Tree in Hungarian) is headquartered in Budapest Hungary, and a third company called Haida Climate is headquartered in the village of Old Masset on the British Columbia islands known as Haida Gwaii and in Vancouver, British Columbia. Further I work and consult regularly with governments and organizations in Europe, China, and North and Central America

to assist development of land and sea ecorestoration projects to revive plant communities and ecosystems for their myriad ecosystem services and benefits including the newly emerging ecosystem service commonly called a carbon offset or carbon credit. For the record I am also personally and professionally engaged as President CEO and Scientist in a business called D2Fusion based in the Silicon Valley of California and in Los Alamos New Mexico which is the culmination of nearly 20 years of work in quantum and nuclear physics. D2Fusion is working to deliver safe clean nuclear fusion energy based on solid state fusion conditions which offer a technological solution that I am convinced will one day soon safely and affordably relieve us of our energy dependence on fossil fuels.

Present Corporate Brief on Planktos

Planktos' ocean work is in an early stage of classic R&D, with an emphasis on the "D" side of the equation. We are following in the footsteps of 20+ years and upwards of \$100 million in research efforts by international public science agencies on investigations of the role of mineral micronutrients, especially iron, in ocean phytoplankton (plant life) ecology. Our interpretation of this work is that it has provided dramatic evidence that ocean plant life, plankton blooms, are tightly linked to mineral micronutrients that mostly arrive in the form of Aeolian (wind-borne) dust, from coastal shelf mineral sources, and from ocean upwellings. The results of the work to date has been most illuminating when once considers the role of Aeolian dust and the analog to that dust which is iron added by intent by ocean science organizations. Our basic business plan has been provided on our web site for many years and recently has been widely reported by the media. Our plan follows the consensus opinion of many ocean scientists who have called for larger, more controlled, and more fully monitored iron addition trials that will generate the multidisciplinary data needed to understand this technology's true capacity as a tool for CO2 mitigation and ocean stewardship. As a for profit business, we are of course also interested in the economic implications of that data and have designed our studies along the lines of small commercial pilot projects. Toward this end we have been able to raise funds in an ongoing fashion to support this frontier enterprise effort. We consider this work to be akin to the development of the applied science and technologies of agronomy and forestry, and believe it can finally foster similar stewardship based enterprises for the world's oceans.

Our diverse business involves both forest and ocean based ecorestoration projects, but given our start-up status in which we are just beginning our first major projects, it is impossible to make precise projections of the volumes of offsets we may produce. We are encouraged by the very dramatic international market that trades in excess of €50 - €100 million per day of carbon offsets in the European Union markets. This is why the bulk of our efforts are directed at developing and serving those EU markets and why we are so actively engaged in developing approved and approvable methodologies for providing our ecorestoration offset products into the EU and Asian markets. Our forestry efforts seek to restore hundreds of thousands of acres of land to mixed species native forests within the national park systems of the EU. Our initial projects in collaboration with Hungary's government, Academy of Sciences and National Parks Directorate involve the creation of 10,000 hectares of new "climate forest parks" that will prove out the model and generate millions of JI Track 1 credits for Kyoto markets. We take some guidance from other ecoforestry projects that have provided carbon offsets that have reaped in recent years sales agreements of as much as \$145 million for 25,000 acre ecoforestry projects.

Voluntary markets for climate change offsets are emerging slowly in the United States and more dramatically abroad in countries that are signatories to the Kyoto Accord. At present the volume of credits sold by our company into the voluntary market is very a small number, not exceeding a few thousand tonnes. We don't expect this voluntary market, especially in the USA, to become a significant part of our business.

It is easy to imagine a larger voluntary market one day emerging but at this point in time we still do not see evidence of that especially in the USA. To the best of our knowledge, the US voluntary market at present amounts to no more than tens of thousands of tonnes of CO₂e per year. As such the economic value of that market is quite inconsequential as prices for such voluntary offsets generally is in the \$5 - \$10 per tonne range. We question whether organizations selling into the US voluntary market at present recoup fully burdened costs associated with those sales. We do not, but then again we are working to develop awareness through this effort so our voluntary market sales are in part an educational outreach activity. Many organizations have aspirations to turn the corner and become profitable in this voluntary market and if that becomes possible we are well positioned to do so as well.

Our ocean plankton restoration pilot projects will generate the first substantial iron seeded blooms aimed at serving our twin purposes of restoring ocean plant ecosystems and sequestering atmospheric CO₂. Since these projects are designed to obtain knowledge of ocean processes as well as the engineering, economic, political, and regulatory factors surrounding this activity, they require ‘forward looking methods’ to predict production volumes. Our stated goal is to conduct a series of up to six modest sized blooms that are on the order of 1%-2% the size of natural iron stimulated blooms in order to capture the data needed to answer many questions about this work’s potential. These blooms will be about one order of magnitude larger than the largest iron stimulated blooms created by the earlier multinational science teams and be consistent with the size those teams have stated is the next appropriate step.

We take as a guiding principle authoritative science reports that the recent critical decline in ocean plant life has diminished annual ocean fixation of CO₂ by at least 3-4 billion tonnes based on NASA and NOAA documented baselines from 1979~81. Note that this diminished capture of CO₂ by ocean plants represents roughly half the net anthropogenic CO₂ surplus of 6-8 billion tonnes per year. We leave it to you to judge whether this 3-4 billion tonne annual carbon capture deficit might serve to stimulate an ocean restoration industry funded in part by monetized carbon offsets.

Recent Ocean Iron Fertilization “Controversy”

Comments on Recent Misleading Press Releases and News Stories on Planktos Proposed Ocean Work .

Planktos is about to conduct a carefully planned series of ocean restoration pilot projects aimed at developing methodologies and technologies to restore dramatically damaged ecosystems of ocean phytoplankton via replenishment of depauperate micronutrient iron. Ordinarily we’d rejoice at being covered in the media, however we take issue with the slanted portrayal of our work in various recent news stories. In the fever of a fabricated controversy many journalists have fallen prey to doing the story right now instead of doing the story right.

The press releases from some NGOs that fueled the debate about Planktos’ pilot project efforts employed the classic straw man tactic, first portraying our work falsely then criticizing us for their fabricated description. Ordinarily one expects responsible journalists to at least fact check when reporting controversies with potentially momentous implications; and we were sincerely surprised when so many writers quite apparently did not. One reporter characterized hematite, a ubiquitous natural form of iron on the planet, as an “industrial waste product.” This would have simply seemed sad if it had not been written in a famous science journal and fit so neatly into our critics “ocean dumping” claims.

The noted Journal Nature made a subsequent assertion that gauging how much carbon blooms sequester “is still unclear” but that same journal might have at least responsibly referenced Blain et al.’s detailed study on just that question in their own April issue as well as Buesseler et al.’s simultaneous report in Science, both of which document that such assessments can and are being accurately achieved. Moreover,

their studies show that depending on location 20~50% of the bloom fixed carbon is reaching 1000 meters in depth where it is effectively sequestered from the atmosphere for many centuries. The reporter from Nature goes on to quote without comment charges that these are premature “large-scale operations” when our pilot projects are only an order of magnitude larger than the last multinational iron fertilization project in 2002 and exactly the size that researchers from the ten previous trials have been calling for as the next logical step in developing this field.

The Planktos project involves replenishing missing micronutrient iron to a patch of ocean rich in major plant nutrients but low in productivity; and we will for the first time in the history of ocean science the resulting plankton bloom will have a dedicated research ship remain with the bloom for its entire 4~6 month life cycle. This work will take place hundreds of miles west of the Galapagos well away from any possible influence on or from the islands. The reason for this location is that the islands themselves are a major source of iron which results in a massive plankton bloom called the Galapagos Plume. It is the existence of this massive natural iron stimulated bloom that initially drew ocean scientists researching iron replenishment to the region for two previous successful though smaller iron experiments. The vast natural Galapagos bloom serves as a perfect scientific control for studying such iron induced blooms. It is also this vast natural bloom that creates the unique marine oasis that makes the Galapagos environment so bountiful and unique.

Now here's the twist, unfortunately WWF's US office and two other groups decided to oppose this work, but instead of engaging us on the merits of the project or ever mentioning the 50% plankton decline in the region we are working, they fabricated another straw man and falsely claimed our work would endanger the magnificent Galapagos environment and the livelihoods of the people who live there. Although aware that the project will take place far out to sea in currents that will bear our bloom even further away, they falsely portrayed our work in widely disseminated press releases as a senseless endangerment of a natural wonder to generate public alarm. They suggest this endangerment would derive from the micronutrient iron Planktos will put into the ocean to raise iron concentrations by mere tens of parts per trillion and the plankton bloom that would be initiated. However the alarms of these NGO's opposing the work of Planktos are based on utterly false and intentionally misleading declarations that the work of Planktos poses a threat to the Galapagos Islands which are themselves a massive natural source of iron to the regions ocean resulting in a vast plankton bloom that enriches that very region.

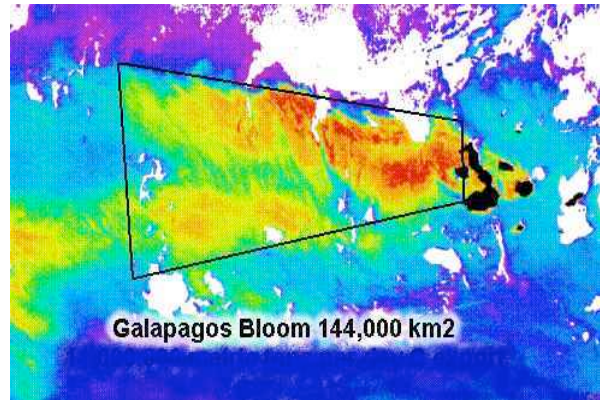
Besides this initial shock tactic, they fabricated a litany of negative environmental impacts they propose will likely result from this work. Had the media examined these claimed “ill effects “ they would have easily and surely found that the implied danger of every one of these alarming impacts is refuted by their absence in the natural but much more massive Galapagos bloom that envelopes the islands and extends far to the west. In the absence supporting facts, to the unwary and uninitiated these fears all may seem worthy of great concern, but in this case not only is there a complete absence of corroborating facts there is an overwhelming number of countervailing facts.

What is worse they have ignored the right story which is the desperate crisis in the world's oceans where a rapid mass extinction of plant life is underway. Ocean plants, the phytoplankton, are dying off at a phenomenal rate and have been doing so for scores of years and something must be quickly done to slow and reverse this trend. The primary causes of this decline are higher surface temperatures and the shortfall of micronutrient iron from rapidly diminishing Aeolian dust.

Ocean net primary productivity as calculated by the satellite measure of chlorophyll in the oceans has been shown as suffering losses of 17% in the North Atlantic, 26% in the North Pacific, and 50% in sub-tropical tropical oceans since the early eighties when our first competent measures of this sort began. To put this into a lay context we are seeing about the same 1% loss per year of ocean forest that the rainforests are shown to be suffering. However the rainforests cover a mere 2-3% of the planet while the ocean forest covers 72%. One can thus easily infer that in each 3-4 year period an amount of ocean plant

life equal to all rainforest plants on earth disappears. The fact that Planktos is working carefully, in the best traditions of science, to develop the ability to slow this ocean ecosystem collapse we would have thought was a great story. Unfortunately sensational misinformation seems to have offered many reporters a much easier story that was just too good to check.

Here's an image the media might have chosen to run to inform and salve public fears. It shows the massive Galapagos bloom which is so critically important to any story on Planktos' work. The existence of the massive Galapagos bloom enveloping the islands and extending its vast "plume" of plankton fertility might have contained a caption explaining that this natural iron induced bloom is responsible for the marine oasis effect that makes the Galapagos such natural wonder. It ought to be clear to anyone looking at the image that our tiny project 1/15th the size of just this portion of the natural bloom and hundreds of miles to the west could not impact the islands' environment or the lives of residents in any way.



Temperate Forest Albedo

A recent theory posited by Ken Caldeira of Stanford claims planting trees in temperate latitudes may actually warm the Earth rather than help reduce global warming. Quite simply we do not believe that an oversimplified mathematical climate physics model provides any worthwhile insights into the complex reality of the environment and it would be absurd to employ it as a to guide climate policy.

The Caldeira study makes a bold assumption that everything important about the role of CO₂ and forests is captured within the context of atmospheric warming effects governed entirely by the phenomenon of "albedo" or light reflectivity. Since light-colored surfaces on Earth reflect more of the sun's heat back into the atmosphere than do dark surfaces, the study claims that, given the Earth's curvature, conversion of light-colored surfaces non-forested lands to dark colored surfaces, forests, in boreal and temperate regions would warm the planet more over time.

Most importantly the model offers neither acknowledgment nor accommodation of the powerful complex interdependencies and effects of CO₂ that are mitigated when it is fixed and sequestered in forests as opposed to being allowed to circulate and impact other vital ecosystems such as dry lands and oceans. In some of those systems forest CO₂ mitigation or the lack thereof exerts a potent forcing effect on the overall planetary carbon cycle. For example higher CO₂ in the atmosphere due to temperate forests not fixing CO₂ is shown to result in greater growth of CO₂ sensitive vegetation especially dry land grasses. This forcing effect causes the production of more 'ground cover' and reduces Aeolian dust. The diminished dust supply correspondingly starves the oceans of vital mineral micronutrients accelerating the devastating decline in the ocean's net primary productivity. Even more importantly forest CO₂ sinks help slow the deadly pace of ocean acidification, which the Royal Society predicts will start triggering mass extinction events in the ocean in as little as 50 years.

Our colleagues at the Pacific Forest Trust have also studied the issue and agree the study's assertion is based on a theoretical, narrow and highly simplified computer model which generates highly speculative, preliminary, and untested results. This dangerously reductionist "physics only" view not only cavalierly

dismisses the crucial role forests play in helping to stabilize the climate, it totally ignores the life-sustaining services it offers to life in the seas.

“Among other flaws, the Caldeira study does not take into account the real role forests play in the global warming equation. It ignores the fact that forest loss is a significant, historic source of CO₂ emissions and that extensive deforestation continues today. Restoration of some part of that lost forest cover must logically restore some of the ecological balance to the global ecosystem with regard to carbon fixation and sequestration.

Forest loss, scientists agree, is responsible for roughly 25% of all man-made, global CO₂ emissions today (and more than 40% in the past when forestlands were cleared to make way for cities and farmlands). In the U.S., for example, roughly 1.5 million acres of forests are currently lost to development and conversion each year. Figured conservatively, this forest loss results in the release of 275 million metric tons of CO₂ into the atmosphere – *a release equivalent to the emissions output by 53 million vehicles over a one-year period.*

Forests alone, of course, cannot solve global warming. The challenge is enormously complex and will require multi-faceted solutions from multiple sectors to effectively address. Nonetheless, it's important we all recognize here and now that forest loss has been a substantial part of the problem, forest conservation and stewardship are part of the solution, and that forest carbon sequestration is an essential complement to the absolutely necessary focus on reducing the use of fossil fuels.”

Regulation of Voluntary Markets.....

Voluntary markets for climate change offsets are emerging slowly in the United States and much more dramatically outside of the USA in countries that are signatories to the Kyoto Accord. At present our company volumes of credits sold is a small number and not a significant part of our business. We don't expect this voluntary market, especially in the USA, to become a significant part of our business. Rather we are almost entirely focused on the mandatory markets in the Kyoto complaint world of Europe and Asia.

It is easy to imagine a much larger voluntary market one day emerging but at this point in time we do not see evidence of that market materializing especially in the USA. To the best of our knowledge the US voluntary market is at present not more than a few tens of thousands of tonnes of CO₂e per year. As such the economic value of that market is quite tiny as prices for such voluntary offsets generally is \$5-\$10 per tonne. Surely organizations selling into the US voluntary market at present do not recoup costs associated with those sales. However many organizations have aspirations to turn the corner and become profitable in this voluntary market.

We are unaware of examples where such voluntary actions that might be considered roughly equivalent to the sale of carbon offsets are regulated or have federal oversight save through ordinary consumer protection statutes. Given the present small size of the voluntary market we'd not expect federal regulation above and beyond ordinary consumer protection provisions are warranted.

However with respect to the work we do to offer our own standards from its inception several years ago, Planktos has been committed to reasonable and fair market standards to ensure 'real, additional, verifiable, permanent, enforceable and transparent' GHG offsets; that is, to ensure what consumers and companies are getting what they pay for. Planktos believes that most companies active in this space are of a similar mind.

Whether in the voluntary or the regulated arena, Planktos encourages performance-based standards as opposed to technology-based standards, believing that so long as any method or technology can demonstrate ‘real-to-transparent’ criteria, all such methods should be allowed to help society head off the worst effects of climate change.

In the absence of leadership from the US federal government to create mandatory climate change requirements or to engage in the climate change market a voluntary marketplace has emerged and been hard at work to develop and standardize performance requirements for GHG offset providers. Understanding the importance of standard business practices, Planktos was involved in the formation this year of the Carbon Offset Providers Coalition (COPC), a trade association to which institutions providing testimony here today may belong. Alongside of other COPC members, Planktos has been involved in creation of the Voluntary Carbon Standard (VCS) planned for release later this year by The Climate Group. In addition, Planktos is participating in creation of the Greenhouse Gas Emission Reductions Product Certification Standard sponsored by the Center for Resource Solutions, creators of the Green-e Standard for renewable energy. Thirdly, as part of a recent GHG offset proposal submitted to the Oregon Climate Trust, Planktos adopted the GHG accounting standard developed by the World Resources Institute and the World Business Council for Sustainable Development.

As important as a discussion of voluntary standards is, it cannot be separated from discussion about regulatory standards. This is because the two approaches help inform one another. So, on the regulatory front, as part of its membership in the California Climate Registry, Planktos has hired TetraTech/EMI to help develop, review and submit verifiable protocols for its ocean biomass carbon sequestration work. These methods may someday serve as the basis for a certified ocean biomass protocol under the California Global Warming Protection Act, AB 32. Further, there may be reciprocity for a California-approved standard in other regions of the US, or with some eventual federal program. Finally, Planktos has also engaged Det Norske Veritas (DNV) based in Oslo, Norway, to support its efforts towards a Kyoto-approved protocol for ocean biomass sequestration.

What is the future of the Voluntary Carbon Offset Market and how significant a role might it play.....

The voluntary market originates as a grass roots expression of the need for individuals and institutions to address the looming effects of climate change and related environmental catastrophes (such as ocean decline). In Europe, the voluntary market is growing.

The voluntary market for carbon offsets will continue to reflect the needs, wants, preferences and desires of society while governments continue to wrestle with enforceable GHG emission reduction standards, or mechanisms of certifying GHG mitigation. Whether this will remain so depends on government’s ability to cooperate in the face of almost certain economic and environmental chaos brought on by accelerating climate change effects.

Carbon offsets generated by restoration of ecosystem services can have an enormous positive effect on both the national economy and the nation’s environmental health. Policies dedicated to protecting and enhancing these services now lead to application of tested methodologies in the disciplines of restoration ecology, conservation biology and adaptive management. Further, the role of the marketplace in rewarding eco-restoration initiatives has long been established, evidenced by markets for airshed improvements via bank-and-trade strategies for SO₂, NO_x and VOCs; or markets for wetland restoration and for biodiversity enhancement; or markets for watershed improvement and for aquifer recharge. Creation of markets for GHG mitigation – characterized by remediation of rising CO₂ via biological /

ecosystem capture – is but another step towards building and reinforcing the environmental economy that will likely serve as the basis for all human productivity in the not so distant future.

As but one example of what might be achieved, consider that a typical EU Planktos forest project is planned for about 10,000 hectares, and produces about 8-9 million emission reduction units (carbon credits) over a 50 year period. Planktos plans on implementing ten such projects in Hungary alone, and it is possible that up to 1,000,000 hectares might ultimately be brought back into forest cover there. In addition to reducing the impacts of climate change, these projects will result in new economic opportunities associated with forest management and tourism. And there will be enormously important additional values related to air, soil and water quality, and biodiversity.

A typical modest scale ocean restoration project will cover about 10,000 square km, fix many million of tonnes of CO₂ from the air as biomass, and produce 2 or more million ERUs over a six month period. This is because plankton are adapted to take advantage of the presence of micronutrient iron mineral dust, and they rapidly respond when it is available. And just like traditional land based farming, where one recently grown tract is allowed to recover while a neighboring tract is planted, so in the oceans another adjacent plankton community can be restored, generating additional millions of tonnes of reductions in atmospheric CO₂ in incredibly short order.

How much of the ocean can be managed in this way? According to NASA studies published in 2003 and 2006, the planet has lost about 13% of ocean plankton productivity over the past 30 years. This equates to loss of about 4 billion tonnes (gigatonnes) in uptake of atmospheric CO₂. This means that if society were to collectively undertake restoration of plankton productivity to 1980-type levels, and go no further, about 70% of the entire worldwide GHG emission profile (said to be about 6 gigatonnes) could be mitigated by this method alone.

And, as with forests on land, the value of returning plankton productivity to 1980 levels would bring highly valued co-benefits in the form of rejuvenated populations of sea birds, mammals and fish, including a host of commercially valuable species that otherwise will not be able to sustain themselves in the face of continually growing resource demands.

The information provided in this brief paper is far from comprehensive or sufficient to present a thorough understanding of the topics covered. I would be happy to provide additional information more extensively covering the questions raised by the committee.

My thanks to the committee for the opportunity to make this abbreviated presentation.

We have also appended several brief papers and reports that document our claims and hopefully draw the Committee's attention to the extraordinary need for and potential of ocean restoration as a climate policy tool.

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