



VEDA Climate Change SOLUTIONS LIMITED

(An enviro-social enterprise to benefit poor from carbon Credits)

23 April, 2012

From
Sriharsha Masabathula
President

To:
The Executive Secretary,
The Inspection Panel
1818 H Street, NW,
Washington, DC 20433,
USA

1. I, Sriharsha Masabathula represent VEDA Climate Change Solutions Ltd (VCCSL) <www.vccslindia.org> which partnered with BioCarbon Fund of the Carbon Finance Business of The World Bank for the project **"Improving Rural Livelihoods through carbon sequestration by adopting environment friendly technology based agroforestry practices (IRL)"** (UNFCCC / CDM Registration No.4531) located in India. My contact address is given below.

2. The project is expected to benefit 1605 small land holders owning 1590 ha of degraded land in **six backward districts of Koraput, Kalahandi, Rayagada and Srikakulam, Vizianagaram and Visakhapatnam in Orissa and Andhra Pradesh respectively in India.** The participating farmers are suffering as a result of the World Bank's failures or omissions in the BioCarbon Fund project.

3. Some of the participating farmers of the IRL BioCF project are being deprived of carbon revenue though they have not been responsible for the delay in project execution by the World Bank. As the World Bank has failed to adhere to the timeframes, some of the farmers have harvested the plantations raised by them in conformity with the management practices and Project Design Document. Though reasonable efforts have been made by the Project entity for transformation of ERs into CERs, The World Bank is not willing to pay for the ERs generated by the farmers who have harvested the plantations.

Sri.Rama Nilayam, H. No: 2-35-15/2, Nellimarlavari Street, Perraju Pet,
Kakinada - 533 003, Andhra Pradesh, India.

Tele fax : 00 91 884 - 2372430, E-mail : vcc@vccslindia.org, Website : www.vccslindia.org.


4. Provisions of the Emission Reduction Purchase Agreement (ERPA) of the India Improving Rural Livelihoods Project dated 8 May, 2007 (TF058308) among VEDA Climate Change Solutions Ltd (VCCSL) and J K Paper Ltd. (JKPL) together referred to as Project Entities and IBRD as the Trustee for the BioCarbon Fund have not been followed in letter and spirit causing severe loss to the participating farmers of the IRL Project.

We have brought the shortcomings to the notice of The World Bank / BioCF staff on several occasions (as per the list attached) by emails and also in meetings whenever there was an opportunity. We have not received any response to our requests and when received the responses were neither satisfactory nor adequate. We do not consider that the explanations and answers solved the issues raised. In some cases, the responses were in no way connected to the points highlighted circumventing the issue at stake.

We request the Inspection Panel recommend to the World Bank's Executive Directors that an investigation of these matters be carried out.

I shall be happy to provide any further information that you may require for consideration of my request.

We authorize you to disclose our identities.

Signature: 

Date: 23 April, 2012

Mr. Sriharsha Masabathula
President,
VEDA Climate Change Solutions Ltd;
2-35-15/2;
Perraju Pet,
Kakinada-533003;
India;
Telefax: 00 91 884 2372430;
00 1 740 803 803 0822 (Mobile)
email: vccsl@vccslindia.org;

List of attachments:

□□

1. Open letter dated 19 April, 2012 addressed to the President, The World Bank Group
2. Email dt.28 December, 2011 addressed to Ms. Rachel Kyte, Vice President, Sustainable Development Network, The World Bank
3. Powerpoint presentation highlighting the concerns sent to Ms. Rachel Kyte, Vice President (SDN), The World Bank.
4. Trail of emails between VCCSL and BioCF ending 7 March, 2012.
5. Open letter dated 30 September, 2011 addressed to Ms. Elly Baroudy, BioCF Manager.
6. Proceedings of the Workshop organized by Sriharsha to determine land eligibility for project Development under CDM / VCS held at Visakhapatnam, India during 10-12 August, 2011.
7. Video Clip on VCCSL placed on YouTube
<<http://youtu.be/ekaftosWKEg>>
8. A research paper on "Implications of afforestation on global climate" written by Sriharsha in association with Prof. Craig Jackson, Ohio Wesleyan University.
9. Resolution of the Board of Directors of the VCCSL designating Sriharsha as its President.
10. Two brochures on the IRL project and enterprises i.e VCCSL and Socio-eCO₂nomix-Global



VEDA Climate Change SOLUTIONS LIMITED

(An enviro-social enterprise to benefit poor from carbon Credits)

19 April, 2012

Sriharsha Masabathula
President

To
The President
The World Bank
1818 H Street, NW
Washington, DC 20433

Dear Mr. President,

As a young president of an enviro-social enterprise, VEDA Climate Change Solutions Ltd (www.vccslindia.org) which developed and implementing one of the few CDM projects in Afforestation and Reforestation Sector to address climate change and poverty in partnership with the World Bank's Carbon Finance Business, I take this opportunity to congratulate you on steering The World Bank to reach new heights during your presidency over the last five years. As the world is confronted with the challenges of addressing poverty and climate change among many other contentious issues, we hope that your guidance and support will continue to be available to development practitioners even after successful completion of your tenure with the World Bank.

Being from India, I keenly followed your last visit to the mangroves in Orissa but I wish you also found time to interact with the poor farmers in the backward tribal areas in Orissa who are "beneficiaries" of the BioCarbon Fund (BioCF) Project "Improving Rural Livelihoods Through Carbon Sequestration by Adopting Environment Friendly Technology Based Agroforestry Practices (IRL)." They have been waiting patiently for over seven years to receive the promised carbon revenue payments from the World Bank for the first time in India. Least, I had hoped that the innovative project which is making carbon revenue to the poor farmers a reality would have found a place in your scintillating speech at the press conference in New Delhi. I am disappointed that the project perhaps was not brought to your notice as it raised many issues and concerns and the World Bank may have wanted to expose you only to the "friendly" projects. You would appreciate that it would have been more appropriate to bring your attention to the projects confronting critical issues so that the concerns of multiple stakeholders would provide useful inputs to the policy making with learnings from ground realities.

I even requested the BioCF to explore the possibility of handing over the first release of carbon payments during the on-going Spring Meetings in any appropriate session to mark the importance of the occasion and to bring this significant achievement to the notice of the international community. However, the BioCF informed that it might not be possible as the bureaucracy in the Bank would take its own time for release of carbon revenue.

As the unique pilot project which provided a model for public-private partnership is not getting the attention it deserves from the World Bank and not being given a forum to share its learnings, concerns and issues, I have decided to participate in the Spring meetings as an ambassador of the social enterprise in India even at the cost of missing my classes as I am an undergraduate student of Economics at Ohio Wesleyan University. Since I am not sure of getting a chance to meet you in person, I am bringing some of the issues bothering me to your notice through this open letter.

We hold The World Bank in high esteem for the values it promotes and expect it to be rational, unbiased and sympathetic to the stakeholders who include poor farmers, social enterprises, small businesses etc. However, our experience of working in partnership with the World Bank over the last seven years has belied our expectations.

While I am enthused to participate in the session on **"Social Accountability** for better results" being chaired by you during the Spring Meetings, the question that came up in my mind is "to whom The World Bank is accountable?" Is accountability only meant for social enterprises such as ours? To cite an instance, VCCSL entered into an Emission Reduction Purchase Agreement (ERPA) with the World Bank which is heavily loaded in favor of the Bank instead of being fair to all the signatories of the ERPA. Of course, when differences of opinion are common even between two brothers and a husband and wife, there will inevitably be concerns and issues among parties who enter into a business proposition. Who in such cases would decide what is right and wrong? How can the World Bank would have the last word when it itself is an interested party? Don't you think that there is a need for an independent redressal mechanism to address the concerns and issues arising out of the execution of the ERPA? May be you can consider setting up a mechanism with participation from civil society, technical and legal experts to oversee implementation of such agreements entered by the World Bank with other stakeholders. This is perhaps even more important when the World Bank has assumed the role of a business partner with only profit as a motive and not as a development agency.

"Transparency" perhaps is another issue towards which I want to draw your kind attention. You will agree that the ground rules for all the partners should be the same when entering into a business agreement. I fail to understand when a social enterprise agrees for due diligence by the World Bank, why the World Bank should feel shy of the same? How can the World Bank take shelter under the immunity granted to it being a UN agency when entering into a business deal? While the Carbon Finance Business of the World Bank is an innovative mechanism and established many carbon funds including BioCarbon Fund to operate on a self sustaining mode, you will appreciate that there is a need to restructure these funds to serve the purpose for which they have been established. There needs to be more clarity regarding their developmental roles and business proposition.

As per the 'recitals' enunciated in the ERPA drafted by The World Bank itself:

Pursuant to the Fund Instrument the Executive Directors of the IBRD have established the Fund for the purposes of:

- (i) providing resources to projects designed to reduce emissions through carbon sequestration in agriculture and forests;
- (ii) stimulating private capital flows for sustainable development to expand the reach of carbon finance and the Kyoto Protocol flexible mechanisms to countries and communities which would otherwise be potentially excluded from the benefits of the emerging carbon market; and
- (iii) To improve rural livelihoods and promote the objectives of the United Nations Convention on Biological Diversity and the United Nations Convention to Combat Desertification.

If we critically examine the above to ascertain to what extent the stated objectives have been fulfilled, it can be seen that much needs to be done. From our experience of working in partnership with the World Bank during the last seven years, the World Bank has not provided any resources to at least the IRL project designed to reduce emissions through carbon sequestration in forests and instead it provides resources to the BioCF. A critical analysis of the BioCF Project would testify this and it will be interesting to see who is providing resources to whom? Is the World Bank providing resources to the Projects or is it the other way round?

It would be interesting to know what the World Bank has done to stimulate private capital flows for sustainable development in the context of the BioCF Project. While it supports the organization of Carbon Expos, its projects are not invited to attend to help them establish linkages with the private industry. I only hope the BioCF would connect the enterprises such as VCCSL which have been established on the advice of the World Bank with IFC and other such institutions to stimulate private capital flows for sustainable development through innovative mechanisms.

Coming to the primary objective of improving rural livelihoods and promoting the objectives of the UNCBD and UNCCD, it seems the same has been left to social enterprises such as VCCSL as The World Bank / BioCF has shown little or even no commitment to sustain the innovative projects such as IRL project in India and does not want to even match the contributions made by small enterprises like VCCSL for the successful implementation of the project. It seems there is a role reversal. While The World Bank acts in a purely business mode, tiny business enterprises such as VCCSL take on the developmental role which is the domain of the mammoth institutions like The World Bank.

The BioCarbon Fund has been established to test and demonstrate how land use, land use change and forestry (LULUCF) activities can generate high-quality ERs with environmental and livelihood benefits that can be measured, monitored and certified, and stand the test of time. However, in the case of IRL Project, even though the tCERs having a life span of 5 years have been delivered by the project since 2004 providing

also socio-economic benefits to the poor farmers, the BioCF emphasizes that only ERs that are standing at the time of verification were considered to be generated by the project. It may be pertinent to mention here that The World Bank though has waived verification and the release of carbon payments should be based on the Annual Report as per the agreed ERPA, the BioCF's insistence to release payment for only standing trees at the time of verification defies logic.

According to the Recitals, the Project Entities and Trustee intend that both the Parties will make all reasonable efforts in accordance with the ERPA to transform the Emission Reductions(ERs) into Certified Emission Reductions (CERs) in accordance with the International Rules. In this regard, the World Bank would appreciate that both the Project Entities and the Trustee have made reasonable efforts to transform the ERs into CERs despite delays due to various factors that include the change of methodology at the behest of BioCarbon Fund, delay in commissioning validation by the BioCF etc. The delays subsequently led to harvesting of matured plantations, though a permitted activity as per the management practices included in the Project Design Document which has been validated and registered by the Executive Board of UNFCCC. However, this resulted in non transformation of part of the ERs into CERs in accordance with the International Rules in vogue and the BioCF's refusal to pay for the ERs is not in conformity with the provisions of the ERPA. Because of the unreasonable stand taken by the BioCF, a large segment of the farmers are being deprived of carbon revenue even though they have actively participated in the project since inception and they should not suffer for the delays caused by the World Bank in release of the carbon payments.

VCCSL has been making concerted efforts to bring these and many other issues to the notice of the BioCF and also the World Bank through its communications including an open letter to the BioCarbon Fund Manager. Being a student of Economics, I also offered to undertake a critical analysis of BioCF projects from a project developer's perspective and also offered to make presentations to the participants of the BioCF and senior management of The World Bank to draw their attention to the learnings, concerns and issues which would help in restructuring these climate funds to provide benefits on a much larger scale to a wider community. For the purpose of brevity, I have brought only a few important concerns to your attention here and I reiterate my offer to make a detailed presentation in any forum that you may consider appropriate.

I shall be happy to provide any further information / clarifications that may be required to make these climate funds responsive to the needs of the multiple stakeholders to provide social, economic and environmental benefits on a sustained basis. Being an environmentally and socially conscious young global citizen, I am willing to walk that extra mile with The World Bank to contribute in its efforts to achieving the Millennium Development Goals through public-private-people partnerships.

Would you give me a chance, Mr.President?

Sincerely,

Sriharsha Masabathula
Tel: 00-1 740-803-0822



**Improving Rural
Livelihoods Through
carbon sequestration by
adopting environment
friendly technology
based agroforestry
practices**

VEDA Climate Change Solutions Ltd

&

JK Paper Ltd



VCCSL

*VCCSL is an **Enviro-Social Enterprise** established as an innovative institutional mechanism on the advice of The World Bank for delivery of carbon credits to The World Bank and carbon revenue to the farmers.*



Project details

Project area: 3,500 ha. – Initial

1,600 ha. – After validation

(Due to difficulty in proving land eligibility for small parcels)

669 ha. – After verification

(Farmers harvested 491 ha of the plantations and not replanted due to delay in validation and verification)

No. of farmer participants: 1580

Current status

Conceptualised : 2004

ERPA signed: May, 2007

Validation: April, 2009

UNFCCC registration: April, 2011

Verification: 1-8 December, 2011



Project Objectives

- To pilot reforestation activities for generating GHG removals by sinks that can be measured, monitored and verified.
- To develop plantation and agro forestry models, which can provide multiple benefits to farmers.
- To provide additional income to resource poor farmers through carbon revenues.
- To build capacity of multiples stakeholders to benefit from global mechanisms.





Farmer participants showing their willingness to be part of the project activity

Issues with The World Bank

- Credibility
- Accountability
- Transparency

Credibility

- The BioCF offered a grant of USD50,000 for Environment Management Framework at the time of ERPA discussions in 2006.
- Subsequently amended ERPA to treat it as an advance.
- Wants to recover it now.

Going back on the commitment?

Mail dt.7 Sep, 2009 of VCCSL to Ms. Monali, DM

- Dear Ms.Monali, We are writing to you again after patiently waiting for over a month though you promised to get back to us within ten days in your last mail. For your ready reference, herewith I enclose the Minutes of the ERPA discussions held on 18-19 December, 2006 i.e almost three years ago wherein the World bank committed to provide a grant of \$50,000 to the project entities to meet the EMF compliance costs. Though the release of EMF grant is not linked to opening of ESCROW account which is meant for transfer of carbon revenues, we were told that the EMF grant would be released as soon as opening of an ESCROW account. However, after opening of the ESCROW account, we were told that the grant would be released on production of original receipts. But when we produced the original receipts at the World Bank office in New Delhi, we were asked to produce the same before the World Bank's Financial Team in the project office in AP/Orissa. VCCSL and JKPL participated actively in the due diligence by the Finance Expert in the month of May, 09 and produced all records to the satisfaction of Finance Expert. Subsequently, we were asked to incorporate the details in the draft Grant Agreement which also we compiled. VCCSL also conveyed its 'no objection' to the inclusion of JKPL in the Grant Agreement. A copy of the draft Grant Agreement is enclosed herewith which is also more than three months old by now. I am also enclosing a copy of the draft ERPA amendment which is also one year old by now. We are really at loss to understand why the World Bank is not able to finalise the ERPA amendment and the Grant Agreement. Non adherence to timelines has delayed the project considerably and questions are being raised in various fora about the delay. It is a pity that environmental management which is so vital for a project of this nature has so badly been neglected. If there are any bottlenecks, it may be useful to bring them to the notice of senior management of the World Bank at Washington and New Delhi and also the Government of India so that we will be able to move forward. I would once again request your attention to the outstanding issues. Best regards, Rao Mr.C.A.RaoManaging DirectorVEDA Climate Change Solutions Ltd

Accountability

- Farmers harvested plantations over 491 ha and not replanted due to delay in validation. Harvested plantations are not eligible for carbon credits as per the CDM methodology.
- Who is accountable?
- Should the farmers be penalized for delays by the BioCF / The World Bank.

Mail dt.10 Sep, 2009 from VCCSL to Mr.Ranjan, TTL

- Dear Mr.Ranjan, After having experienced the respect for timeframes over the past four years, we are now exploring other options to pass on promised benefits to the participating farmers. Since part of the plantation activity was initiated way back in 2004 and reached harvesting stage, we are now finding it difficult to restrain the farmers to wait for long. Even after addressing the comments of Validator satisfactorily, it would take about 8 weeks for the completeness check and after that another 8 weeks for requesting registration – in case any request occur the time would even be longer. Even after the registration, there would again be some time gaps before verification and actual release of carbon revenue to the farmers. When it has taken more than three years for the World Bank even to initiate the release of committed grant for EMF which was only commissioned at its behest (still we are not sure whether/when it would be released), we are not able to imagine how much time would it take for the carbon revenues to flow to the poor farmers. We can not treat the poor farmers as Guinea Pigs for our experiments and we need to ensure that they get some benefit for believing in what we have been saying for more than five years now. Before everyone loses faith in the project, it may be appropriate for the World Bank to consider release of carbon revenues to the extent of tCERs it has committed to purchase i.e.25% of the tCERs expected from the project without waiting for validation. The World Bank may even consider having its own 'verification' before validation for distribution of carbon revenue to the farmers. Alternatively, we may explore the possibility of excluding the 2004 and 2005 plantations from the CDM project activity and get them validated against any voluntary standard and the CDM project may include only the plantations of 2006 onwards. In a way, split the present project into two, a VCS Project and a CDM Project i.e one VCS project with 2004 and 2005 plantations and the original CDM project containing only plantations of 2006 onwards. However, this requires us to write a new VCS PDD and conduct the risk assessment. Further, the assessment of an additional VCS PDD would obviously require some additional effort on the part of validators and would also require some additional financial resources/contract though another field visit may not be required. Being air conditioned, The World Bank may not be feeling the heat, but the temperatures and tempers are rising in the field and we can no longer sit back and relax. Climate change is happening and we must act now. Best regards, Rao Mr.C.A.Rao Managing Director VEDA Climate Change Solutions Ltd

Mail dt. 15 March, 2010 from VCCSL to Ms.Monali, DM

- Dear Ms.Monali,

.....We are deeply concerned that the PDD is not yet finalised by the World Bank despite our repeated requests. If the World Bank is unable to address the additionality issue even after almost an year (Validation was initiated last year around the same time), the same may please be sent to us and we will try to address the additionality as best as we can. There is no point in delaying the PDD indefinitely and we should be prepared to face the reality. Instead of each one trying to reinvent the wheel, it is best left to those who invented the wheel in the first place.

Email dt.20 Jan, 2011 from VCCSL to Mr.Rama, Methodological team, BioCF

- Dear Mr.Rama, We are aware that the ITC project used methodology AR AM0001, popularly known as China methodology which did not include leakage assessment module as rightly mentioned by you. You may also be aware that we initially started the project development in 2004 using AR AM0001 only but changed it to AR-AM0004 known as Honduras methodology as advised by the Methodological team of The World Bank which opined that the China methodology is not applicable to Indian conditions. This necessitated us to rewrite the PDD and put us almost a couple of years behind schedule. However, the ITC project which used AR AM0001 continued with the same methodology and has also been registered a couple of years back and we are still struggling to address the leakage issue. From this experience, we learnt the lesson that there is wisdom outside The World Bank too and started looking at issues more closely than ever before instead solely relying on the advise of the World Bank. You will appreciate that our research is not just limited to the projects which used the same methodology and also the similar projects which used some other methodologies. In fact, we also looked at Bagepalli Project which is a VCS project. You would agree that the stakes of VCCSL, JKPL and the participating farmers are much higher than that of the World Bank which may be considering this project as one millionth of its activities. We are committed to make this project a success even at the cost of displeasing The World Bank and we only hope you will appreciate our concerns for timeframe. We were hoping to send the project for registration before Christmas and I wonder whether we will be able to do it even before Easter if we look at the way things are going. JKPL is working on the information you wanted. We are still of the view that leakage assessment may not be necessary if we use the livestock Census data of 2003 and 2007. You may like to discuss with Mr.Sebastian if it would be acceptable to him. Let us work together to find a solution which is practical and feasible and we shall be ever ready to contribute in whatever way we can. Best regards, Rao

Email dt.19 Jan, 2011 from VCCSL to Ms.Monali, DM

- Dear Ms.Monali, We feel that there is nothing wrong in taking a second opinion when there is a difference in perception though the expert advise **may only confirm Mr. Rama's opinion**. Our **only concern is that if there is further delay, we may only end up counting cattle in the plots once the trees are harvested by the participating farmers**. However, the IRL team has also been trying in the meantime to collect the village level data from the district offices and also through web search. IRL team has also done similar websearch much earlier and could already find some data even from the links mentioned by you. From the mail of Asutosh, you can see that there are many gaps in the data availability. IRL team has also done research and looked at the PDD of ITC project which is similar to ours and also looked at the Honduras project whose methodology we have adopted to know how they addressed the leakage issue. You will appreciate that there are 501 villages in the project area with an average of 2-3 plots per village. The number of blocks/Tehsils is 97. Collecting village level data for only some blocks will not serve any purpose and it is cumbersome too. The Livestock Census data of 2003 and 2007 at district level will prove $NaAR, T > NaBL$ and hence there is no need for calculating Existing Grazing Land (EGL) parameter itself. We need to explain the things logically instead of methodological team choosing the easier option to throw the ball into our court seeking more data. May we would have complied this too, had your methodological team pointed this out in the beginning of the project and not certainly after more than 5 years from inception of the project. We would rather prefer to convince the verification team than to confirm to the assumptions and requirements of your methodological team. Hope the teleconference with the IRL team will resolve the issue and we move forward. Best regards, Rao

Email dt.17 Jan, 2011 from VCCSL to Ms.Monali, DM

- Dear Ms.Monali, Many thanks for your mail requesting village level data to assess leakage as suggested by Mr.Rama. We are of the opinion that the data provided by JKPL on livestock population based on Census data should be sufficient to explain the leakage in the project area. Collection of village level data in the project villages itself is another project and this should not be treated as a research project by your methodological team. They should be able to explain the leakage based on the broad parameters in the project area and instead of seeking more and more information, the methodological team should be able to effectively put forth the logic to take the project forward. Let us not see ghost in CDM Board. However, we will address the issue if it is pointed out by the CDM Board after the same is submitted for registration. Data requirement should be seen in the context of the project and should not be seen in isolation. It is not that it will not be possible to obtain the data required by your methodological team but they must appreciate how much effort, time, manpower and money is needed for the same? Best regards, Rao

Transparency

- VCCSL requests the BioCF to share the details of actual expenditure incurred by The World Bank under Project Preparation and other Kyoto costs before deducting the same from the carbon revenue to be passed on to the farmers.

Transparency

Email dt. 15 June, 2011 from VCCSL to Ms.Monali, DM

- Dear Ms.Monali, Many thanks for the clarification. You will appreciate that VCCSL and JKPL have readily agreed for due diligence of their accounts by the Bank's Financial Expert before release of the advance payment by the Bank earlier. VCCSL is always willing to present its books of accounts for inspection whenever required by the Bank. As the Bank has always set high standards for transparency and following the principles of natural justice, it is only appropriate that the same standards are followed for all the project participants i.e. VCCSL, JKPL and the BioCF. Sharing of details of project preparation costs by all project participants would help in appreciation of the costs involved in developing a CDM project and to further develop cost effective models for replication by reducing those costs which are considered non-essential. Developing a CDM project is not an end in itself but only a means to scaling up of such innovative initiatives to benefit a large community of farmers. We would request your understanding and cooperation in this regard. Further, when 'for profit' enterprises such as VCCSL and JKPL can forego their project preparation costs substantially, the World Bank may also consider reducing their costs to a reasonable limit to benefit the participating farmers. If the carbon revenue to be passed on to the farmers is adversely affected due to the deduction of seemingly high project participation costs by the BioCF, it may give the impression that the BioCF is the major beneficiary of the project instead of poor farmers. Hope our concern for participating farmers would receive serious consideration of the BioCF/World Bank. Best regards, Rao

Mail dt.11 March, 2010 from VCCSL to Ms.Monali, DM

Dear Ms.Monali,

Despite our reservations on the use of PPC to meet the EMF costs, we agree to the proposed amendments to the ERPA to move the project forward. As before, VCCSL remains committed to the project and willing to be flexible to ensure that carbon revenues to the poor will be a reality

May I request you once again to share the details of PPC incurred by the World Bank for our appreciation. We may need to have a common understanding and agreement of the PPC as we need to keep them at the lowest failing which the pilot project may not be replicable. Our intention is not to question the PPC incurred by the World Bank but to keep the transaction costs to the minimum for its replication and scaling up. We do not see this project as an end in itself but as a model to connect the poor with international carbon markets. We are ever willing to travel that extra mile to make it a reality.

Best regards, Rao Mr.C.A.Rao Managing Director VEDA Climate Change Solutions

Redressal Mechanism

- Absence of a redressal mechanism in the ERPA for resolving concerns arising out of the project development and implementation.
- Need for an arbitrator?

Lessons Learnt

At Various Levels

- At Project Sponsor level
 - These projects are commercially less attractive as the land holdings are small and to make a viable CDM project many farmers need to be grouped.
 - Process is cumbersome
- At Farmer Level
 - The resource poor farmers and rural communities, who should be ideally commissioning such projects, are not able to sponsor themselves as they do not possess the necessary finances.
 - They are also not organized into cooperative organisations with necessary finance and wherewithal to do such projects.

Lessons

At Government level

- Lack of continuity.
- Lack of ownership.
- Difficulty in benefit sharing

At Consultant Level

- There are no ready made templates available for development of such rural A/R projects
- Long gestational period
- Non-availability of project sponsors



Lessons from the project

- Difficulty in proving land eligibility. Availability of aerial images which facilitates land eligibility is limited.
- Accurate quantification of project-level carbon benefits difficult
- Limited expertise
- Need for indigenous DOEs to cut transaction costs,



**VCCSL promoted “Socio-eCO₂nomix-Global”,
a not for profit enterprise for replication and
scaling up of this innovative project.**

Mandate:

- Economic advancement
- Social upliftment
- Environmental improvement



Build Partnerships Among Multiple stakeholders



International

- **Multilateral agencies**
- **Bilateral agencies**
- **Private Foundations**
- **Academic Institutions**
- **Research Institutions**
- **Multinationals**



National

Federal ministries

Universities

Financial Institutions

Industries



LOCAL

CBO's

NGO's

Provincial Governments

Local governments



Local *National*

INTEGRATION

International



Sustainability

**BUSINESS UNUSUAL
MODELS**



Products

Carbon Credits

&

Social Credits

Target

50,000 hectares over next 5 years to
benefit 100,000 farmers

First step

Develop a cost effective replicable model to determine eligibility in developing countries for project development under CDM / VCS.

Basket of projects

CERs:

- Program of Activities (PoA)
- Large scale CDM Project
- Small scale CDM Projects

VERs:

Voluntary Carbon Standards

CCBA, Plan Vivo etc.

VISION

Establish a carbon exchange for retail sale of carbon credits / social credits

Promote 'Development Alliance'

IPO to invite capital from individuals/ organisations concerned for environment and development.

Build

◆ Social Capital

◆ Green capital

◆ Financial capital

VCCSL would like to provide a platform for development agencies, governments and communities to collaborate for providing social, economic and environmental benefits both locally and globally on a sustained basis.

Connecting poor to international carbon
markets through global mechanisms for poverty
alleviation and climate change mitigation



**We seek the support
of all
BUT
will not wait for any**



BioCF Project
INDIA-Improving Rural Livelihoods through Carbon Sequestration-
CDM Registration no.4531

An open letter to BioCarbon Fund, The World Bank

Dear Ms. Elly,

I would like to detail the chronology of events to put the things in proper perspective particularly regarding participation in UNFCCC meeting in Panama.

On receipt of mail dt. 7th Sep, 2011 from Ms. Neeta Hooda, Deal Manager for the IRL – BioCF project requesting nomination of a person from IRL project, VCCSL suggested on the same day the participation of JKPL even before their reaction to the mail seeking nomination. When Mr. M. C. Goel, JKPL nominated Mr. Ashutosh Mahana subsequently, we confirmed his nomination to you within minutes of receiving Mr.Goel's mail.

Accordingly, Mr. Ashutosh, JKPL was in touch with the World Bank for completion of pre-departure formalities and when no progress was made regarding issuance of his VISA for his visit to Panama till 26 September, vide my mail dt. 26th September, I suggested the participation of Mr. M. Sriharsha, President, VEDA Climate Change Solutions Ltd. (VCCSL) who is currently in USA with a valid VISA and as such has no problem to visit Panama at a short notice to represent the IRL project as only a back-up to Mr. Ashutosh Mahana and not in place of him. Ms.Neeta Hooda vide her mail dt.28th September informed that the Bank's team has been working to ensure that Mr.Ashutosh gets his VISA and does not wish to support the participation of additional members and expressed her inability to assist in this regard.

Vide my mail dated the same day i.e 28th Sep, I conveyed our compliments for **ensuring** the participation of Mr.Ashutosh and expressed our happiness that Sriharsha does not have to travel to Panama in the midst of his mid semester exams in Ohio Wesleyan University (OWU) where he is studying. In the same mail, I have also informed that Mr.Sriharsha has been designated as President, VCCSL by its Board of Directors in a recent meeting as it felt that the leadership of social organizations such as VCCSL should be in the hands of younger generation who will not only directly face the effects of climate change but are also more concerned about the environment than the present generation. He sought your support and guidance in his endeavor to address the two most contentious issues of our times i.e. climate change and poverty. As requested by us, Mr. Sriharsha has conveyed his views on project learnings including land eligibility in particular to Mr. Ashutosh and requested him to incorporate them in his presentation and also offered all help in finalizing the presentation to be made at Panama.

On learning from Mr. Ashutosh on 29th Sept that the World Bank has **failed to ensure** issuance of VISA to him and he is not able to go to Panama (we have not been informed by BioCF), I requested Ms. Neeta again vide my mail dt. 29th Sept, to reconsider the participation of Mr.Sriharsha as there is no other alternative to present the project in the UNFCCC meeting in view of the shortage of time and requested her to facilitate his participation as this is for the first time the BioCF has given an opportunity to the project to present itself to the international community in general and UNFCCC in particular. Ms. Neeta replied on the same day i.e. 29th Sept informing that the logistics team in the Bank is not in a position to

process any travel requests and also cited lack of accommodation at Panama as another reason while agreeing that it is important to share the lessons at the forum.

In response, vide my mail dated 29th Sept., I conveyed that we do not agree with the contentions of the World Bank regarding logistics as accommodation reserved for Mr. Ashutosh could be provided to Sriharsha and it requires only a couple of minutes to book airline tickets through the internet in today's times. I conveyed our resentment for denying an opportunity to the IRL project to share its learnings in person as the decision of the World Bank is not based on merits. Further, vide my mail dt. 30th Sept I conveyed that a UN organization like the World Bank should not discriminate against a social enterprise such as VCCSL which has strived so hard to enable the poor to benefit from global mechanisms such as the UNFCCC and conveyed our disappointment and hurt feelings as the IRL project is denied an opportunity to bring the problems to the notice of the UNFCCC since the project encountered many critical issues during the last seven years. We particularly considered the event important as it is a precursor to Conference of Parties to be held in South Africa later this year which is likely to decide the future of the Kyoto Protocol.

Mr. Sriharsha particularly wanted to bring to notice the issues of land eligibility for project development under CDM in the context of the UNFCCC for which he was awarded a "Theory to Practice Grant" (copy attached) by his University in Ohio and visited the project area in Andhra Pradesh, India along with his Professors of Geography and Economics (Dr. John Krygier (jbkrygier@owu.edu) and Dr. Andrew Meyer (agmeyer@owu.edu) and Ms. Amy Work (awork@iagt.org), Institute for Application of Geospatial Technologies (IAGT), NY. He organized a brainstorming session at Visakhapatnam on this critical issue which is confronting many project developers across the world and which is also one of the issues the meeting in Panama intends to address. He shared a copy of the proceedings of the meeting with you and others at the World Bank for your guidance on this critical issue. Mr. Ranjan Samantary, Sr. NRM Specialist at the World Bank, New Delhi who attended the brainstorming organized by him representing the World Bank may also have apprised you of the recommendations of the meeting. You may also recollect that Mr. Sriharsha visited the World Bank in March this year and discussed the issues related to land eligibility with you, and other members of BioCF team i.e. Ms. Monali Ranade and Mr. Rama Reddy.

He also presented a poster on "Mapping Carbon Credit Eligibility" (copy attached) in the Symposium organized by his University in USA on 18th Sept which received wide appreciation. He is researching on developing mathematical models for climate change along with Prof. Craig Jackson, Dept of Mathematics, OWU and also intends to visit Alaska in Spring next year to further study climate change.

Being the President of the VCCSL at such a young age of 18, he was deeply disturbed at the denial of an opportunity to present the IRL project conceived and developed by VCCSL with which he has been associated over the last four years initially as an intern and later as an Executive Trainee. Feeling responsible to go to Panama in the interest of the project and also to represent his country, he informed you vide his mail dt. 1st Sept, that he is ready to go to Panama at his own cost to present the project to the UNFCCC and only requested for a letter of invitation to enable him to get a VISA on arrival without which he can not enter Panama. He requested and waited in great anxiety for an immediate response from you to organize his logistics for travel the next day.

For attending the UNFCCC meeting at Panama, he convinced his parents to allow him to visit Panama in the interest of the project and also to represent the country instead of coming

home to India for the Christmas break (as it would be expensive for his parents to fund both the visits) and also decided to miss the International Workshop being organized by CR Rao Advanced Institute of Mathematics, Statistics and Computer Sciences, Hyderabad during 2-6 January, 2012 (www.ties2012.com) which he plans to attend. He has submitted an abstract titled "Implications of Afforestation on Global Climate Change" (abstract attached) and is competing in the "Best student category". While requesting for an invitation, he was also conscious of his self respect and excused himself from the dinner organized by the World Bank after the event as he intends to go to Panama to satisfy his hunger for knowledge and not for food.

He awaited a quick response with his fingers crossed because he needed time to request one of his Professors to introduce him to a travel agent to get him an air ticket on loan for his travel to Panama, needed time to find a friend who is having a friend in Panama so that he can get some local assistance, needed time to borrow some money from a fellow student to meet the cost of his lodging in Panama (he does not have a credit card and has only around \$300 in his checking account no.912328523 with Chase Bank), needed time to search for a budget hotel on the internet instead of the Sheraton where the meeting is held and also where the World Bank officials may be staying, needed time to talk to Indian embassy in Panama to request for any assistance that he may require at the time of immigration, needed time to finalize his presentation to be made at the UNFCCC meeting to name a few. He waited with his bated breath till 6 p.m. and when he did not receive any response whatsoever, he had to give up the fight realizing that he does not have the support of the World Bank in his battle against the climate change and poverty. He wondered why not even one among many whom he copied his mail responded?

Yes. He was in tears having lost the opportunity to represent his country at a global forum to share his learnings of a project he nurtured with his tender hands, to interact with the international community to join in their efforts to address climate change and also to gain knowledge from the delegates as to what else can be done to combat this threat which concerns you, me and all of us. His father tried to console him. Told him to go and play a game. Or watch a movie. Or else chat with a friend. If not, go for a walk. This is what a person of that age is supposed to do. Isn't it? But, he replied with an emphatic NO. "Development" is exciting than any or all of those, Sriharsha says. Maybe he is right.

Sriharsha asked me a simple question- "Is the World Bank not as efficient as an 18 year old even to organize a delegate's travel to a meeting which itself is organizing?" I did not have the answer. You may have neither. Maybe, the answer lies somewhere within the bureaucracy of the World Bank. He wants to know. But how? He was asking whether he should write to the President of the World Bank for an answer? May be he should. But he is not sure how to reach him. Will anyone in the BioCF help him to pass on his queries to the Bank's President? May be not. He is thinking and exploring options. He comes up with another interesting one. He says, "may be I should write an open letter to the President of the World Bank and send it to "Time", "The Economist" or any such other magazine. They may publish it if they think that it would make an interesting story and the President may get to read it while on one of his travels criss-crossing the world". Or should I seek the assistance of organizations such as Greenpeace? He ponders. Or should I put it up facebook? He asks. Maybe he will explore many more options. Let us wait and watch. It will be his decision.

We are all aware that the BioCF IRL project is at a critical juncture, having taken seven years for registration. We are finally on to verification. Who knows how many years that will

take? Sriharsha says "How do I sustain VCCSL whose brainchild the project is? What is that we should do for replication and scaling up of the pilot project which is only a proof of the concept. He suggested to establish linkages with Global Environment Facility, UNDP and other developmental programs. However, he was disappointed that there was no response when VCCSL requested the World Bank to help establish linkages with other Bank funded initiatives and other programs and projects to address the two critical issues of climate change and poverty.

He remembered, VCCSL was not given an opportunity to present the IRL project even in India in the Carbon Market Enclave sponsored by the World Bank itself in New Delhi a few days ago in September even when requested. He recollected, VCCSL pleaded with the World Bank again a few days back to give it an opportunity to showcase the IRL project in a GEF workshop supported by the World Bank itself at Goa last month. Again the opportunity was denied. Why, he wonders?

Being a student of Economics, he raised a very pertinent question. Should VCCSL exit the IRL project because it does not make economic sense? Or should it continue with the project because it provides social and environmental benefits to improve the livelihoods of the poor as well? May be yes. Then how? He wanted to know who will be with him to complete this uphill task? He asks, "who will run with me to attain the Millennium Development Goals (MDGs) by 2015?" He wanted to know. A tall order indeed. He wonders - Do I conserve my energies to fight against climate change and poverty or should I waste my energies simply waiting for an invitation from the World Bank for an opportunity to share my learnings and to evolve strategies?

He has many more questions and wants answers for all of them. Having taken the responsibility of leading VCCSL and the BioCF project "Improving Rural Livelihoods through Carbon Sequestration" it supports, he is skeptical whether he can carry forward this onerous task on his young shoulders? Whom the BioCF project is really benefitting? Are the poor farmers, the real beneficiaries? Or is it the BioCF itself the major beneficiary? It is often said that the rich can support the poor. Or is it the other way? He questions whether it would be more appropriate in this case to say that the poor are feeding the rich? Are the poor farmers such as those in the backward tribal areas of Orissa and Andhra Pradesh in a developing country like India sustaining the BioCF? He was asking "Is it the responsibility of an 18 year old youngster to sustain the poor as well as the mammoth institutions such as the World bank which are established by the contributions from both rich and the poor as well? May be yes, He says. We need enterprises such as BioCF which benefit the farmers and farmers in turn return the favor by contributing a share of their revenue to BioCF to sustain them. Yes, it is a cycle or more accurately, is it the economics of poverty? No one knows where the buck stops.

He looked for an opportunity to find answers for his questions. He thought that the UNFCCC meeting would be a good forum to share his concerns with the BioCF, UNFCCC and also the international community. He was prepared to go at his own cost in the midst of his mid semester exams. He took the trouble of venturing into an unknown territory. He is driven by passion, commitment and conviction. But he was stopped. By none other than the World Bank on which he is banking. Why? He asks? What wrong have I committed? He questions, "While the World Bank organizes conclaves to inspire the youth to take greater responsibilities, why is it not supporting a youngster to represent a project with which itself partnered ?

He sought an answer, "how do I reach the international community to benefit from their collective wisdom?" May be he can not. Neither he has the resources to reach them nor has the support of organizations such as the World Bank. Should I keep quiet then? He asks? But he comes up with an answer as well. He says, if I can not reach them, I will ask them to reach me. He says he will write an open letter to the international community and request the World Bank to circulate it through their development network. He says he will invite them to the project site to see for themselves what it takes to develop a BioCF project and whom it is benefitting? He said he will ask them to interact with those who are contributing to it voluntarily and making it what it is today. Sai Kishore, Pragya, Chinnamamba, Rao and many more who work behind the scenes day and night to make a collective difference. On project visits, while the World Bank officials stay in the Five Star hotels and charge their expenses to the project thereby reducing the farmers' share of revenue, these hapless volunteers spend their own hard earned money, stay in dormitories and walk in the muddy villages and sleep even without mosquito nets only to be down with Malaria. Still, running a high fever, they work overnight to comply to the deadlines set by the World Bank housed in centrally air-conditioned buildings, without complaining. Is this the social justice that the World Bank is mandated to address? He wants to know. May be the World Bank knows it better. But he says the World Bank would not respond to him since he is only an 18 year old and doesn't have the wisdom and experience of the World Bank.

He said he would be willing to share his concerns given an opportunity at any forum such as Panama meeting, UNFCCC or any other appropriate forum at the World Bank but would not request for the same once again. He said, "I will wait". Yes, he has many more years to go. He is only 18. He added, "but the question remains, do climate change and poverty alleviation have the same kind of time?"

He went on and on. I am tired. But, Sriharsha is not. He said he will find answers. He just wants your moral support. Nothing else. At the least, he doesn't want to be stopped if the World Bank can not join him in his fight against climate change and poverty. He will carry on and many will join him. He knows.

What is he going to do to get answers for his thought provoking questions? We can only wait and watch and wish him good luck with his quest.

Best regards,

Rao
Designated Focal Point
VEDA Climate Change Solutions Ltd
(www.vccslindia.org)

Note: If any one has answers to his questions, Sriharsha can be reached on his mobile: 00 1 740 803 0822 (Mobile); Email: mharsha_6293@yahoo.com / ssmasaba@owu.edu.



Modeling the Impact of Afforestation on Global Climate: A 2-Box EBM

Craig Jackson

Department of Mathematics
and Computer Science,
Ohio Wesleyan University

Sriharsha Masabathula

Ohio Wesleyan University

Abstract

Afforestation programs have become increasingly prevalent around the world as trees are considered crucial in mitigating climate change due to their carbon sequestration potential. In recent years, international agreements such as the Clean Development Mechanism established under the United Nations Framework Convention for Climate Change have notably fueled afforestation activities. However, several complicating factors are often neglected when evaluating the effects of afforestation on global climate. For instance, while carbon uptake by forests reduces the greenhouse effect, the increase in evapotranspiration due to afforestation tends to increase it. An increase in forest cover also lowers the albedo of afforested regions due to the fact that afforestation efforts tend to be carried out on barren lands having relatively high albedo. Further, atmospheric transport exacerbates the cumulative effect of afforestation on global temperatures due to the interaction of poleward transport of sensible and latent heat with ice-albedo feedback.

In this study, we assess the impact of afforestation on global and regional temperatures utilizing a mathematical climate model incorporating carbon dioxide forcing, land/ice albedo feedback, evapotranspiration, and atmospheric heat transport. We investigate the extent to which changes in surface reflectivity and moisture content of the atmosphere caused by afforestation offset the cooling potential of carbon sequestration. In addition, we examine the degree to which these climatic responses depend on the latitude of the afforested region. Considerations such as these have the potential to increase the positive impact of afforestation efforts by identifying land types and latitude regions that, when planted, result in greater mitigation of global warming.

Keywords: afforestation, climate systems modeling.

1. Introduction

The United Nations Conference on Environment and Development, held in 1992, has been successful in generating widespread awareness regarding the need for sustainable development. Following the conference, international market-based development mechanisms, such as the Clean Development Mechanism, were established under the United Nations Framework Convention on Climate Change and have notably fueled afforestation activities. In addition, initiatives such as the Billion Tree Campaign, led by the United Nations Environment Programme, have raised awareness about the carbon-sequestration potential of large-scale plantations, leading to increased interest in afforestation as an effective means of climate change mitigation.

However, a growing body of literature has consistently challenged advocates of afforestation-driven carbon sequestration with the admonition that afforestation can potentially result in a net positive radiative forcing resulting in an overall warming of the global climate. Gibbard et al. (2005) observe that “when changing from grass and croplands to forest, there are two competing effects of land cover change on climate: an albedo effect which leads to warming and an evapotranspiration effect which tends to produce cooling” (p. 1). In this same context, Bonan et al. (2008) argues that while boreal forests create a positive forcing due to a low albedo, tropical forests create a negative forcing through evaporative cooling.

It should be noted, however, that the cooling due to evaporation is local and may only be confined to the region of plantation. In general, the moisture added to the atmosphere from increased surface evaporation will be transported to higher latitudes where it condenses, thereby releasing heat. A number of studies have shown water vapor and atmospheric transport of latent heat are very important in shaping the polar amplified response of the climate to forcing (Flannery 1984, Schneider et al. 1997; Alexeev 2003; Rodgers et al. 2003; Alexeev et al. 2005; Langen and Alexeev 2005; Cai 2005; Langen and Alexeev 2007; Graversen and Wang 2009). Therefore, an increase in poleward latent heat transport due to large scale afforestation in the tropics has the potential to lead to extra-tropical warming despite the cooling effect caused by carbon uptake in the forest. In fact, interactions between the atmospheric transport and the ice/snow albedo feedback could lead to an overall global warming response to afforestation.

Because of its strong greenhouse effect and positive dependence on atmospheric temperature the presence of water vapor in the climate system results in a strong positive feedback independent of transport (Hall and Manabe 1999; Held and Soden 2000). As such, the impact on atmospheric water vapor should be taken into account when assessing the potential climate response to large scale afforestation, not simply the negative forcing due to carbon uptake. For instance, Soden et al. (2002) showed that atmospheric drying resulting from a simulated volcanic eruption in a GCM amplifies the negative radiative forcing due to injected volcanic aerosols. Since large afforestation projects on dry/barren lands lead to increased evapotranspiration, there is the possibility that the water vapor feedback in this case will dampen, or even negate, the radiative forcing (Pielke et al. 2002).

Changes in the albedo of afforested regions should also be taken into account given that many large afforestation projects are carried out on lands that have a relatively high albedo. This decrease in albedo due to afforestation will have a local warming effect, though, again, the

potential exists for this local effect to be felt in different latitudes due to the atmospheric circulation. Cess (1978) has shown that extremely long term changes in the surface albedo can double the sensitivity of the global climate to factors which produce climate change. Betts (2000) simulated radiative forcings due to changes in land surface albedo and argues that for boreal forests the positive forcing induced by the decreases in albedo can fully offset the negative forcing induced by carbon sequestration so that afforestation in high latitudes can lead to warming. In such cases, it may even be argued that deforestation is a preferred strategy for mitigating climate change. Foley et al. (2005), relying on Bonan et al. (1992), says that deforestation in high latitudes can cool the climate due to an increase in surface albedo.

Both high-altitude and high-latitude regions – where one can expect consistent snow cover – have been accepted as regions where deliberate land-use change in the form of afforestation can lead to a net positive forcing due to a lower surface albedo. In addition, GCM simulations by Gibbard et al. (2005) showed that total replacement of current vegetation by trees would lead to warming similar to $2 \times \text{CO}_2$ scenarios while replacement of vegetation by grassland would lead to moderate cooling. Their simulations also indicate that mid-latitude forestation shows the possibility of a potential positive forcing and net warming.

It is evident, then, that there is more than one effect of land-use change on the global climate. In essence, afforestation can do more than simply sequester carbon. Further, the relative effects of the different feedback processes involved are not well understood and are difficult to estimate using GCMs. Even very large plantations are negligible when compared to the land area that is currently forested. Hence, extracting a simulated climate response to a given plantation in a GCM will be problematic given the inherent variability on multiple timescales that exists in most large models.

Forests have complex non-linear interactions with the atmosphere and affect planetary energetics, the hydrological cycle, and atmospheric composition which can dampen or amplify anthropogenic climate change. An additional complication that is important for modeling, as well as model validation, relates to carbon stock assessment in the field. Unfortunately, different assessment technologies sometimes give different estimates of carbon content. Hence, a consensus view on the best methods to use to gauge carbon stocks has not materialized. Of course, it is even more difficult, if not impossible, to develop accurate general formulae for biomass carbon densities across the board (Christie and Scholes, 1995). This seems to call for a more regional, project-specific approach while evaluating afforestation activities.

Most of our current understanding about forests and their interactions with the climate system comes from models, which are abstractions of many complex systems in our atmosphere. It is these models that contribute to policy making under treaties such as the Kyoto Protocol. Because of this, accurate quantification/parametrization of model processes is essential if the policies we enact are to have the effect we intend them to have. But we would add that a knowledge of important climate processes, including the mechanics of their interaction, is of equal importance in shaping policy going forward.

As models become more complex they allow for greater climate prediction, but they also become less useful for understanding and conceptualizing climate systems. For this reason,

we chose to consider the impact of afforestation on the global climate using a simplified 2-box energy balance model. The model is sufficiently detailed in that it incorporates the main climate processes governing the interaction between forests and the climate system as discussed above. However, the model's simplicity (it has only two prognostic variables) allows for a focused study of competing climate feedbacks via a qualitative analysis. Also, individual climate processes can be easily switched off in the model to isolate their effect by means of, for instance, a formal feedback analysis.

Afforestation is widely recognized for its carbon sequestration potential in the policy-world. We think this recognition should be expanded to include albedo changes, water vapor feedbacks, and atmospheric transport of heat. We echo the contention of Pielke et al. (2002) that a system which takes regional effects into account in a new metric will be useful in developing a more comprehensive protocol than what we have currently. A more complete assessment and understanding of the ways in which afforestation can impact the climate system can only aid in our ability to craft sound policies for guiding the implementation of large scale afforestation efforts so they have their intended effect.

2. Model Schematics

The model used in this paper is adapted from a 2-box energy balance model used by Alexeev and Jackson (2012) to assess the relative roles of atmospheric heat transport (AHT) and surface albedo feedback (SAF) in shaping the polar amplified response of the global climate to uniform forcing. It consists of two boxes or regions, shown schematically in Figure 1, one topical and one extra-tropical, dividing the hemisphere equally area-wise at 30°N . Each box contains equal parts land and ocean. The model incorporates surface albedo feedback, atmospheric heat transport, CO_2 -dependent emissivity, evapotranspiration, and water vapor feedback in the simplest possible formulation. The change in temperature of the regions is modeled as a function of incoming shortwave solar fluxes, atmospheric heat fluxes (sensible and latent), outgoing longwave radiation, and CO_2 forcing. The model takes into account albedo of the regions as well. Moisture availability for latent heat transport depends on the temperature of the tropical atmosphere as well as the area available for evapotranspiration. We assume free evapotranspiration over both ocean and forested regions, while barren (non-forested) lands are assumed to be dry.

3. Model Equations

Model state variables are T_1 and T_2 , the average temperature of the tropical and extra-tropical boxes, respectively. The temperature of the tropical box is assumed to be independent of latitude, while the temperature of the extra-tropical box is assumed to decrease linearly from T_1 at 30°N . This assumption is justified by the annual zonally averaged meridional temperature profile described, say, in Piexoto and Oort (1992). The extent of the ice cap is determined as the area north of the latitude where the temperature crosses a prescribed

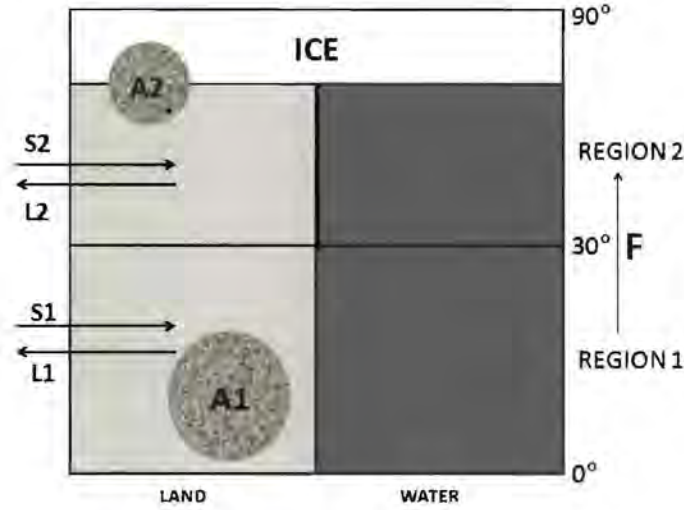


Figure 1: Schematics of the model. S_1 and S_2 are incoming shortwave fluxes. L_1 and L_2 are outgoing longwave radiation. F shows the poleward transfer of heat (latent and sensible) from the tropics to extra-tropics. Forested regions are depicted by A_1 and A_2 .

freezing temperature, here taken to be -2°C . Model equations are given by an energy balance:

$$\begin{aligned} H dT_1/dt &= S_1 - F - (A + B T_1) + \varepsilon \\ H dT_2/dt &= S_2(1 - 2\alpha a) + F - (A + B T_2) + \varepsilon \end{aligned} \quad (1)$$

Here H is the heat content of each region, determined primarily by the upper ocean layer heat content; S_1 and S_2 are the net incoming solar fluxes in the tropical and extra-tropical boxes, respectively; A and B are the Budyko-Sellers constants for parametrization of the outgoing long-wave radiation as a function of surface temperature; a is the fractional area of the hemisphere covered by snow/ice; α is the effective ice albedo; and ε represents the carbon forcing. Units for these parameters are in petawatts where 1 PW in either box is equivalent to $10^{15}/r^2 = 7.8 \text{ W/m}^2$ at the top of the atmosphere. The atmosphere is assumed to have minimal heat content as compared to the land and ocean. In any case, for purposes of evaluation of the model, H determines only the relative time scale of the model response, hence precision in the actual value is completely unnecessary.

The snow/ice area as a fraction of the hemisphere is determined geometrically as mentioned above:

$$a = 1 - \sin \left(30^\circ + 30^\circ \frac{T_1 - T_{\text{ice}}}{T_1 - T_2} \right). \quad (2)$$

Albedo effects due to afforestation are incorporated into both the solar flux terms, S_1 and S_2 ,

as well as effective ice albedo, α . Forest area is parametrized as a forest fraction f_i , which represents the fraction of the land surface of region i that is forested. Ice-free surface albedo is then calculated by an area-weighted average of ocean, forest, and barren land albedo. This surface albedo is then used to scale the incoming solar flux. Hence, both S_1 and S_2 depend, respectively, on independent forest fractions f_1 and f_2 .

To determine the effect of ice on the radiation budget we first assume that the extra-tropical forest is well-distributed throughout the region. Secondly, where forest and snow/ice-covered regions overlap we take the albedo to be that of the darker forest. These are both somewhat unrealistic assumptions, but they have been made in order not to underestimate the effect of extra-tropical afforestation on ice albedo. In fact, this assumption will very likely overestimate the albedo effect of extra-tropical afforestation since such efforts tend to occur in the mid-latitudes and the albedo of a snow-covered forested region will be necessarily be a value strictly between that of snow and forest (Betts and Ball 1997).

The ice albedo, $\alpha_I(f)$, a function of extra-tropical forest fraction, is then converted to an effective ice albedo which describes the net reflective effect of the ice-covered surface over that of the ice-free surface, $\alpha_L(f)$:

$$\alpha(f) = \frac{\alpha_I(f) - \alpha_L(f)}{1 - \alpha_L(f)}. \quad (3)$$

The atmospheric heat transport F is parameterized as follows:

$$F = F_0 + \gamma_1(T_1 - T_2) + \gamma_2 C(T_1)(T_1 - T_2) \quad (4)$$

$$C(T_1) = \exp\left(k_0 + \frac{k_1}{k_2 - T_1}\right)$$

The first term in this formula for F describes the mean background value; the second and third terms are included to mimic the sensible and latent heat transports, respectively. Exponential dependence of latent heat transport on T_1 describes the moisture availability in the atmosphere. The particular form given here is that of the Magnus-Tetens approximation to the Clausius-Clapeyron equation which takes into account the temperature dependence of the latent heat of vaporization at the phase-change boundary ($k_0 = 12.5$, $k_1 = 4277$, $k_2 = 30$). We assume that the majority of the moisture in the extra-tropical atmosphere comes from the tropics and therefore T_2 is not included in the expression for $C(T_1)$. Additionally, as discussed above, we relate moisture availability in the atmosphere to the tropical forest fraction, f_1 , by scaling γ_2 by $(1 + f_1)/2$, which represents the fraction of the tropical box that is ‘wet.’

Lastly, we assume the radiative forcing due to carbon sequestration in forests is uniform across both regions due to the fact that CO_2 is a well mixed greenhouse gas. This TOA forcing is computed via the relation given in REF:

$$\varepsilon = c \log\left(\frac{C_0 - C_1 - C_2}{C_0}\right) \quad (5)$$

where C_0 is a base atmospheric CO₂ value and $C_i = (\mu_i * 0.5 * 3.67) f_i L$. That is, C_i expresses the total CO₂ sequestered in a forest of area $f_i L$ where L is the area of each land region in hectares. The biomass density of the forest is μ (tonnes per hectare) and we assume that half of the forest biomass is carbon (Myneni et al. 2001, Penman et al. 2003). Carbon content is converted to CO₂ by multiplying by 3.67, which is the ratio of the molecular weight of CO₂ to that of carbon. The scaling parameter c in formula (REF) is often taken to be 6.3 (see Table 2.2 in Houghton et al. 1990), but Myhre et al. (1998) use a detailed analyses of three broad band radiative transfer models to argue for a value of $c = 5.35$. It is this latter value which we use here.

The values of μ used in our simulations below are approximate values based on available data and research. As we noted in the introduction, estimation of forest carbon stocks is a complex field in itself. Given that each plantation is influenced by location-specific factors such as soil, hydrology, and microclimate, it is almost impossible to come up with generic formulae for a particular species. Though detailed procedures and estimates for volume, biomass and carbon content of different species have been produced for IPCC reports (e.g., Annex 3A.1 and 4A.2, Penman et al. 2003), extensive field research being carried out in different parts of the world has shown varying results.

For instance, Gonzalez et al. (2010) estimated carbon densities of forests in California, USA using remote sensing technologies, including lidar and satellite imagery, with calibration by in situ measurements. They report that both lidar and satellite image analysis produce lower estimates of forest carbon density than field estimates. They conclude that lidar captures a more complete picture of areas of low tree density than the field sample, whereas satellite image analysis seemed to systematically undercount live tree density.

Many estimates of forest biomass/carbon density have been produced. Brown and Lugo (1984) surveyed existing volume estimates of tropical forests and produced an estimated weighted biomass densities for undisturbed closed and open tropical broadleaf forests of 176 and 61 tonnes per hectare, respectively. However, a later study using more varied data sources (Brown and Lugo, 1992) saw them raise their mean biomass estimate to 300 T/ha. Milne and Brown (1997) combined numerous surveys and census data to estimate forest carbon densities in Great Britain. They estimated maximum stand densities for the oldest forests at 127 and 173 tonnes carbon per hectare for coniferous and broadleaf species, respectively. However, the mean densities (averaged over age and area distribution) were reported to be 21 and 61 tonnes/ha, respectively.

Similarly, Chaturvedi et al. (2011) report that tropical forests in India show a wide distribution of carbon density based on their age and location. For a very productive site, their sample shows a carbon density of 151 tonnes/ha with a growth rate of 5.3 tonnes/ha/year while on a less productive site the carbon density is reported to be 15.6 tonnes/ha with a growth rate of 0.05 tonnes/ha/year.

For our model, we use forest biomass densities that are consistent with the above estimates. Again, precision in these values is not essential in a qualitative study such as this where we seek to compare bulk climate effects of afforestation across regions.

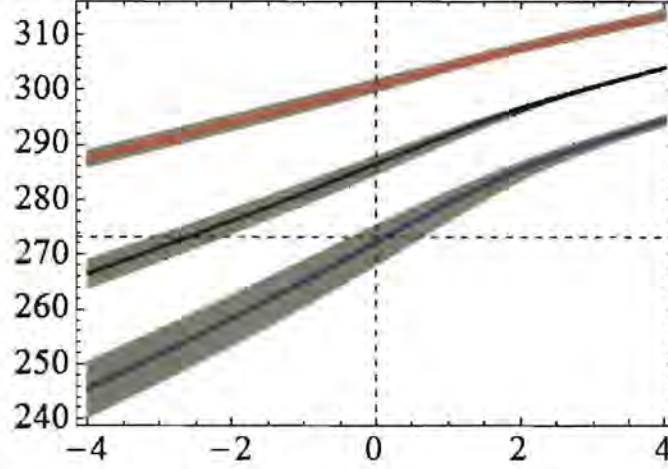


Figure 2: Model climates with $f_1 = f_2 = 0$. Horizontal axis shows TOA forcing value while vertical axis shows temperature. Model parameters are: $S_1 = 41$ PW; $S_2 = 24$ PW; $\alpha = 0.33$; $A = -49.0$ PW; $B = 0.29$ PW/K; $F_0 = 3$ PW; $\gamma_1 = 0.025$; $\gamma_2 = 1.5$. Grey bands show the effect of 10 % variation in the values for effective ice albedo, γ_1 , and γ_2 .

4. Model Climates

We establish a base climatology range by first tuning our model to reproduce a present-day climate and then finding the equilibrium response of this model climate to uniform forcing (Figure 2). By a ‘present-day’ climate we mean one with average temperature, ice area, and heat transport at 30°N near to their present-day values. Of course, this is somewhat artificial given that we initialize our model with forest fractions prescribed to be zero. That is, our base climatology is determined by an Earth with barren land surface. Nevertheless, we do not consider this a problem given that (1) we are confining our analysis to a qualitative description of model differences with respect to various afforestation regimes and (2) our model is already highly idealized and is not meant to be used for either replication of current climate or prediction of future climates.

Figure 3 shows total AHT and ice latitude across a range of climates. We note that AHT shows a generally positive relation to global temperature with a saturation, and even a possible decrease, in the low-gradient, high-temperature regime located near the +2 PW forcing value. This is consistent with AHT behavior derived from more sophisticated models, for example Caballero and Langen (2005). However, for even warmer climates (upwards of +2 PW) AHT shows a renewed and steady upwards trajectory. This could lead to some concern that our simple parametrization of AHT in equation (4) is insufficient to describe AHT response in very warm climates. However, we note that the experiments carried out in this paper will never result in such high temperatures so we don’t consider it a major cause for concern.

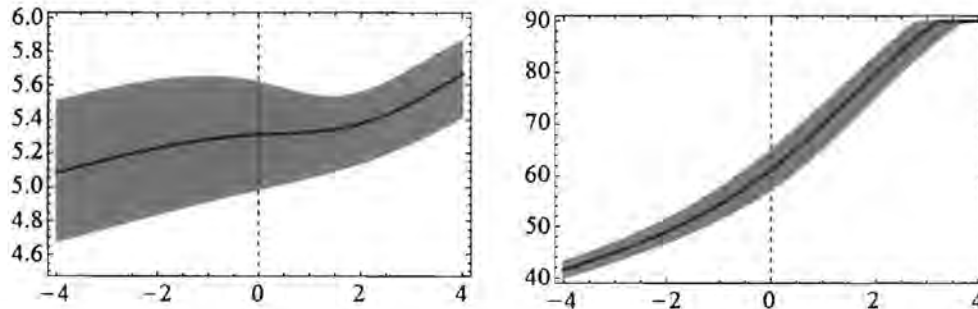


Figure 3: Total AHT in PW (left) and ice latitude in degrees (right) across a range of climates. Horizontal axis shows TOA forcing value. Grey bands show the effect of 10% variation in the values for effective ice albedo, γ_1 , and γ_2 .

5. Afforestation Experiments

As discussed above, the model used in this study has been adapted from a model used to assess the relative roles of AHT and SAF in shaping the polar amplified response of the global climate to uniform forcing. But it is important to note that despite a more or less uniform impact on global CO_2 levels, the climate impact of afforestation is essentially non-uniform given its local effect on albedo and evapotranspiration. Nevertheless, these local effects can have large impacts across the globe due to the atmospheric circulation. Alexeev et al. (2005) investigated the effect non-uniform forcing on a 3D aquaplanet GCM. They found that even without ice-albedo feedbacks a $+4 \text{ W/m}^2$ forcing applied in the tropics resulted in a more or less uniform global response.

Figure 4 shows the outcome of our afforestation experiments. In these experiments the model was subjected to both tropical (case ‘T’) and extra-tropical (case ‘X’) afforestation and allowed to equilibrate. Forest fractions from 0 to 0.3 were prescribed in both regions in separate model runs. Three test cases were used corresponding to forest biomass densities of 100, 150, and 200 tonnes/ha. We refer to these cases as ‘low,’ ‘medium,’ and ‘high’ biomass density. Forest albedo was kept fixed in all model runs.

One first notices that model temperatures decrease in all regions for medium to high density forestation, but show no change, or even warming, for low density forest. Of course, there is no difference here between low, medium, and high biomass forests in terms of their effect on surface albedo or evapotranspiration. Hence, the region-specific differences between temperature response in each case is due mainly to the difference in carbon uptake.

Looking at tropical temperatures (Figure 4(a)) we see that the model response differs significantly depending on the region subjected to afforestation, i.e., case T or case X. In particular, afforestation in case X is seen to result in much cooler tropical temperatures when compared to equivalent afforestation in case T. Extra-tropical temperatures (Figure 4(b)) show a similar relation: afforestation in case T leads to cooler temperatures in the extra-tropics as compared to equivalent afforestation in case X. However, the magnitude of the temperature differences

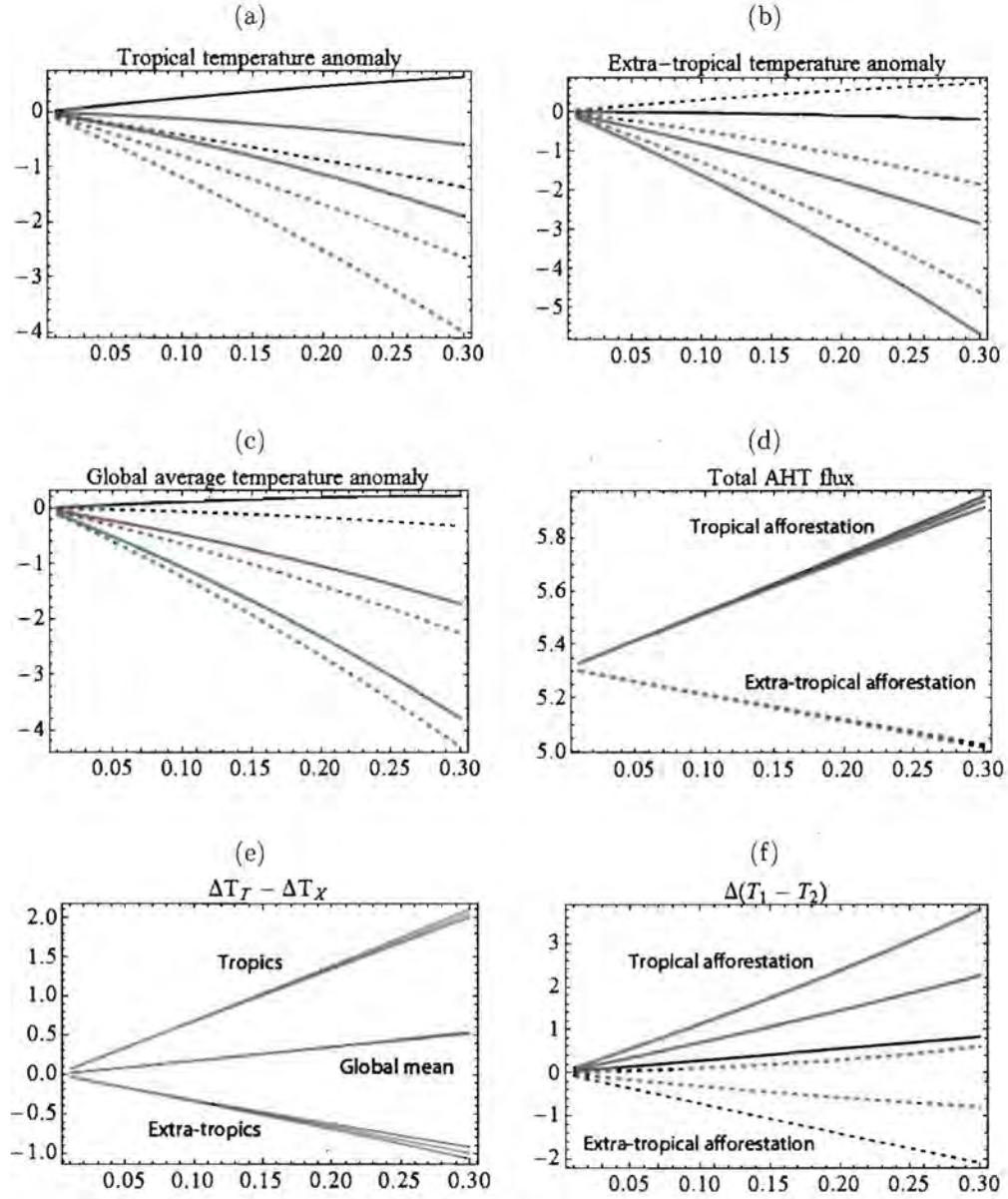


Figure 4: Results of afforestation experiments. Solid lines refer to tropical afforestation (case T), unless otherwise indicated. Dashed lines refer to extra-tropical afforestation (case X).

in the extra-tropics different afforestation regimes (T, X) are not as great under as they are in the tropics. These temperature differences are shown in Figure 4(e). We see, for instance, that for a forest fraction of 0.3 the tropics will be 2°K warmer if the afforested region is chosen to be in the tropics (case T) rather than in the extra-tropics (case X). On the other hand, the extra-tropics will be 1°K cooler in case T than in case X for the same forest fraction.

We conclude that tropical afforestation leads to increased meridional temperature gradients in our model (Figure 4(f)). This increase in gradient is accompanied by an increase in total AHT at 30°N (Figure 4(d)) which is remarkably consistent for all choices of forest density. Given that AHT acts to extract heat from the tropics, we conclude that the increased gradients in case T are due primarily to the surface albedo effect, both that of the forest and the ice cap: tropical afforestation lowers the albedo of the forested region which will lead to a significant increase in absorbed solar radiation, thus increasing the radiation budget in the tropics while, at the same time, ice albedo feedback tends to increase the meridional gradient in cooling scenarios due to the natural polar amplification exhibited by the model.

Extra-tropical afforestation will lead to decreased meridional temperature gradients, however, as can be seen in Figure 4(f). This is interesting because, again, in cooling scenarios one naturally expects to see polar amplification, and thereby an increase in gradient. This then is an artifact of the non-uniform forcing caused by regional afforestation. The natural polar amplified response of the model is overwhelmed by the local albedo effects of afforestation in case X.

It is interesting to note that the differences between case T and case X are much reduced when viewed from the perspective of global temperatures. Figure 4(c) shows the global temperature response as a function of forest fraction, while Figure 4(e) shows the difference in mean global temperature response between case T and case X. From these plots we see that in the simplest view of global temperature change, there is not much difference between afforestation in the tropics vs. the extra-tropics. Though, interestingly, what difference there is indicates that, all else being equal, a greater cooling effect will result from afforestation efforts carried out in the extra-tropics.

The fact that the response curves in Figure 4 are all linear suggests that for most model variables X , the rates dX/df_1 and dX/df_2 will depend only on the forest biomass density μ . At least, this is the case for sufficiently small forest fractions ($f_i \leq 0.3$). Figure 5 gives plots of these rates (as functions of biomass density, μ) for model temperatures, both globally and in individual boxes. In fact, nonlinearities do show up for very large forest fractions ($f_i > 0.8$) due both to nonlinear model processes (SAF, Clausius-Clayperion) as well as the logarithmic parametrization of the carbon forcing in equation (5).

The solid lines in Figure 5(a) correspond to a tropical afforestation scenario. The μ -value at which they cross (approx. 60 T/ha) is the forest biomass density for which tropical afforestation will result in uniform temperature change in both regions (warming in this case). For larger biomass densities tropical afforestation will result in increased temperature gradients and increased heat/moisture transport even in cooling scenarios (Figure 4(d)).

For extra-tropical afforestation (Figure 5(a) dashed lines), this point of intersection occurs for a much larger μ -value (approx. 180 T/ha). Hence, for most forest biomass densities in

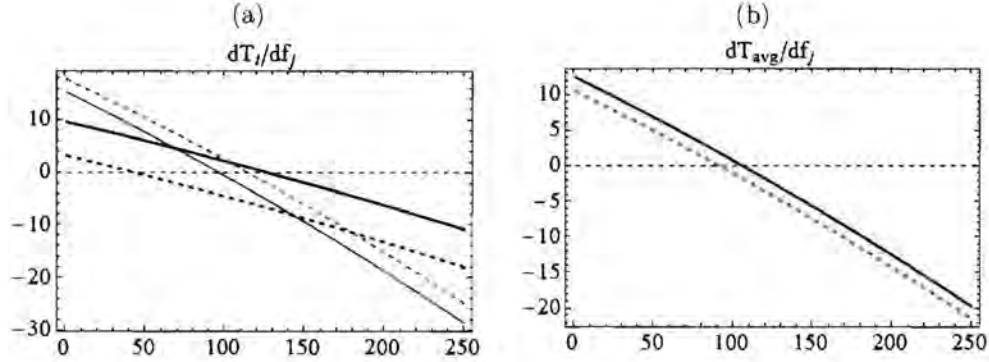


Figure 5: (a) dT_i/df_j for $i, j = 1, 2$; solid lines indicate a tropical afforestation scenario (case T) while dashed lines indicate extra-tropical afforestation (case X); thick lines correspond to tropical temperatures; dashed lines correspond to extra-tropical temperatures. (b) dT_{avg}/df_j for $j = 1, 2$; solid line indicates case T; dashed line indicates case X.

our test range (100-200 T/ha), extra-tropical afforestation results in decreased gradients and reduced heat/moisture transport.

It is worth noting once again that, as far as global temperatures are concerned, extra-tropical afforestation has the larger cooling effect in this model. This is seen in Figure 5(b) where the curve in case X crosses the axis first. The difference between mean temperatures in case T and case X are not as large as for regional temperature differences in these two scenarios. However, this difference is not insubstantial either. For instance, the μ -intercepts of the curves in Fig 5(b) differ by approximately 15 T/ha, or approximately 10% of our mean carbon density. Such an amount could not be considered negligible when assessing the carbon sequestration potential of a given forestation project. Hence, it should not be ignored here where this difference represents the separation between overall warming and overall cooling of otherwise identical afforestation projects based on the region (tropical or extra-tropical) in which they are located.

6. Discussion and Conclusion

Carbon sequestration is only one means by which large scale afforestation projects impact the global climate system. In this study we used a simple 2-box model to illustrate the role of non-carbon processes (albedo effects, increase surface vapor flux, and atmospheric transport of latent and sensible heat) in shaping the global response to non-uniform forcing induced by afforestation.

Our model shows that tropical afforestation tends to increase meridional temperature gradients while extra-tropical afforestation tends to suppress them. Global mean temperatures

in our model show a smaller dependence on the latitude of the afforested region, with high latitude plantations resulting in more global cooling than tropical plantations of the same size. This may seem somewhat surprising given that claims in the literature tend to suggest the opposite. However, tropical forests tend to have greater carbon densities and higher albedo than extra-tropical forests (Betts and Ball 1997; Culf et al. 1995). Hence, a comparative analysis such as ours which holds all parameters in common except latitude cannot treat this issue.

Complex general circulation models are growing in their predictive capacity. However, disagreement exists over the parameters needed for accurate quantification of particular afforestation activities as well as the best technologies for determining these parameters. Given this, and the high degree of variability of GCMs on relevant timescales, we feel that a qualitative approach using a simple model is a good alternative.

In any case, given that proponents of large scale afforestation have targets in the range of 30 million ha per year (Nilsson and Wolfgang 1995), it is important to consider more than just carbon when addressing the climate mitigation efficacy of afforestation.

References

- [1] Alexeev VA (2003) Sensitivity to CO₂ doubling of an atmospheric GCM coupled to an oceanic mixed layer: A linear analysis. *Clim Dyn* 20:775–787
- [2] Alexeev VA, Langen PL, Bates JR (2005) Polar amplification of surface warming on an aquaplanet in “ghost forcing” experiments without sea ice feedbacks. *Clim Dyn* 24:655–666
- [3] Alexeev A, Jackson C (2012). Polar Amplification: Is atmospheric heat transport important? Submitted.
- [4] Betts AK, Ball JH (1997) Albedo over the boreal forest. *J. Geophys. Res.* 102(24): 28,901–28,909
- [5] Betts RA (2000). Offset of the potential carbon sink from boreal forestation by decreases in surface albedo. *Nature*, 408: 187–190.
- [6] Bonan GB, Pollard D, Thompson SL (1992). Effects of boreal forest vegetation on global climate. *Nature*, 359: 716–718.
- [7] Bonan G (2008). Forests and Climate Change: Forcings, Feedbacks, and the Climate Benefits of Forests. *Science*, 320: 1444–1449.
- [8] Brown S, and Lugo A (1984). Biomass of Tropical Forests: A New Estimate Based on Forest Volumes. *Science*, 223 (4642): 1290–1293.
- [9] Brown S, Lugo A (1992). Aboveground Biomass Estimates for Tropical Moist Forests of the Brazilian Amazon. *Interciencia* 17(1): 8–18.

- [10] Caballero R, Langen PL (2005). The dynamic range of poleward energy transport in an atmospheric general circulation model. *Geophys Res Lett*, 32: L02705.
- [11] Cai M (2005). Dynamical amplification of polar warming. *Geophys Res Lett*, 32:L22710.
- [12] Cess R (1978). Biosphere-Albedo Feedback and Climate Modelling. *Journal of the Atmospheric Sciences*, 35 (9): 1765-1768.
- [13] Chaturvedi RK, Raghubanshi AS, Singh JS (2011). Carbon density and accumulation in woody species of tropical dry forest in India. *Forest Ecology and Management*, 262 (8): 1576-1588.
- [14] Christie SI, Scholes RJ (1995). CARBON STORAGE IN EUCALYPTUS AND PINE PLANTATIONS IN SOUTH AFRICA. *Environmental Monitoring and Assessment*, 38: 231-241.
- [15] Culf AD, Fisch G, Hodnett MG (1995) The Albedo of Amazonian Forest and Ranch Land. *J. Clim* 8: 1544-1554.
- [16] Dommenges D, Floter J (2011). Conceptual understanding of climate change with a globally resolved energy balance model. *Clim Dyn*, 37: 2143-2165.
- [17] Flannery BP (1984). Energy-balance models incorporating transport of thermal and latent energy. *J Atm Sci*, 41:414-421.
- [18] Foley JA, DeFries R, Asner GP, Barford C, Bonan G, Carpenter SR, Chapin FS, Coe MT, Daily GC, Gibbs HK, Helkowski JH, Holloway T, Howard EA, Kucharik CJ, Monfreda C, Patz JA, Prentice IC, Ramankutty N, Snyder PK (2005). Global Consequences of Land Use. *Science*, 309: 570-574.
- [19] Gibbard S, Caldeira K, Bala G, Phillips TJ, Wickett, M (2005). Climate effects of global land cover change. *Geophys. Res. Lett.*, 32: L23705.
- [20] Gonzalez P, Asner G, Battles J, Lefsky M, Waring K, Palace M (2010). Forest carbon densities and uncertainties from Lidar, QuickBird, and field measurements in California. *Remote Sensing of Environment*, 114: 1561-1575.
- [21] Graversen RG, Wang M (2009). Polar amplification in a coupled climate model with locked albedo. *Clim Dyn* 33:629-643.
- [22] Hall A, Manabe S (1999). The Role of Water Vapor in Unperturbed Climate Variability and Global Warming. *Journal of Climate*, 12.8: 2327-2346.
- [23] Houghton RA (2005). Aboveground Forest Biomass and the Global Carbon Balance. *Global Change Biology*, 11: 945-958.
- [24] Houghton JT, Jenkins GJ, Ephraums JJ (eds.) (1990). IPCC First Assessment Reports. Intergovernmental Panel on Climate Change. Cambridge University Press.

- [25] Held IM, Brian SJ (2000). Water vapor feedback and global warming. ANNUAL REVIEW OF ENERGY AND THE ENVIRONMENT, 25: 441-475.
- [26] Langen PL, Alexeev VA (2005) A study of non-local effects on the Budyko-Sellers infrared parameterization using atmospheric general circulation models. Tellus 57A:654-661.
- [27] Langen PL, Alexeev VA (2007) Polar amplification as a preferred response in an idealized aquaplanet GCM. Clim Dyn, 29: 305-317
- [28] Milne R, Brown TA (1997). Carbon in the Vegetation and Soils of Great Britain. Journal of Environmental Management, 49: 413-433.
- [29] Myhre G, Highwood E, Shine K, Stordal F (1998). New Estimates of radiative forcing due to well mixed greenhouse gases. GEOPHYSICAL RESEARCH LETTERS, 25 (14): 2715-2718.
- [30] Myneni RB, Dong J, Tucker CJ, Kaufmann RK, Kauppi PE, Liski J, Zhou L, Alexeyev V, Hughes MK (2001). A Large Carbon Sink in the Woody Biomass of Northern Forests. Proceedings of the National Academy of Sciences of the United States of America, 98 (26): 14784-14789.
- [31] Nilsson S, Wolfgang S (1995). The carbon-sequestration potential of a global afforestation program. Climatic change, 30 (3): 267-293.
- [32] Penman J, Gytarsky M, Hiraishi T, Krug T, Kruger D, Pipatti R, Buendia L, Miwa K, Ngara T, Tanabe K, Wagner F (eds.) (2003). Good Practice Guidance for Land Use, Land-Use Change and Forestry. Intergovernmental Panel on Climate Change. Institute for Global Environmental Strategies.
- [33] Pielke RA, Marland G, Betts RA, Chase TN, Eastman JL, Niles JO, Niyogi DDS, Running SW (2002). The influence of land-use change and landscape dynamics on the climate system: relevance to climate-change policy beyond the radiative effect of greenhouse gases. Phil. Trans. R. Soc. Lond. A., 360: 1705-1719.
- [34] Peixoto J, Oort A (1992). PHYSICS OF CLIMATE. Melville, NY: AIP Press. Print.
- [35] Rodgers KB, Lohmann G, Lorenz S, Schneider R, Henderson GM (2003). A tropical mechanism for Northern Hemisphere deglaciation. Geochem Geophys Geosys, 4(5):1046.
- [36] Schneider EK, Lindzen RS, Kirtman BP (1997). A tropical influence on global climate. J Atmos Sci, 54:1349-1358.
- [37] Soden BJ, Wetherald RT, Stenchikov GL, Robock A (2002). Global cooling after the eruption of Mount Pinatubo: A test of climate feedback by water vapor. Science, 296 (727): 727-730.

Affiliation:

Craig Jackson
Department of Mathematics and Computer Science
Ohio Wesleyan University
Delaware, OH 43015
E-mail: chjackso@owu.edu



Veda Climate Change SOLUTIONS LIMITED

(An enviro-social enterprise to benefit poor from carbon Credits)

EXTRACT OF THE MINUTES OF THE MEETING OF THE BOARD OF DIRECTORS OF THE COMPANY i.e. VEDA CLIMATE CHANGE SOLUTIONS LTD (VCCSL) HELD ON THE 11th AUGUST, 2011 AT 6:00 P.M. AT FLAT No.201; KURUPAM ENCLAVE, PEDA WALTAIR; VISAKHAPATNAM; ANDHRA PRADESH.

To designate Mr. Sriharsha Masabathula as President of VEDA Climate Change Solutions Ltd.

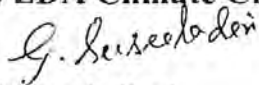
The Board of Directors states that Mr. Sriharsha Masabathula infused new ideas and fresh thinking into the management of VCCSL during his association with it as an intern and Executive Trainee over the last four years and the Board of Directors convey its compliments to him. It further appreciates the contribution made by Mr. Sriharsha to the furtherance of the objectives of the Company.

Further Resolved that in recognition of his leadership skills, commitment and conviction to address climate change and also to improve livelihoods of poor people, he has been designated as 'PRESIDENT' of the company and wish him all success in his endeavor to connect poor to international carbon markets.

Further Resolved that the certified true copy of the above resolution be submitted to those concerned under the signature of any of the Directors of the Company.

Certified True Copy

For **VEDA Climate Change Solutions Ltd**


G.Suseela Devi
DIRECTOR

FOR IMMEDIATE RELEASE

The World Bank

Contact: In Delhi: Hemu Bala Subramanian / Vinitha Ranaide
Tel: 24617241

Improving Rural Livelihoods through Carbon Credits

For the first time in India, small and marginal farmers in Orissa and Andhra Pradesh will benefit from carbon finance

New Delhi, May 8, 2007: The World Bank's BioCarbon Fund (BioCF) today signed an Emission Reduction Purchase Agreement (ERPA) that will enable small and marginal farmers in Orissa and Andhra Pradesh to earn additional revenues through carbon credits by afforesting their severely degraded lands. Under the agreement, the BioCF will purchase 270,000 tCO₂e (tons of carbon dioxide equivalent) between 2008 and 2017, with an option for an additional purchase of 370,200 tCO₂e. There is also a grant component from the BioCF Plus for capacity building for the Environmental Management Framework.

"The ERPA is the first of its kind in India," said Martien Van Nieuwkoop, the World Bank's task team leader for the project. "It is India's first LULUCF (Land Use and Land Use Change and Forestry) project to sell emission reductions (ERs) earned through carbon sequestration in newly established agro-forestry plantations. This will not only create additional income for resource-poor farmers, but will also contribute to reducing global greenhouse gas emissions (GHGs)."

The BioCarbon Fund will purchase ERs generated by the "India Improving Rural Livelihoods through Carbon Sequestration Project". Carbon sequestration is the term describing processes that remove carbon from the atmosphere to help mitigate global warming. The project has been developed jointly by JK Paper Ltd in Rayagada, Orissa and by VEDA MACS, Hyderabad - which addresses

An imaginative scheme in one of India's poorest states empowers small farmers to sell carbon credits on the world market by growing trees. **Shaboon Doney reports.**



cutting carbon



BioCarbon Fund Project



VEDA
Climate Change Solutions Ltd



JK PAPER LTD.
Creating lasting impressions



Promoting Public-Private Partnerships to address global warming and poverty

Improving rural livelihoods through carbon sequestration by adopting environment friendly technology based agro-forestry practices



The Afforestation/Reforestation (A/R) CDM project activity mobilizes resource poor farmers to raise plantations on their lands to enable them to earn additional revenue through carbon credits.

VEDA
Climate Change Solutions Ltd
2-35-15/2 Perraju Pet
Kakinada - 533003
Andhra Pradesh, India
Telefax: 00 91 884 2372490
Email: vccsl@vccslindia.org
Website: www.vccslindia.org

JK Paper Ltd
Unit - JKPM
Jaykaypur - 765017
Orissa, India
Telefax: 00 91 6856 234078
Email: mcgoel@jkpm.jkmail.com
Website: www.jkpaper.com

DESIGN: artstation@gmail.com



BioCF Project:

The project activity is implemented on 1600 ha of degraded lands which are either left barren or under rainfed subsistence agriculture in the two states of Orissa and Andhra Pradesh in India. The World Bank has entered into Emission Reduction Purchase Agreement with VCCSL and JKPL for purchase of carbon credits generated by the Project. <http://wbcarbonfinance.org/Router.cfm?Page=BioCF&PID=9708&ItemID=9708&tr=Projects&ProjID=9636>

VCCSL has piloted the CDM project in coordination with JKPL, farmers, and other stakeholders to facilitate the flow of Carbon revenue to the participating farmers. It is envisaged that 80% of the carbon revenue will be transferred to the beneficiary farmers and a joint escrow account of VCCSL and JKPL has been opened for channelling carbon revenues to the farmers.

JKPL supports the supply of improved planting stock to the participating farmers, provides technical support for plantation activity and formalised arrangements for purchase of wood from the plantations established under the project.



Salient features:

- Pilot reforestation activities for generating high-quality green house gas removals by sinks that can be measured, monitored and verified.
- Development of institutional mechanisms for implementing A/R CDM project activities.
- Develop plantation and agro forestry models, which can provide multiple benefits to farmers from timber, firewood and non-wood forest products.
- Provide additional income and improve livelihoods of resource poor farmers through carbon revenues.
- Reforest degraded lands to control soil and water erosion and improve productivity through a participatory approach.
- Reduce the dependence of industry on natural forests thereby conserving biodiversity.
- Build capacity of multiple stakeholders including farmers to benefit from global mechanisms.
- Development, testing and dissemination of best practices in plantation and agro forestry to maximize economic, environmental and social benefits.
- Provision of seedlings raised from clonal technology to the farmers to raise plantations.
- Promotion of farmer-industry partnerships with buy-back arrangements to purchase wood.

Project benefits:

Economic

- Would benefit the small farmers in getting higher rate of financial return from their lands.
- Will generate productive self employment to small farmers and their family members.
- Direct and indirect employment generation along the value chain.
- Business development for companies at local and global levels.
- Local paper and construction industry will be able to meet their wood requirements.

Environmental

- Reduction of GHG emissions through sequestration of atmospheric CO₂.
- Offsetting carbon footprints of corporates, governments and non governmental organisations.
- Degraded farm lands are brought into appropriate land use through afforestation and agro-forestry practices.
- Will help in moisture and soil conservation.
- Conservation of biodiversity through reduced dependence on natural forests.

Social

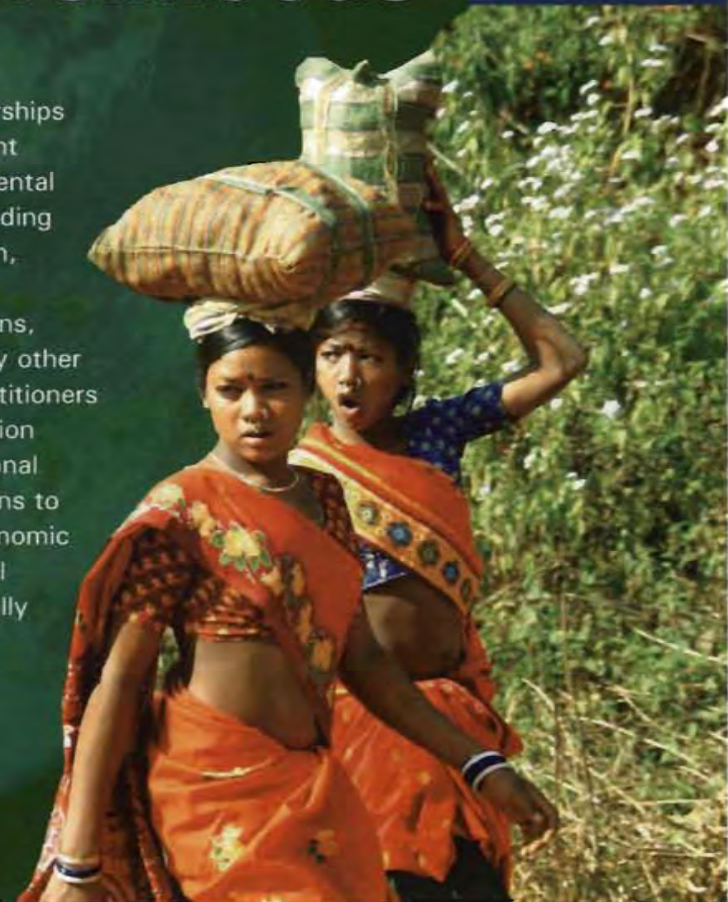
- Improvement in livelihoods of resource poor farmers.
- Inclusive development.
- Climate justice through equitable sustainable development.
- Capacity building of farmers to benefit from global mechanisms.
- Foster relationship among multiple stakeholders in a mutually beneficial manner and contribute to global conservation efforts.
- Corporate social responsibility fulfilled integrating development and environmental conservation.

LEFT TO RIGHT: Barren lands being addressed by the project; Ms Saima Qadir, The World Bank, along with the participating farmers; Clonal technology facility of JK Paper Mills Ltd; Degraded land prepared for planting; A mature plantation.

Interact Integrate Innovate

Mitigating Climate Change Improving Livelihoods

Promoting partnerships among government and non governmental organizations, funding agencies, research, management and financial institutions, industry and many other development practitioners to ensure integration across local, regional and global concerns to provide socio-economic and environmental benefits both locally and globally on a sustained basis.



Interact
Integrate
Innovate

Socio-eCO:nomix-Global
VEDA Climate Change Solutions Ltd
2-35-15/2 Perapu Pet
Kakinada - 533003
Andhra Pradesh, India
Teletax: 00 91 884 2372490
Email: vccl@vcclindia.org
Website: www.vcclindia.org

015000 - art@vcclindia.org



Socio-eCO₂nomix-Global

Connecting poor to international carbon markets

The Knowledge Processing Organization promotes consortiums with multiple stakeholders to benefit from each other's strengths and to pool resources to address global warming and poverty through local action.

It designs, develops and undertakes projects that are capable of generating carbon revenues to enhance livelihoods of rural communities.

Vision

Achieving sustainability and a low-carbon economy will not only depend on technological innovation, but will require far ranging socio-economic and environmental innovations. Socio-eCO₂nomix-Global is an enviro-social enterprises established to provide economic, social and environmental benefits both locally and globally through 'business unusual'.

It aims at linking grassroots with international organizations through global mechanisms such as United Nations Framework Convention on Climate Change (UNFCCC) for social advancement, environmental improvement and also for economic development.

The innovative venture generates Social Credits in addition to Carbon Credits by integrating socio-economic and environmental concerns into the business of development for the benefit of poor and also the corporates. While the Carbon Credits i.e. VERs/CERs would provide additional revenues to the farmers, the Corporates/Development agencies/ Governments can use these Social/Carbon Credits to offset their carbon footprints.

A Not for Profit Enterprise

Mandate

- To provide additional income through carbon revenues to improve livelihoods of disadvantaged, vulnerable and indigenous communities in general and women in particular.
- Development, testing and scaling up of local financing and institutional arrangements for improving livelihoods through carbon finance mechanisms.
- Strengthening institutional mechanisms to aid the sale of Certified Emission Reductions (CERs)/ Voluntary Emission Reductions (VERs).
- Provision of micro credit and microinsurance from financial institutions to resource-poor farmers.
- Build partnerships with international and national research organisations to develop viable models for adoption by farmers to increase their returns.
- Strengthening capacity of multiple stakeholders including farmers, governmental and non-governmental organizations through training and technical assistance to enhance their skills to take advantage of the international mechanisms.



Veda Climate Change Solutions Limited (VCCSL)

Promoting Public-Private Partnerships to address global warming and poverty



The venture epitomizes the way that progressive business models are moving today.

Tina Goyal, an associate with Endeavor, a New York-based non-profit that assists entrepreneurs in eight developing country markets

- Promoted by Vanitha Empowerment, Development and Advancement (VEDA) Mutually Aided Cooperative Society (IMACS) on the advice of The World Bank as an institutional mechanism to build Indian capacity in implementing CDM projects.
- The only organization in India to cross the complete Afforestation/ Reforestation (A/R) CDM project cycle upto Emission Reduction Purchase Agreement (ERPA).
- VCCSL is responsible for delivery of Carbon Credits to The World Bank and carbon revenue to the farmers.
- Provides support and hand holding of farmers up to receipt of carbon revenue from the sale of Certified Emission Reductions (CERs).
- Focused mainly on rural and allied sectors to enable farmers to benefit from CDM and voluntary market mechanism.
- Domain knowledge in sectors like forestry, agriculture, coastal management, agro-forestry, horticulture, bio-energy etc.
- Cross-functional expertise in Economics, Finance, Statistics, Human Resource Development, Social Change Management, Community Institutions and Environment.
- Linkages with international and national organisations, and experts in the areas of climate change and poverty alleviation.
- Ability to effectively link global mechanisms to local requirements for multiple benefits.

For Profit Company