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Paolo A. Lopes

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Paulo A. Lopes
American University Washington College of Law

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*by Paulo A. Lopes**

Introduction

"What is a cynic? A man who knows the price of everything and the value of nothing."[1] Although uttered in Oscar Wilde's 1892 comedy, *Lady Windermere's Fan*, its reference could not have been more foreboding.[2] Wilde's comedy foreshadowed what was to come as the classical economics of the 18th and 19th century[3] evolved into neoclassical economics in the 20th century,[4] and finally into mainstream economics[5] built on the theory, and now the practice, of free market economies.[6]

Unfortunately, over the years, free market economies have long since forgotten Wilde's definition of a "cynic" even though remembrance of it today is paramount for environmentalists as they try to mitigate climate change. Today, humans have embarked on what may be the last frontier of mainstream economics, the monetization of what was once thought incalculable, Earth's ecosystems,[7] some of which remain largely unscathed by mainstream economies.

Payment for ecosystem services ("PES")[8] is a type of mainstream economic recognition of benefits provided by land. However, this rebirth of economic land recognition is not a reincarnation of Adam Smith's economics that consisted of labor, land, and capital.[9] Instead, PES programs, such as reducing emissions from deforestation and forest degradation ("REDD"),[10] try to monetize aspects of nature, including carbon dioxide ("CO_2") sequestration with REDD projects.[11]

The lack of recognition of the total value of land by mainstream economics is in large part because of the continued classification of land as a subcategory of capital, which results in undervaluation of the land.[12] This undervaluation of land is an externality of mainstream economics that discounts the ecosystem services provided by the natural environment.[13] Mitigation of these externalities can occur when there is actual recognition of the ecosystem services.[14] Although mainstream economies advocate that REDD programs will help "save" the planet from climate change,[15] current REDD programs fail to internalize many of the ecosystem services provided by forests, thus perpetuating the undervaluation of land recognition in mainstream economics.[16]

This article argues that the current design of REDD is a myopic Partial PES at best.[17] Forest ecosystems provide numerous services beyond the sequestration of CO_2, such as protecting upstream watersheds,[18] conserving biodiversity[19] and gene pools,[20] soil formation,[21] nutrient recycling,[22] and plant pollination.[23] Thus REDD programs should recognize and include these and other ecosystem services.[24] After reviewing REDD in the international context and the accounting scheme, recommendations and concerns are provided for why the expansion of REDD to include other ecosystems and services would result in not only a greater CO_2 reduction, but also other important environmental benefits.[25] The article concludes by recognizing that REDD's accounting loopholes, by focusing solely on CO_2 reduction without recognition of the ensuing impact from that reduction, will impose negative externalities on other ecosystem services, and that REDD needs to transition to a program that internalizes these externalities.[26]

Paying for Ecosystem Services

Payment for Ecosystem Services Generally

The Earth's ecosystem provides benefits, sometimes referred to as "services," for all organisms on the planet.[27] These ecosystem services may or may not be directly recognized by mainstream economics.[28] PES is a financial valuation of Earth's ecosystem services.[29] The primary purpose of a PES program is to maintain a specific ecosystem "service," such as clean water,[30] carbon sequestration,[31] or biodiversity habitat,[32] for some type of economic value.[33] However, the transfer of money to maintain the ecosystem service is not the defining factor of a PES program.[34] Rather, it is the fact that the "payment causes the benefit to occur where it would not have otherwise."[35] By having the service be "additional," a value for the service can be determined, thus creating a PES program.[36]

Reducing Emissions from Deforestation and Forest Degradation is an Example of a Payment for Ecosystem Services Program

As mentioned above, carbon sequestration is one of the ecosystem services provided by forests. The net forest loss between 1990 and 2000 was 13.1 million hectares ("ha") per year and 12.9 million ha between 2000 and 2005,[37] the equivalent of the land area of Greece[38] or New York[39] every year, and according to the Intergovernmental Panel on Climate Change ("IPCC"), emissions from deforestation during the 1990s were estimated at 5.8 gigatonnes ("Gt") of CO_2 per year.[40] With emissions

* *Paulo A. Lopes is a J.D./M.P.P. Candidate, 2011, at American University, Washington College of Law and School of Public Affairs.*

from deforestation and forest degradation accounting for nearly twenty percent of total greenhouse gas emissions,[41] there is a need to reduce emissions from forests.

Over the years, varying countries have undertaken numerous schemes, and institutions have proposed ways to reduce emissions from deforestation.[42] Some programs, listed in order from narrowest to broadest include: reducing emissions from deforestation ("RED"); reducing emissions from deforestation and degradation ("REDD"); and reducing emissions from deforestation, degradation, and the enhancement of carbon stocks (the "+" in "REDD+") by means of carbon sequestration.[43] These schemes—coupled with needed financing—should result in reducing emissions from deforestation.[44]

REDD Within the International Climate Context

In 1997, the third Conference of the Parties ("COP-3") of the United Nations Framework Convention on Climate Change ("UNFCCC" or "Convention") adopted the Kyoto Protocol.[45] Article 3(3) of the Kyoto Protocol limited Land-Use Change and Forestry ("LUCF") activities to afforestation, reforestation, and deforestation,[46] while Article 3(4) provided flexibility with the inclusion of other activities as determined by the first session of the Meeting of the Parties to the Kyoto Protocol.[47]

Noting the conclusions found by the Subsidiary Body for Scientific and Technological Advice ("SBSTA") at its eighth session and the decision by the IPCC to prepare a report on Land-Use, Land-Use Change and Forestry ("LULUCF"), the fourth Conference of the Parties ("COP-4") of the UNFCCC, began to lay the legal groundwork for the recognition and inclusion of LULUCF.[48] This establishment of more specific legal provisions for LULUCF continued with the sixth Conference of the Parties ("COP-6") in 2000, with the IPCC scientific report[49] and the Food and Agriculture Organization ("FAO") definition for "forests."[50] At the 2001 seventh Conference of the Parties ("COP-7"), the Parties agreed upon the inclusion of additional activities, such as revegetation, forest management, cropland management, and grazing land management, which were prohibited from jointly implemented activities but included in domestically conducted activities.[51]

In 2007 in Bali, Indonesia, the thirteenth Conference of the Parties ("COP-13") recognized "the urgent need to take further meaningful action to reduce emissions from deforestation and forest degradation in developing countries."[52] The Bali Action Plan established a goal to complete the policy approaches and incentives to reduce emissions from deforestation by 2009.[53] While the fifteenth Conference of the Parties ("COP-15"), in 2009, concluded with the nonbinding[54] Copenhagen Accord, which "recogniz[ed] the crucial role of reducing emission[s] from deforestation and forest degradation,"[55] the goal set by the Bali Action Plan was not met.[56]

At the sixteenth Conference of the Parties ("COP-16"), in 2010 in Cancun, Mexico, the COP concluded by adopting numerous decisions, including one that recognized the need to reduce emissions from forests.[57] The outcome of the thirteenth session of the Ad Hoc Working Group on Long-term Cooperative Action ("AWG-LCA-13") under the Convention resulted in agreement by Parties for "policy approaches and positive incentives on issues relating to [REDD] in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries."[58] It encouraged each country, as appropriate, to undertake the following actions: "(a) Reduc[e] emissions from deforestation; (b) Reduc[e] emissions from forest degradation; (c) Conservation of forest carbon stocks; (d) Sustainable management of forest; [and] (e) Enhancement of forest carbon stocks."[59] Countries agreed to develop a national strategy or action plan[60] and a "robust and transparent national forest monitoring system for the monitoring and reporting of the activities" listed above.[61] During the development and implementation of their national strategies or action plans, developing countries are asked, "to address, inter alia, drivers of deforestation and forest degradation, land tenure issues, forest governance issues, gender considerations and . . . [to] ensure the full and effective participation of relevant stakeholders, inter alia, indigenous peoples and local communities."[62] This agreement of the AWG-LCA-13 text at COP-16 in Cancun, Mexico is a step forward for the recognition and implementation of REDD at the international level.[63]

CO_2 Emissions Accounting

It is important to recognize that forestry accounting of CO_2 emissions, although maturing, is in its infancy and thus still imprecise.[64] Accurate accounting allows for the determination of whether the REDD program will have added benefit,[65] which requires that the benefit be accurately quantified and documented.[66] For a carbon offset to actually result from a REDD program, one must review the additionality, definition of a forest, leakage, measurement, verification, and permanence of the offset.[67] If a REDD program fails to meet any or all of these requirements, then the offset is not actually realized since forestry CO_2 emissions were not reduced.[68] Recognition of this failed emission reduction offset would allow countries to emit more, since emissions were not offset by the REDD program even though they were recognized as having occurred.[69]

Additionality

Additionality refers to the quantity of emission reductions that result from the implementation of the REDD program when compared to business as usual.[70] The difference between the reference level and the emission reductions achieved is the "additionality."[71] Although in theory this sounds possible, if not straightforward, experts still differ on approaches for determining the additionality amount since "there is no correct technique for determining additionality because it requires comparison of expected reductions against a projected business-as-usual emissions baseline . . . [, which] is inherently uncertain because, it may not be possible to know what would have happened in the future had the projects not been undertaken."[72] Fundamentally, the test to determine additionality will always vary depending on the balance between reduction of administrative costs versus program rigor and environmental certainty.[73]

Definitions of Forests

Article 3(3) of the Kyoto Protocol lists LULUCF activities as afforestation, reforestation, and deforestation[74] but does not provide definitions for these activities.[75] In 2000, the IPCC, in a special report on LULUCF, recognized the importance of providing clear definitions of these activities to facilitate accounting for different land-use activities.[76] The report also notes that "[f]orest definitions based on legal, administrative, or cultural considerations" may not be appropriate for carbon accounting since these definitions do not always correlate to the quantity of carbon stored on the site as illustrated by the following forest definitions.[77] The ninth session of the Conference of the Parties ("COP-9"), in 2003 in Milan, Italy, provided the Parties with flexibility on a forest definition with "(a) A single minimum tree crown cover between 10 and 30 per cent; (b) A single minimum land area value between 0.05 and 1 hectare; and (c) A single minimum tree height value between 2 and 5 meters."[78] The Food and Agriculture Organization ("FAO"), in a 2006 working paper, also noted the issue of selecting a forest definition for accounting in Clean Development Mechanism ("CDM") projects.[79] Unlike COP-9's three criterions, the FAO working paper put forward a ten-step process to aid countries in selecting the optimal parameters for a forest definition.[80] As evident by these different approaches, providing flexibility in defining forests is necessary since ecosystems around the world vary greatly. This variation prohibits creation of a uniform international definition applicable to all countries, because it would result in winners and losers amongst countries.[81]

Leakage

While the emphasis and requirements under the Kyoto Protocol that CDM projects be additional[82] is important, the risk of leakage must also be recognized.[83] Leakage "occurs when economic activity is shifted as a result of the emission control regulation and, as a result, emission abatement achieved in one location that is subject to emission control regulation . . . is offset by increased emissions in unregulated locations."[84] For example, in the context of a REDD program, leakage occurs when site A's forest emissions, which are under a REDD program, are reduced by two tonnes of CO_2, yet CO_2 emissions from site B, which is not under a REDD program, increases CO_2 emissions by two tonnes.[85] The achieved emission reductions of site A is negated by the increased emissions from site B, resulting in a zero-sum game of emission reductions.[86] COP-9 recognized leakage if the increase in emissions occurs outside of the project and is measurable and attributable to the reduced emissions undertaken by the project.[87]

Measurement and Verification

Measurement and verification of deforestation is essential to any REDD project with a goal of issuing emission reduction credits.[88] However, measurement and verification of carbon sequestration is difficult since "rates vary by tree species, soil type, regional climate, topography and management practice."[89] In the United States, carbon sequestration rates for tree species are better understood than soil carbon sequestration rates, which vary by cropping practice and soil type.[90] Over time, the rate of carbon sequestration absorption decreases in trees and stops as it nears the saturation point, when no additional sequestration of carbon is possible.[91]

Permanence

Permanence is one of the major concerns with biological carbon sequestration projects such as REDD,[92] because it is key when trying to achieve overall emission reductions.[93] With biological sequestration programs—unlike emission reductions that achieve results by reducing the release of carbon—if the sequestered carbon is released sometime in the future, the sequestration program is a failure.[94] This concern over a potential release also applies to avoided deforestation, since avoided deforestation today may turn into future deforestation.[95] The release of sequestered carbon may result from human causes, such as changes in land use and management, or from natural causes, such as a fire.[96]

Policy Recommendations and Concerns: Expanding Beyond the Myopic Confines of REDD to Recognize and Include Other Ecosystems and Services Will Result in Not Only a Greater CO_2 Reduction but Other Important Environmental Benefits.

Other Ecosystems: Expanding REDD to Mitigate REDD's Accounting Loopholes

The negotiations concerning biological carbon sequestration evolved over the years from COP-3 with the Kyoto Protocol's recognition of LULUCF,[97] to the COP-6 debate,[98] and final recognition by COP-7 of a more expansive program recognizing additional activities.[99] In 2007, the Bali Action Plan of COP-13 acknowledged the need to establish incentives to reduce emissions from deforestation,[100] which was reiterated in the Copenhagen Accord of COP-15.[101] At COP-16, additional progress occurred with the decision to adopt the AWG-LCA-13 policy approaches and positive incentives on REDD.[102] Although the progression of the need to reduce emissions from biological sources is evident, the unifying theme over the COPs has come to focus on forests, as a result of the recognition of the need to reduce emissions from deforestation and degradation.[103]

The progression is also apparent with the IPCC accounting of emissions recognized by the UNFCCC.[104] The IPCC has released numerous reports over the years on forestry and carbon capture: in 1996, on Land-Use Change and Forestry ("LUCF"), which identified major emissions from large probable land use sources;[105] LULUCF in 2003, which expanded LUCF to include all carbon pools;[106] and in 2006, a report that transformed LULUCF into Agriculture, Forestry, and Other Land Use ("AFOLU"), which integrated both the agriculture and LULUCF sectors.[107]

While the IPCC accounting has evolved over the years to include all carbon pools from all sectors, the UNFCCC's decisions and resolutions on RED, REDD, and REDD+ all focus on forestry.[108] Although emissions from forests are substantial and

the need to reduce forest emissions is necessary,[109] the UNFCCC should evolve negotiations on REDD+ to include all of the land use sectors recognized under AFOLU.

Is There a Better Scheme than RED, REDD, or REDD+?

A scheme that would go beyond the confines of RED, REDD, and REDD+ is Reducing Emission from All Land Uses ("REALU").[110] By applying AFOLU accounting, some of the emissions recognized by REALU would include forestland, grassland, cropland, settlements, wetlands, and other lands; meanwhile this would also account for agriculture and other land use emissions resulting from liming, urea, manure, enteric fermentation, nitrous oxide, and others.[111] REALU with AFOLU accounting would "include all land use proportionate to actual emissions and emission potential."[112] REALU, like other proposals,[113] is supported by many organizations and is still evolving.[114]

One of the lingering issues pertaining to REDD is the definition of what is a forest[115]—or rather when does a tree become classified as a forest? The Kyoto Protocol and COP-9 provided a flexible definition based on tree crown cover, minimum land area per hectare, and minimum tree height,[116] a 2006 working paper by the FAO provided a ten-step process for selecting the optimal parameters for a forest definition,[117] and the IPCC special report on LULUCF noted the importance of clarity.[118] However, none of these definitions account for trees outside the forest or wetlands, which also sequester large quantities of carbon.[119] REALU with AFOLU accounting, since it covers all sectors, would recognize the tree that is not yet considered a forest under these other definitions, along with the vast expanses of wetlands.[120]

The definition of forests in the Kyoto Protocol also allows for "areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest" to maintain their forest classification.[121] The Kyoto Protocol establishes no duration for "temporarily unstocked" forest,[122] yet still regards these areas as forested.[123] Thus, the Kyoto Protocol does not recognize the release of emissions from clearcutting as long as there is an intention to replant the forest since it is only a "temporary" release.[124] Furthermore, the Kyoto Protocol forest definition does not account for the emissions from clearcutting of trees not classified as forest, regardless of whether there was an intention to replant the trees.[125] The Kyoto Protocol forest definition creates this "in or out" distinction for a tree,[126] which would not be a concern under the more expansive REALU with AFOLU accounting.[127]

Another issue created by distinguishing among trees is that of leakage.[128] To avoid leakage, forest B's emissions should not increase as a result of a REDD program decreasing forest A's emissions.[129] However, by only counting forests, a REDD program that decreases forest A's emissions may result in an emissions increase from the non-forest area C of woody vegetation or wetlands.[130] Technically, there is leakage, since the increase in emissions from area C negated the decrease in emissions from forest A.[131] Yet under REDD, which only pertains to forests, there is no leakage.[132] REALU, by applying a more expansive landscape accounting, AFOLU, would recognize the leakage coming from area C, since AFOLU encompasses sequestered carbon areas above and below ground, forested and non-forested.[133]

Reduction of forest emissions is necessary, as emissions from deforestation and forest degradation account for nearly twenty percent of total greenhouse gas emissions.[134] But it is also evident that the current attempts with RED, REDD, and REDD+ still falter in many areas because of the forest definition.[135] Emissions and leakages pertaining to wetlands, agriculture, and other land uses are not accounted for in forestry schemes.[136] Thus, the deficiency that stems from the definition of forests impacts the other accounting elements of REDD, additionality and leakage, which subsequently impacts measurement and verification.[137]

REALU with AFOLU captures all of the sectors, which is more effective and efficient[138] while also being more equitable since AFOLU accounting standards would apply to all countries. REALU and AFOLU sectors include high forest cover and low rates of deforestation ("HFLD")[139] and low forest cover and low rates of deforestation ("LFLD").[140] A phased implementation of biological sequestration starting with REDD that recognizes indigenous peoples' rights, as established in COP-16,[141] and that transitions to REALU with AFOLU accounting, would prevent a delay in emission mitigation from the forestry sector while also allowing the necessary time for the development and refinement of REALU with AFOLU.[142] A REALU scheme with AFOLU may not address all of the biological sequestration issues, but it would alleviate many of the problems with the current efforts to mitigate forestry emissions under REDD.[143]

Wetlands: An Example of Biological Carbon Sequestration Within REALU but Excluded by REDD Type Schemes

Wetlands include freshwater mineral-soil wetlands, peatlands, and estuarine wetlands (i.e. salt marshes) and in North America, they are the second largest natural carbon sink.[144] Worldwide wetlands store about 223 billion tons of carbon.[145] Although wetlands absorb about one-tenth of the amount of carbon as forests, wetlands absorb three times more than agricultural soils.[146]

While one-tenth might appear to be a small amount, wetlands currently only comprise 5.5% of the U.S. landmass because land use changes, such as agriculture, have led to the destruction of over fifty percent of wetlands.[147] In the United States, wetlands sequester thirty-five percent of the nation's total terrestrial carbon and further loss of the wetlands would result in the release of sequestered carbon, increasing the carbon concentration in the atmosphere.[148] The North American[149] estuarine wetland carbon sequestration is currently estimated at over ten million tons per year.[150] Collectively, North American wetlands have the ability to sequester forty-nine million tons of carbon per year.[151] It is important to recognize that although wetlands

only comprise 5.5% of the total landmass,[152] the total sequestered carbon stored in wetlands is sixty-four billion tons, only slightly less than forests, which store sixty-seven billion tons[153] in twenty-five percent more land.[154]

Wetlands are a much more effective natural carbon sink than forests. As peatlands are drained and converted from wetlands to other land uses, the carbon oxidizes, which reduces the carbon captured in wetlands by about fifteen million tons per year in North America.[155] The recognition of wetlands by the UNFCCC and payment for the service of carbon sequestration would help mitigate the destruction of wetlands through land use changes.[156]

Other Services: Expanding the Carbon Centric "Partial" Payment for Ecosystem Services to Recognize Co-Benefits

In addition to storing carbon, forests provide multiple ecosystem services such as soil formation,[157] water cycle storage and release,[158] biodiversity conservation,[159] and nutrient recycling.[160] However, forests under a REDD scheme are only recognized for one ecosystem service, carbon sequestration.[161] Although carbon sequestration is an important and necessary ecosystem service provided by forests, the current REDD scheme can and already has led to the deterioration of other forest ecosystem services.[162]

The other ecosystem services that are not internalized by REDD are not only valuable but also necessary for native forests to survive.[163] Although REDD is a PES, in its current insular form REDD should be viewed as a Partial PES.[164] In contrast, the recognition of and payment for CO_2 sequestration, soil formation, water cycle storage and release, biodiversity conservation, and nutrient recycling could be considered a Full PES.[165] By recognizing these other economic benefits, mitigation of the perverse incentives induced by REDD would be mitigated.[166] The numerous ailments of the Partial PES REDD are reviewed below and illustrate the need for the transition to a Full PES, such as REALU with AFOLU accounting, to protect the forests and other ecosystems.[167]

Soil Erosion: What Role Does Flora Coverage Play?

The first ecosystem service that REDD does not recognize is that provided by soil in reducing or preventing erosion. Erosion occurs when the energy from water or wind is transmitted to the soil, and it increases after a forest is deforested or temporarily unstocked.[168] When raindrops hit exposed soil, such as a deforested area, the particles of soil and water are launched into the air.[169] When the land is covered by biomass, such as a forest, it protects the land area by dissipating the wind and water energy, which results in reduced soil erosion.[170]

After erosion occurs, the quantity of water runoff on the area of land increases, which reduces the availability of water for plant vegetation to grow.[171] The rate of erosion is often high on lands with higher gradients, with sometimes half of the soil within the splash eroding.[172] Deforestation on higher gradient land is regularly used to replace spent agricultural land damaged by erosion.[173]

The eroded soil can end up in ecosystems such as streams and lakes.[174] The shape of the Araguaia River in Brazil has changed, as sedimentation increased by twenty-eight percent, and the river became straighter and deeper.[175] According to the U.S. Department of Agriculture, the final destination for sixty percent of soil erosion is streams.[176] The Huang He River in China, often referred to as the Yellow River because of the color of the silt, transports and deposits two billion tons of soil per year into the Gulf of Bohai.[177]

For a forested area to prevent soil erosion, the forest must cover a minimum of sixty percent of the land.[178] Without the flora that reduces the rain and wind energy,[179] soil erosion results in a decrease in plant nutrients, such as nitrogen, phosphorus, potassium, and calcium.[180] Without these vital nutrients, yields in plant growth decrease.[181] The eroded soil can contain as much as three times the nutrient content as the soil that remains.[182] Fertilizers and pesticides, derived from hydrocarbons, along with irrigation, are often used to temporarily mitigate the natural nutrient depletion from erosion on cropland.[183] Once the application of hydrocarbon-based fertilizers and pesticides become futile against the barren soil, the cropland is abandoned.[184] To replace this wasted land, additional forests are cleared for agricultural use and the cycle repeats.[185]

While at first glance it may appear that a REDD scheme would mitigate many of the above soil erosion issues, since people would be paid to reduce deforestation and forest degradation, if the scheme uses the term "temporarily unstocked" in the definition of forests as the Kyoto Protocol does, it actually facilitates soil erosion.[186] Since the Kyoto Protocol establishes no duration for a "temporarily unstocked" forest, but still classifies it as a forest, with enough time, the extent of soil erosion may have degraded the soil to the point of not allowing the land to be "restocked" with the forest that once existed.[187] Since erosion increases water runoff, the soil in the "temporarily unstocked" region will have less moisture because less water has infiltrated the land, resulting in a decrease in water-storage capacity of the soil.[188] Additionally, the erosion of the soil reduces organic nutrients and soil depth, which are necessary to restock the forest.[189] Restoration of the eroded soil is a slow process that can take between "200 and 1,000 years to form 2.5 cm (1 inch) of topsoil under cropland conditions, and even longer under pasture and forest conditions."[190]

Water Cycle: Does Variation in Root Depth Matter?

The second ecosystem service not recognized by REDD is the water cycle storage and release provided by the deep roots of forests. After a forest is removed as a result of deforestation, the flora that replaces the forest typically has shallower root structures and fewer leaves, which results in the new flora requiring less water than the forest.[191] The evaporation from the new flora is less than that from a forest because the new flora has shallower roots.[192] This decrease in evaporation reduces the quantity of water vapor returned to the atmosphere, resulting in more water runoff from the land and increasing stream flow.[193] Thus the shallower roots result in less water availability and

evapotranspiration during the dry season along with less precipitation during the wet season, all of which negatively impact the water cycle.[194]

The degree of impact on the water cycle depends on not only how the forested land is utilized after deforestation but also how much of the forest remains.[195] Deforestation of twenty percent or less will have little effect on the water cycle while deforestation of fifty to one hundred percent, which typically results from modern agricultural and heavy equipment use, can result in a large change in the quantity of water runoff.[196] In Brazil, the deforestation of about fifty percent of the Tocantins and Araguaia watersheds over the past fifty years has resulted in a twenty-five percent annual increase in river discharge.[197]

The decrease in evapotranspiration, because of the decrease in root depth,[198] impacts the heat flux, resulting in a decrease in the cooling of the surface soil, equating to higher surface temperatures, especially during the dry seasons.[199] The dry season is vital for reforestation efforts, but because of the impacts from deforestation, such as a decrease in evapotranspiration and an increase in surface temperature, there may be a water shortage.[200] This decrease in evapotranspiration can result in extended drought periods, thus slowing the uptake of the reforestation efforts and possibly making the habitat more hospitable for drought-resistant species.[201]

However, there is cause for concern if the project uses a definition for forests that permits them to be "temporarily unstocked."[202] Although the removal of the forest is not classified as deforestation, because there is an intention to restock the forest, the deep roots from the forest are "temporarily" killed.[203] Without deep roots, the evapotranspiration will decrease and the water runoff will increase.[204] This in turn makes reforestation efforts more difficult because the quantity of water stored in the soil has decreased[205] and the surface temperature has increased.[206] If schemes allow for forests to be temporarily unstocked they assume the replanting of the forest and that the restocking of the forest will negate the initial carbon release.[207] Nevertheless, this reasoning is myopic since successful restocking is dependent on the root growth, and reestablishment of deep roots will likely be more difficult because of longer dry periods that are "warmer, drier and more intense."[208]

Biodiversity: Does REDD's Focus on Carbon Concentration Create Perverse Incentives for Other Ecosystems?

The third ecosystem service that REDD does not internalize is biodiversity of fauna and flora that have a symbiotic relationship with the forest. Forests cover roughly seven percent of the Earth's dry land, yet they may contain half of the species on Earth.[209] Some species are so particular to their forest microhabitats that they live nowhere else, which increases the chances of their extinction.[210] After deforestation and loss of these specialized species, the surrounding fauna and flora may also face extinction as the biodiversity in the forest decreases and the habitat becomes fragmented.[211] In Riau, Indonesia, the tiger population actually declined at a quicker rate than the rate of deforestation because of habitat fragmentation.[212]

The fauna and flora also impact the soil composition.[213] Before deforestation, the forest soil is teeming with organic matter, possibly supporting up to one thousand species of fauna per square meter.[214] The bacteria and fungi in the soil can add an additional four to five thousand diverse species.[215] However, the lack of forest cover exposes the soil to erosion, washing the nutrients from the deforested land and further diminishing biodiversity, and potentially causes the surrounding ecosystem to collapse.[216]

Although initially it would appear as though REDD would complement efforts to protect biodiversity, low-biomass and high-diversity ecosystems, such as grasslands, savannas, woodlands, and transition forests, may be at a disadvantage for protection when compared to high-biomass forests, such as plantations.[217] This is because REDD focuses on the quantity of biological carbon sequestered and thus biomass that sequesters more carbon, i.e. high-biomass ecosystems, are more advantageous for REDD projects than ecosystems that store less carbon, i.e. low-biomass ecosystems.[218] This focus on carbon concentration in biomass results in a preference for high-biomass ecosystems even if the low-biomass ecosystem has a higher conservation value pertaining to biodiversity, soil, and water, since the focus of REDD is on biomass concentration and not biodiversity.[219] Thus, REDD programs will be more apt to protect high-biomass ecosystems because of the higher return on investment, which is based on carbon concentration, than that of a low-biomass high-diversity ecosystem, with the latter likely being more prone to conversion for agricultural use.[220]

Forests with high-diversity native ecosystems must also counter the introduction of alien species that grow quickly, such as monocrop eucalyptus plantations.[221] With REDD's focus on high-biomass because of carbon credits, trees that grow quickly, such as eucalyptus trees, are already encouraging some REDD projects to introduce these alien monocrop species.[222] In Brazil, in an effort to earn carbon credits, eucalyptus plantations, which are native to Australia, are replacing savannas and high-diversity cerrado woodland ecosystems.[223] However, these eucalyptus plantations, since they are non-native, often require fertilizers and pesticides, which increases the risk of chemical contamination and soil degradation.[224] Additionally, the definition of forests under the Kyoto Protocol makes no requirement that a temporarily unstocked forest be restocked with species native to that ecosystem.[225]

Furthermore, genetically modifying the non-native species to increase the chance of survival in the foreign habitat is another risk since species with increased resilience may overtake the native species.[226] These practices currently occur under REDD projects and is one of the perverse incentives induced by REDD since the accounting does not recognize a distinction between carbon stored in genetically modified species versus native species.[227] This deficiency in REDD is one of the reasons that organizations are proposing REALU with AFOLU accounting since

it does recognize the carbon sequestered in native species of the savannas and woodlands.[228]

The exclusion of ecosystems from the Kyoto Protocol separated biodiversity and ecosystems from carbon and climate change, and has resulted in the UNFCCC ignoring these synergies and placing biodiversity at risk.[229] This is unfortunate and inward-looking by the international community because only five years prior to the adoption of the Kyoto Protocol, the United Nations Conference on Environment and Development, more commonly known as the Earth Summit, in Rio de Janeiro in 1992[230] resulted in numerous important achievements, two of which were the Convention on Biological Diversity ("CBD")[231] and the Framework Convention on Climate Change ("UNFCCC"),[232] the latter of which lead to the Kyoto Protocol.[233]

Some might view the link between these two documents as only being intrinsic, but in 2001, the CBD's Subsidiary Body on Scientific, Technical and Technological Advice took "note of the discussion of the interlinkages between biological diversity and climate change."[234] Two years later, the Secretariat of the CBD released a formal report[235] and in 2008, COP-9 of the CBD recognized the possible use of REDD pertaining to climate change[236] but also the need to monitor "the threats and likely . . . impacts of climate change mitigation and adaptation activities on biodiversity."[237] In 2009, the Secretariat of the CBD released a second formal report and a year later at COP-10, the CBD recognized the need to "enhance the benefits for, and avoid negative impacts on, biodiversity from [REDD]."[238] Moreover the CBD stressed the need to consider "converting only land of low biodiversity value or ecosystems largely composed of non-native species, and preferably degraded ones" while also "avoiding [the use of] invasive alien species."[239]

Although the CBD has been proactive in recognizing the interlinkages between biological diversity and climate change, the UNFCCC is focused almost exclusively on the objective outlined in 1992—the adverse affect of anthropogenic climate change on natural ecosystems and humankind.[240] At COP-16, the AWG-LCA under the Convention indicated that actions should be "consistent with the conservation of natural forests and biological diversity" and that they should not be "used for the conversion of natural forests, but are instead used to incentivize the protection and conservation of natural forests and their ecosystem services, and to enhance other social and environmental benefits."[241] While the AWG-LCA document does mention biodiversity, the UNFCCC continues to be myopic in regards to biodiversity and makes no reference or granular distinction like the CBD's document between low- and high-biodiversity ecosystems or the risk of introducing alien species, such as eucalyptus trees.[242]

Conclusion

The accounting of REDD, which focuses on additionality, definitions of forests, leakage, measurement, verification, and permanence, while all important facets, is not actually the difficult part of implementing a successful REDD program.[243] These "difficult" facets are merely illusions that hide the true difficulties of REDD, the loopholes that REDD accounting are plagued with.[244] The lack of protection of other ecosystems and services beyond CO_2 sequestration, which REDD accounting externalizes instead of internalizes, facilitates the market's ability to exploit these loopholes, without regard to the externalities imposed on others.[245]

REDD accounting currently gives no regard and thus no value to soil formation, water cycle storage and release, or biodiversity conservation and nutrient recycling.[246] REDD simply facilitates the market determination of the price of carbon stored at the expense of these other ecosystems and services provided by nature.[247] Adam Smith's recognition of labor, land, and capital resulted in a more accurate valuation and pricing of these other ecosystems and services.[248] However, REDD in its current form classifies land as a subcategory of capital by disregarding these other ecosystem services.[249] Although a transition from REDD to REALU with AFOLU accounting may not mitigate all of REDD's externalities, it would help to elevate and start to recognize land as an equal with labor and capital.[250] Therefore, since REDD merely determines the price of carbon without valuing the other ecosystem services provided by forests, environmentalists, when sequestering and monetizing carbon, must not forget Oscar Wilde's definition of a cynic: "[a] man who knows the price of everything and the value of nothing."[251]

Endnotes: Is REDD Accounting Myopic?

1 *See* Oscar Wilde, Lady Windermere's Fan, A Play About a Good Woman, Act III (1892) ("LORD DARLINGTON. What cynics you fellows are! CECIL GRAHAM. What is a cynic? [Sitting on the back of the sofa.] LORD DARLINGTON. A man who knows the price of everything and the value of nothing. CECIL GRAHAM. And a sentimentalist, my dear Darlington, is a man who sees an absurd value in everything, and doesn't know the market price of any single thing.").

2 *Id*.

3 *See* Adam Smith, The Wealth of Nations, An Inquiry into the Nature and Causes of the Wealth of Nations 70-75 (1822) (listing the "component parts of price" — land, labor, and capital stock).

4 Thorstein Veblen, Preconceptions of Economic Science 58 (1990) (introducing the term "neoclassical economics").

5 *See* Paul Samuelson & William Nordhaus, Economics (back of front cover) (1948) (introducing the term "mainstream economics").

6 Murray N. Rothbard, *Free Market*, The Concise Encyclopedia of Economics (2008), http://www.econlib.org/library/Enc/FreeMarket.html.

7 Jim Pipe, Earth's Ecosystems 4 (2008).

8 *See* James Boyd et al., Resources for the Future, What Are Ecosystem Services? The Need for Standardized Environmental Accounting Units 1 (2006), http://www.rff.org/Documents/RFF-DP-06-02.pdf (defining ecosystem services as "the benefits of nature to households, communities, and economies").

9 *Compare* Smith, *supra* note 3, at 70-75 (listing the "component parts of price" – land, labor, and capital stock) *with* Merton H. Miller, Macroeconomics: A Neoclassical Introduction 19 (1986) ("The neoclassical growth model . . . take[s] human labor as one of two inputs . . . [t]he second factor of production, however, is no longer land but capital . . . .").

Endnotes: Is REDD Accounting Myopic? *continued on page 78*

[10] *See generally* UN-REDD PROGRAMME, http://www.un-redd.org (last visited Jan. 3, 2011).
[11] *About REDD+*, UN-REDD PROGRAMME, http://www.un-redd.org/AboutREDD/tabid/582/Default.aspx (last visited on Dec. 30, 2010).
[12] MILLER, *supra* note 9.
[13] *Market Failures and Externalities*, BASIC ECONOMICS, http://www.basiceconomics.info/market-failures-and-externalities.php (last visited Feb. 10, 2011) (defining an externality, which can either be positive or negative, as the action of one economic agent impacting another economic agent not directly involved, such as pollution, which is as an example of a negative externality); Franz Gatzweiler, Economic Values, Institutions and Ecosystems–The Shift from Natural to Social Value and Why Culture Matters (2003) (unpublished manuscript), http://www.indiana.edu/~workshop/colloquia/materials/papers/gatzweiler_paper.pdf (explaining the issues of applying market based valuation techniques to ecosystems).
[14] *See Environmental Pricing Reform*, EIONET–THE EUROPEAN TOPIC CTR. ON SUSTAINABLE CONSUMPTION & PRODUCTION, http://scp.eionet.europa.eu/definitions/Environmental%20pricing%20reform (last updated Dec. 8, 2009) (defining environmental pricing reform ("EPR") as "the process of adjusting market prices to include environmental costs and benefits").
[15] Crystal Davis, *Protecting Forests to Save the Climate: REDD Challenges and Opportunities*, WORLD RESOURCES INST. (Apr. 23, 2008, 3:12 PM), http://earthtrends.wri.org/updates/node/303.
[16] *See* David Pimentel et al., *Environmental and Economic Cost of Soil Erosion and Conservation Benefits*, 267 SCIENCE 1117, 1117 (1995), http://www.sciencemag.org/content/267/5201/1117.abstract (explaining how forests mitigate soil erosion); MICHAEL T. COE ET AL., ECOLOGICAL CO-BENEFITS: PAN-AMAZON DEFORESTATION, REGIONAL CLIMATE, AND WATER RESOURCES, THE WOODS HOLE RESEARCH CENTER 1 (2009), http://www.whrc.org/policy/pdf/cop15/Coe_A80.pdf (describing how a forest requires more water than the flora that replaces it and thus the water cycle decreases); Rebecca Lindsey, *Tropical Deforestation*, EARTH OBSERVATORY (2007), http://earthobservatory.nasa.gov/Features/Deforestation/ (noting that although forests cover roughly seven percent of the Earth's dry land, they may contain half of the species on Earth).
[17] *See, e.g.*, Pimentel et al., *supra* note 16; COE ET AL., *supra* note 16; Lindsey, *supra* note 16 (illustrating how the current REDD program does not recognize soil formation, water cycle storage and release, biodiversity conservation, or nutrient recycling).
[18] *See* Lynn Scarlett, *Cleaner, Safer, Cheaper*, 27 ENVT'L. FORUM 34 (2010) ("the City of New York invested over $1.5 billion to protect and restore the Catskill Mountain watershed to sustain the city's water quality, rather than spending up to $9 billion on filtration plants").
[19] *See* José Maria Cardoso Da Silva et al., *The Fate of the Amazonian Areas of Endemism*, 19 CONSERVATION BIOLOGY 689, 690 (2005) ("Amazonia is the largest and most diverse of the tropical forest wilderness areas . . . recent compilations indicate at least 40,000 plant species, 427 mammals, 1,294 birds, 378 reptiles, 427 amphibians, and around 3,000 fishes.").
[20] *See* COMM'N ON GENETIC RES. FOR FOOD & AGRIC., FOOD & AGRICULTURE ORG. OF THE UNITED NATIONS, FOREST GENETIC RESOURCES–BRINGING SOLUTIONS TO SUSTAINABLE FOREST MANAGEMENT (2009), http://www.fao.org/docrep/012/al387e/al387e00.pdf ("[T]he vast majority of forest genetic diversity remains unknown, especially in tropical forests. Estimates of the number of tree species vary from 80,000 to 100,000, yet fewer than 500 have been studied in any depth for their present and future potential.").
[21] Pimentel et al., *supra* note 16, at 1119.
[22] *See id.* at 1118; Peter M. Vitousek, *Nutrient Cycling in Moist Tropical Forest*, 17 ANN. REV. OF ECOLOGY & SYSTEMATICS, 137, 160 (1986), http://www.jstor.org/stable/pdfplus/2096992.pdf (noting that "[m]oderately fertile soils support productive forests that cycle large quantities of nutrient elements").
[23] The International Union for Conservation of Nature, *Forest Environmental Services*, THE ENCYCLOPEDIA OF EARTH (Aug. 22, 2008, 3:09 AM), http://www.eoearth.org/article/Forest_environmental_services.
[24] *Id*.
[25] *See id*. (providing different policy recommendations and concerns).
[26] *See id*. (concluding that REDD's negative externalities—including threats to soil formation, water cycle storage and release, biodiversity conservation, and nutrient recycling—must be internalized).
[27] *See* JAMES LOVELOCK, GAIA: A NEW LOOK AT LIFE ON EARTH 10 (2000) (defining homeostasis (Gaia hypothesis) as, "a complex entity involving the Earth's biosphere, atmosphere, oceans, and soil; the totality constituting a feedback or cybernetic system which seeks an optimal physical and chemical environment for life on this planet").
[28] *Market Failures and Externalities*, *supra* note 13.
[29] *Environmental Pricing Reform*, *supra* note 14. Sven Wunder, Principal Scientist, Forests and Livelihoods Program at the Center for International Forestry Research ("CIFOR"), has put forward a widely accepted definition for PES. *See, e.g.*, Douglas Southgate & Sven Wunder, *Paying for Watershed Services in Latin America: A Review of Current Initiatives*, 28 J. OF SUSTAINABLE FORESTRY 497, 498 (2009) (describing PES in terms of five characteristics: "[1.] There is a well-defined environmental service (e.g., specific changes in peak- or dry-season stream flow at the outlet of a watershed) or a suitable proxy for this service (e.g., [hectares] reforested). [2.] There is at least one buyer of this service or proxy. [3.] There is at least one seller as well. [4.] Transactions between buyer(s) and seller(s) are voluntary. [5.] Payments are conditional on contracted environmental services or proxies for same actually being supplied.").
[30] *See generally* Southgate & Wunder, *supra* note 29, at 497.
[31] *About REDD+*, *supra* note 11.
[32] Lindsey, *supra* note 16.
[33] FOREST TRENDS, THE KATOOMBA GROUP, & UNEP, PAYMENTS FOR ECOSYSTEM SERVICES: GETTING STARTED A PRIMER 3 (2008), http://www.katoombagroup.org/documents/publications/GettingStarted.pdf.
[34] *See id*.
[35] *Id*.
[36] *See id*.
[37] *See* GLOBAL FOREST RESOURCES ASSESSMENT, FOOD & AGRIC. ORG. OF THE UNITED NATIONS 19 (2005), ftp://ftp.fao.org/docrep/fao/008/A0400E/A0400E00.pdf.
[38] *See The World Factbook: Greece*, CENT. INTELLIGENCE AGENCY, https://www.cia.gov/library/publications/the-world-factbook/geos/gr.html (last visited Nov. 5, 2010).
[39] *See State & County QuickFacts of New York*, U.S. CENSUS BUREAU, http://quickfacts.census.gov/qfd/states/36000.html (last updated Nov. 4, 2010).
[40] *See* GERT JAN NABUURS ET AL., FORESTRY IN CLIMATE CHANGE 2007: MITIGATION, IPCC FOURTH ASSESSMENT REPORT 546 (2007), http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter9.pdf.
[41] *See About REDD+, supra* note 11.
[42] *See* CHARLIE PARKER ET AL., THE LITTLE REDD+ BOOK, LIST OF PROPOSALS 1 (2009), http://www.globalcanopy.org/themedia/file/PDFs/LRB_lowres/lrb_en.pdf (proving a list–Countries: Alliance of Small Island States (AOSIS); Australia; Brazil; Canada; Coalition for Rainforest Nations (CfRN); China; Colombia; Central African Forest Commission (COMIFAC); European Union (EU); India; Indonesia; Japan; Malaysia; Mexico; New Zealand; Norway; Panama; Tuvalu; USU; and Organizations: CATIE (Nested Approach); CCAP (Dual Markets); CSERGE (Combined Incentives); EDF & IPAM & ISA (Compensated Reductions); Greenpeace (TDERM); HSI (Carbon Stores); IDDRI & CERDI (Compensated Successful Efforts); IIASA Avoiding REDD Hot Air; Joanneum Research (Corridor Approach); JRC (Incentive Accounting); TCG

(Terrestrial Carbon); TNC (Integrated Incentives); WHRC (Stock-Flow with Targets)).

[43] *See id*. at 20.

[44] *See id*. at 26-27.

[45] *See* Kyoto Protocol to the United Nations Framework Convention on Climate Change, Annex A, Dec. 10, 1997, 37 I.L.M. 22 [hereinafter Kyoto Protocol] http://unfccc.int/resource/docs/convkp/kpeng.pdf.

[46] *See id.* at art. 3(3) ("The net changes in greenhouse gas emissions by sources and removals by sinks resulting from direct human-induced land-use change and forestry activities, limited to afforestation, reforestation and deforestation . . . .").

[47] *See id.* at art. 3(4) ("The Conference of the Parties serving as the meeting of the Parties to this Protocol shall, at its first session or as soon as practicable thereafter, decide upon modalities, rules and guidelines as to how, and which, additional human-induced activities related to changes in greenhouse gas emissions by sources and removals by sinks in the agricultural soils and the land-use change and forestry categories shall be added to, or subtracted from, the assigned amounts for Parties included in Annex I . . . .").

[48] *See* Conference of the Parties to the Kyoto Protocol, Buenos Aires, Arg., Nov. 2-14, 1998, Report of the Conference of the Parties on its Fourth Session, Decision 9/CP.4, U.N. Doc FCCC/CP/1998/16/Add.1 (Jan. 25, 1999), http://unfccc.int/resource/docs/cop4/16a01.pdf (addressing LULUCF specifically).

[49] *See* Conference of the Parties to the Kyoto Protocol, The Hague, Neth., Nov. 13-25, 2000, *Report of the Conference of the Parties on the First Part of its Sixth Session*, Decision 1/CP.6 Annex, Note by the President of the Conference of the Parties at its sixth session, Box C, U.N. Doc FCCC/CP/2000/5/Add.2 (Apr. 4, 2001) [hereinafter COP-6], http://unfccc.int/resource/docs/cop6/05a02.pdf ("Parties decide that for defining afforestation, reforestation and deforestation [forestry activities] the set of IPCC definitions shall be applied.").

[50] *See id*. at Decision 1/CP.6 Box C. Land-use, Land-use change and forestry ("Parties agree that for the implementation of Article 3.3 [of the Kyoto Protocol], 'forest' is defined in accordance with the FAO definition."); *see also The Forest Resources Assessment Programme*, Food & Agric. Org. of the United Nations, http://www.fao.org/docrep/007/ae217e/ae217e00.htm (last visited Feb. 3, 2010) (defining forests as "Land with tree crown cover (or equivalent stocking level) of more than 10 percent and area of more than 0.5 hectares (ha). The trees should be able to reach a minimum height of 5 meters (m) at maturity in situ. May consist either of closed forest formations where trees of various stories and undergrowth cover a high proportion of the ground; or open forest formations with a continuous vegetation cover in which tree crown cover exceeds 10 percent. Young natural stands and all plantations established for forestry purposes which have yet to reach a crown density of 10 percent or tree height of 5 m are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention or natural causes but which are expected to revert to forest.").

[51] *See* Conference of the Parties to the Kyoto Protocol, Marrakesh, Morocco, Oct. 29-Nov. 10, 2001, *Report of the Conference of the Parties on its Seventh Session*, Decision 11/CP.7 Annex, P 1(b)-(c), U.N. Doc FCCC/CP/2001/13/Add.1 (Jan. 21, 2002) [hereinafter COP-7 Report–Part Two (Volume I)] http://unfccc.int/resource/docs/cop7/13a01.pdf; *see also* Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol, Montreal, Can., Nov. 28-Dec. 10, 2005, *Report of the Conference of the Parties Serving as the Meeting of the Parties to the Kyoto Protocol on its First Session*, Decision 16/CMP.1 Annex, P 6, U.N. Doc FCCC/KP/CMP/2005/8/Add.3 (Mar. 30, 2006) [hereinafter COP/MOP-1 Report-Part Two] http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf.

[52] Conference of the Parties to the Kyoto Protocol, Bali, Indon., Dec. 3-15, 2007, *Report of the Conference of the Parties on its Thirteenth Session*, Decision 2/CP.13, U.N Doc. FCCC/CP/2007/6/Add.1 (Mar. 14, 2008) [hereinafter COP-13 Addendum-Two] http://unfccc.int/resource/docs/2007/cop13/eng/06a01.pdf.

[53] *See id*. at 1/CP.13 1(b)(iii).

[54] *See* John M. Broder & Elisabeth Rosenthal, *U.N. Official Says Climate Deal is at Risk*, N.Y. Times (Jan. 20, 2010), http://www.nytimes.com/2010/01/21/science/earth/21climate.html.

[55] United Nations Framework Convention on Climate Change, 15th Conference of the Parties, Copenhagen, Den., Dec. 7-19, 2009, *Copenhagen Accord*, 2/CP.15.6, *in Addendum, Part Two: Action Taken*, U.N. Doc. FCCC/CP/2009/11/Add.1 (Mar. 30, 2010) [hereinafter COP-15 Addendum-Two] http://unfccc.int/resource/docs/2009/cop15/eng/11a01.pdf.

[56] The Copenhagen Accord also provided "new and additional resources . . . approaching USD 30 billion" during 2010 to 2012 on climate change mitigation approaches including REDD+ programs. *See* COP-15 Addendum-Two, *supra* note 55, at 2/CP.15.6, 2/CP.15.8. During COP-15, REDD was discussed in two bodies, SBSTA-31 and AWG-LCA-8. The REDD text recognized by the Copenhagen Accord was from the SBSTA-31, which produced draft text on the methodological issues of REDD. However, the Copenhagen Accord did not include the AWG-LCA-8 draft text on policy approaches and positive incentives of REDD. *See, e.g.*, United Nations Framework Convention on Climate Change, 15th Conference of the Parties, Copenhagen, Den., Dec. 7-19, 2009, *Methodological Guidance for Activities Relating to Reducing Emissions from Deforestation and Forest Degradation and the Role of Conservation, Sustainable Management of Forests and Enhancement of Forest Carbon Stocks in Developing Countries, Subsidiary Body for Scientific and Technological Advice*, Draft decision -/CP.15 (Advanced unedited version), http://unfccc.int/files/na/application/pdf/cop15_ddc_auv.pdf (illustrating the SBSTA draft text that would be incorporated into the Copenhagen Accord); United Nations Framework Convention on Climate Change, 15th Conference of the Parties, Copenhagen, Den., Dec. 7-19, 2009, *Policy Approaches and Positive Incentives on Issues Relating to Reducing Emissions from Deforestation and Forest Degradation in Developing Countries; and the Role of Conservation, Sustainable Management of Forests and Enhancement of Forest Carbon Stocks in Developing Countries, Ad Hoc Working Group On Long-Term Cooperative Action Under The Convention, Eighth session*, Draft decision -/CP.15, U.N. Doc. FCCC/AWGLCA/2009/L.7/Add.6 (Dec. 15, 2009) http://unfccc.int/resource/docs/2009/awglca8/eng/l07a06.pdf (illustrating the deficiencies in the AWG-LCA, which does not implement (1) target measures to stop deforestation, (2) long-term finance commitments, (3) strong safeguards, (4) strong mitigation tools to prevent leakage, or (5) discuss free, prior and informed consent by indigenous peoples); COP-15 Addendum-Two, *supra* note 55 (illustrating the incorporation of the SBSTA draft text but lack of incorporation of the AWG-LCA draft text into the Copenhagen Accord).

The concern over these deficiencies were reinforced when over twenty thousand people and one hundred twenty-five countries attended The World People's Conference on Climate Change and the Rights of Mother Earth hosted by the government of Bolivia in April 2010. *See* Andres Schipani, *Evo Morales' Message to Grassroots Climate Talks – Planet or Death*, Guardian (Apr. 21, 2010, 16:19 BST), http://www.guardian.co.uk/environment/2010/apr/21/evo-morales-grassroots-climate-talks. The World People's Conference voiced ardent concern over the developments occurring under the UNFCCC generally, the definition of forests, and the progression of the market based REDD program. *See, e.g.*, World People's Conference on Climate Change and the Rights of Mother Earth, Cochabamba, Bol., Apr. 22, 2010, Proposal Universal Declaration of the Rights of Mother Earth, art. 3(2)(i) (2010), http://pwccc.wordpress.com/programa/ ("(2) Human beings, all States, and all public and private institutions must: (i) establish precautionary and restrictive measures to prevent human activities from causing species extinction, the destruction of ecosystems or the disruption of ecological cycles"); *see also* World People's Conference on Climate Change and the Rights of Mother Earth, Cochabamba, Bol., Apr. 22, 2010, Peoples Agreement (2010) http://pwccc.wordpress.com/support/ ("The definition of forests used in the negotiations of the United Nations Framework Convention on Climate Change, which includes plantations, is unacceptable. Monoculture plantations are not forests. Therefore, we require a definition for negotiation purposes that recognizes the native forests, jungles and the diverse ecosystems on Earth." "We condemn market mechanisms such as REDD (Reducing Emissions from Deforestation and Forest Degradation) and its versions + and + +, which are violating the sovereignty of peoples and their right to prior free and informed consent as well as the sovereignty of national States, the customs of Peoples, and the Rights of Nature.").

[57] *See* Conference of the Parties to the Kyoto Protocol, Advance Unedited Version, Draft decision -/CP.16 Outcome of the Work of the Ad Hoc Working Group on Long-Term Cooperative Action Under the Convention, III.C. [hereinafter COP-16 AWG-LCA] http://unfccc.int/files/meetings/cop_16/application/pdf/cop16_lca.pdf.

[58] *Id*.

[59] *Id*. at III.C.70.

[60] *See id*. at III.C.71(a).

[61] *Id*. at III.C.71(c).

[62] *Id*. at III.C.72.

[63] *See id.* at III.C.

[64] *See* Richard Betts et al., Forests and Emissions: A Contribution to the Eliasch Review 4 (2008) http://www.ibcperu.org/doc/isis/11467.pdf (indicating

that there are uncertainties in both the estimated rate of deforestation and with forest carbon stocks).

[65] *See* Parker et al., *supra* note 42, at 21.

[66] *See* R. DeFries et al., Tropical Deforestation and Climate Change: Chapter Three Monitoring Tropical Deforestation for Emerging Carbon Markets 35 (Paulo Moutinho & Stephan Schwartzman eds., 2005), http://www.edf.org/documents/4930_TropicalDeforestation_and_ClimateChange.pdf.

[67] *See* U.S. Gov't. Accountability Office, Carbon Offsets: The U.S. Voluntary Market is Growing, but Quality Assurance Poses Challenges for Market Participants 2-3 (2008), http://www.gao.gov/new.items/d081048.pdf (reviewing the issues of additional, measurement, verification, and permanence); *see also* Jonathan L. Ramseur, Cong. Research Serv., CRS Report for Congress–The Role of Offsets in a Greenhouse Gas Emissions Cap-and-Trade Program: Potential Benefits and Concerns 21 (2008), http://www.nationalaglawcenter.org/assets/crs/RL34436.pdf (discussing the issue of leakage).

[68] *See id*.

[69] Jason Schwartz, Note, *"Whose Woods These Are I Think I Know": How Kyoto May Change Who Controls Biodiversity*, 14 N.Y.U. Envtl. L.J. 421, 426 (2006).

[70] *See* Parker et al., *supra* note 42, at 21.

[71] *See id.*

[72] *See* U.S. Gov't. Accountability Office, *supra* note 67, at 6-7.

[73] Nat'l Comm'n on Energy Policy, Bipartisan Policy Ctr., Forging the Climate Consensus: Domestic and International Offsets 6 (2009), http://www.bipartisanpolicy.org/sites/default/files/NCEP%20Domestic%20and%20International%20Offsetsformatted.pdf.

[74] Kyoto Protocol, *supra* note 45, at art. 3(3).

[75] *See generally id.*

[76] *See* Intergovernmental Panel on Climate Change, IPCC Special Report: Land Use, Land-Use Change, and Forestry: Summary for Policymakers, vii (2000), [hereinafter IPCC LULUCF Special Report] http://www.ipcc.ch/pdf/special-reports/spm/srl-en.pdf.

[77] *Id*. ¶ 16.

[78] *See* Conference of the Parties to the Kyoto Protocol, Ninth Session, Milan, Italy, Dec. 1-12, 2003, Report of the Conference of the Parties on its Ninth Session, ¶ 8, Decision 19/CP.9, U.N. Doc FCCC/CP/2003/6/Add.2 (Mar. 30, 2004) [hereinafter COP-9 Report, Part Two], http://unfccc.int/resource/docs/cop9/06a02.pdf.

[79] Till Neef et al., *Choosing a Forest Definition for the Clean Development Mechanism* 6-7 (Food & Agric. Org. of the United Nations, Forests and Climate Change Working Paper No. 4, 2006), http://www.fao.org/forestry/11280-03f2112412b94f8ca5f9797c7558e9bc.pdf.

[80] *Id*. at 3.

[81] *See id*. at 5-6 (noting the variances in forest definitions among countries).

[82] Kyoto Protocol, *supra* note 45, at art. 12.

[83] U.S. Gov't. Accountability Office, *supra* note 67, at 35.

[84] Office of Air and Radiation, U.S. Envtl. Prot. Agency, Tools of the Trade: A Guide to Designing and Operating a Cap and Trade Program for Pollution Control, Glossary-3 (2003), http://www.epa.gov/airmarkt/resource/docs/tools.pdf.

[85] Ramseur, *supra* note 67, at 21.

[86] Office of Air and Radiation, *supra* note 84, at 3.

[87] *See* COP-9 Report, Part Two, *supra* note 78, at -/CMP.1 Annex A.1.(e) (defining leakage as "the increase in greenhouse gas emissions by sources which occurs outside the boundary of an afforestation or reforestation project activity under the CDM which is measurable and attributable to the afforestation or reforestation project activity").

[88] DeFries et al., *supra* note 66, at 35.

[89] *Carbon Sequestration in Agriculture and Forestry Frequent Questions*, U.S. Envtl. Prot. Agency, http://www.epa.gov/sequestration/faq.html (last updated Jun. 22, 2010).

[90] *Id*.

[91] *See id*. (explaining how when trees reach maturity they are also saturated at which point the tree must be maintained to maintain the saturation and thus prevent the sequestered carbon from reentering the atmosphere).

[92] Ramseur, *supra* note 67, at 20.

[93] *See* Marcio Santilli et al., *Tropical Deforestation and the Kyoto Protocol: An Editorial Essay*, *in* Tropical Deforestation and Climate Change 47, 50 (Paulo Moutinho & Stephan Schwartzman eds., 2005).

[94] Office of Air and Radiation, *supra* note 84, at 3.

[95] Roger A. Sedjo & Brent Sohngen, *Carbon Credits for Avoided Deforestation* 6 (Resources for the Future, Discussion Paper, 2007), http://www.rff.org/rff/Documents/RFF-DP-07-47.pdf.

[96] Cong. Budget Office, The Potential for Carbon Sequestration in the United States 2 (2007), http://www.cbo.gov/ftpdocs/86xx/doc8624/09-12-CarbonSequestration.pdf.

[97] Kyoto Protocol, *supra* note 45, at art. 3(3), 3(4).

[98] COP-6, *supra* note 49. *See also* Lavanya Rajamani, *Re-Negotiating Kyoto: A Review of the Sixth Conference of the Parties to the Framework Convention on Climate Change*, 12 Colo. J. Int'l Envtl. L. & Pol'y 201, 223 (2001) ("At COP-6, the Umbrella Group argued in favor of including additional activities in the first commitment period. However, the [Alliance of Small Island States] (AOSIS) and the European Union (EU) opposed it.").

[99] COP-7 Report–Part Two (Volume I), *supra* note 51.

[100] COP-13 Addendum-Two, *supra* note 52, at 2/CP.13.11.

[101] COP-15 Addendum-Two, *supra* note 55, at 4/CP.15.6.

[102] COP-16 AWG-LCA, *supra* note 57, at III.C.

[103] *See* COP-13 Addendum-Two, *supra* note 52, at 1/CP.13, ¶ 1(b)(iii) ("Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries"); COP-15 Addendum-Two, *supra* note 55, at 4/CP.15 ("We recognize the crucial role of reducing emission from deforestation and forest degradation and the need to enhance removals of greenhouse gas emission by forests and agree on the need to provide positive incentives to such actions through the immediate establishment of a mechanism including REDD-plus, to enable the mobilization of financial resources from developed countries."); COP-16 AWG-LCA, *supra* note 57, at III.C (noting the inclusion of the role of conservation and sustainable management of forests with REDD+).

[104] Simon Eggleston & Nalin Srivastava, IPCC National Greenhouse Gas Inventory Programme, AFOLU in the IPCC 2006 Guidelines (2008), http://www.ipcc-nggip.iges.or.jp/presentation/LULUCF-AFOLU.pdf.

[105] *Revised 1996 Guidelines for National Greenhouse Gas Inventories*, Intergovernmental Panel on Climate Change (1997).

[106] *See generally Good Practice Guidance for Land Use, Land-Use Change and Forestry*, Intergovernmental Panel on Climate Change, http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf_contents.html (last visited Feb. 4, 2011).

[107] *See generally 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4 Agriculture, Forestry and Other Land Use*, Intergovernmental Panel on Climate Change, http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html (last visited Feb. 4, 2011).

[108] Good Practice Guidance for Land Use, Land-Use Change and Forestry, *supra* note 106.

[109] *About REDD+*, *supra* note 11.

[110] *See* Meine van Noordwijk et al., *Reducing Emissions from All Land Uses (REALU): The Case for a Whole Landscape Approach,* ASB PolicyBrief 13, (ASB Partnership for the Tropical Forest Margins, Nairobi), 2009, at 2, http://www.asb.cgiar.org/pdfwebdocs/ASBPB13.pdf (defining the following "RED: Reducing emissions from (gross) deforestation; only changes from 'forest' to 'non-forest' land cover types are included, and details depend very much on the operational definition of 'forest.' REDD: RED and (forest) degradation, or the shifts to lower carbon stock densities within the forest; details depend very much on the operational definition of 'forest'. REDD+: REDD and restocking within and towards 'forest' (as specified in the Bali Action Plan); in some versions REDD+ will also include peatlands, regardless of their forest status; details still depend on the operational definition of 'forest'" and defining REALU which "includes REDD+ and all transitions in land cover that affect carbon storage, whether peatland or mineral soil, trees-outside-forest, agroforests, plantations or natural forests. It does not depend on the operation definition of 'forest.'").

[111] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, *supra* note 107, at 1.5.

[112] van Noordwijk et al., *supra* note 110, at 2.

[113] *See* Nophea Sasaki, *What are REDD, REDD+ and REDD++?*, http://nopheasasaki.net/papers/2010/nopheasasaki_REDD.pdf ("REDD++: This is to prevent the conversion of low-carbon but high biodiversity forest lands (reaching minimum threshold of forest definition) for intensive agricultural cultivation or other short-term benefit practices when high carbon-stock forests are guarded for REDD+ benefits.").

[114] *REALU: Reducing Emissions from All Land Uses*, ASB, http://asb.cgiar.org/content/realu-reducing-emissions-all-land-uses (last visited Jan. 3, 2011); *Reducing Emissions from All Land Uses (REALU)*, World Agroforestry Ctr., http://www.worldagroforestry.org/sea/vn/node/109 (last visited Jan. 3, 2011).

[115] Neef et al., *supra* note 79, at 6; COP-9 Report-Part Two, *supra* note 78, at 19/CP.9 Annex F. Participation requirements, ¶ 8.

[116] *See* COP-9 Report-Part Two, *supra* note 78, at 19/CP.9 Annex F. Participation requirements, ¶ 8 (providing a flexible definition of forest: flexibility on a forest definition with (a) minimum tree crown cover between 10 and 30 percent; (b) minimum land area between 0.05 and 1 hectare; and (c) minimum tree height value between 2 and 5 meters).
[117] Neef et al., *supra* note 79, at 3.
[118] IPCC LULUCF Special Report, *supra* note 76, at 5.
[119] Sinks Table Options Paper: Land-Use, Land-Use Change and Forestry in Canada and the Kyoto Protocol, Env't Can. 127 (1999) http://dsp-psd.pwgsc.gc.ca/Collection/M22-132-13-1999E.pdf.
[120] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, *supra* note 107, at 1.5.
[121] COP/MOP-1 Report-Part Two, *supra* note 51, at Decision 16/CMP.1 Annex Definitions A(1)(a).
[122] *Id.*
[123] *See* Jean-Paul Lanly, *Deforestation And Forest Degradation Factors* (2003), www.fao.org/docrep/article/wfc/xii/ms12a-e.htm ("There is no deforestation if the clearfelling is done on an area that is meant to be maintained as a forest (as in the case of 'temporarily unstocked' forests); deforestation on the other hand does exist–and this is actually the point of view of forest management–when the forest in question is cleared in order to be cultivated or abandoned for a long time, and if its regeneration cannot take place before several decades have passed.").
[124] COP/MOP-1 Report-Part Two, *supra* note 51, at Decision 16/CMP.1 Annex Definitions A(1)(a).
[125] *See generally* Kyoto Protocol, *supra* note 45.
[126] COP-6, *supra* note 49, at Decision 1/CP.6 Box C. Land-use, Land-use Change and Forestry ("Parties agree that for the implementation of Article 3.3 [of the Kyoto Protocol], 'forest' is defined in accordance with the FAO definition.").
[127] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, *supra* note 107, at 1.5.
[128] Office of Air & Radiation, *supra* note 84, at 3.
[129] *Id.*
[130] *About REDD+, supra* note 11.
[131] COP-9 Report-Part Two, *supra* note 78, at -/CMP.1 Annex A.1.(e) (defining leakage).
[132] Good Practice Guidance for Land Use, Land-Use Change and Forestry, *supra* note 106, at 14.
[133] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, *supra* note 107, at 1.5.
[134] *About REDD+, supra* note 11.
[135] COP-6, *supra* note 49, at Decision 1/CP.6 Box C. Land-use, Land-use Change and Forestry.
[136] *Id.*
[137] *See* Parker et al., *supra* note 42, at 21; Office of Air & Radiation, *supra* note 84, at 2-8; Carbon Sequestration in Agriculture and Forestry Frequent Questions, *supra* note 89.
[138] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, *supra* note 107, at 1.5.
[139] *See* Parker et al., *supra* note 42, at 113 (classifying the following countries as having high forest cover and low rates of deforestation ("HFLD"): Belize, French Guiana, Gabon, Guyana, Peru, and Suriname).
[140] *See id.* (classifying the following countries as having low forest cover and low rates of deforestation ("LFLD"): Angola, Central African, Costa Rica, Cote d'Ivoire, Cuba, Dominican, Ethiopia, Guinea, Guinea-Bissau, Haiti, India, Kenya, Laos, Madagascar, Mozambique, Nigeria, Philippines, Senegal, Sierra Leone, Sri Lanka, Tanzania, Thailand, Uganda, and Vietnam).
[141] COP-16 AWG-LCA, *supra* note 57, at III.C.72.
[142] 2006 IPCC Guidelines for National Greenhouse Gas Inventories, *supra* note 107, at 1.5.
[143] *See* COP-6, *supra* note 49, at Decision 1/CP.6 Box C. Land-use, Land-use Change and Forestry.
[144] *Sinks Table Options Paper*, *supra* note 119, at 127, 132.
[145] *Id.* at 127.
[146] U.S. Climate Change Science Program, The First State of the Carbon Cycle Report: The North American Carbon Budget and Implications for the Global Carbon Cycle 32 (2007), http://www.climatescience.gov/Library/sap/sap2-2/final-report/sap2-2-final-all.pdf.
[147] *Id*. at 140.
[148] Jon Kusler, *Climate Change in Wetland Areas Part II: Carbon Cycle Implications*, Acclimations, (Aug. 1, 1999), http://bluecarbonblog.blogspot.com/1999/08/climate-change-in-wetland-areas-carbon.html.
[149] U.S. Climate Change Science Program, *supra* note 146, at XIII (defining "'North America' as Canada, the United States of America (excluding Hawaii), and Mexico").
[150] *Id*. at 143, 140 (noting that "estuarine wetlands and some freshwater mineral-soil wetlands rapidly sequester carbon as soil organic matter due to rapid burial in sediments").
[151] *Id*. at 143.
[152] *Id*. at XIII.
[153] *Id*.
[154] Lindsey, *supra* note 16.
[155] *Id*.
[156] *Id*.
[157] Pimentel et al., *supra* note 16, at 1119.
[158] Coe et al., *supra* note 16, at 1.
[159] Lindsey, *supra* note 16.
[160] Pimentel et al., *supra* note 16, at 1118.
[161] About REDD+, *supra* note 11.
[162] Claudia M. Stickler et al., *The Potential Ecological Costs and Cobenefits of REDD: A Critical Review and Case Study from the Amazon Region*, 15 Global Change Biology 2803, 2806 (2009).
[163] Coe et al., *supra* note 16, at 1.
[164] *Id*. at 1; Pimentel et al., *supra* note 16, at 1117; Lindsey, *supra* note 16.
[165] Coe et al., *supra* note 16, at 1; Pimentel et al., *supra* note 16, at 1118-19; Lindsey, *supra* note 16.
[166] Stickler et al., *supra* note 161, at 2806.
[167] *Id*.
[168] Pimentel et al., *supra* note 16, at 1117.
[169] Pimentel et al., *Ecology of Soil Erosion in Ecosystems*, 1 Ecosystems 416, 417 (1998).
[170] *Id*.
[171] Pimentel et al., *supra* note 16, at 1118.
[172] *See id*. at 1117-18 (noting how steep slopes converted to agricultural use often result in high erosion rates: Nigeria – flat slope gradient <1%, lost 2 tons ha^{-1} $year^{-1}$ versus a slope gradient ~12%, lost 221 tons ha^{-1} $year^{-1}$; Philippines – slope gradient greater than 11% on over 58% of the land, and Jamaica – slope gradient greater than 20% on over 52% of the land, resulted in soil loss as high as 400 tons ha^{-1} $year^{-1}$).
[173] Pimentel et al., *supra* note 169, at 417.
[174] *See id*., at 416-17 (proving an example where over a 100-year period, with an erosion rate of 2 tons/hectar/year on 10 ha, the deposit of the eroded soil amasses to a depth of 15 cm on roughly 1 ha of land).
[175] Coe et al., *supra* note 16, at 1.
[176] Pimentel et al., *supra* note 169, at 417.
[177] *Id*.
[178] *See id*. at 418-19 (recognizing that when the forest coverage meets this minimum, the erosion rates are lower, ranging from 0.004 to 0.050 t/ha/yr).
[179] *Id*. at 419.
[180] Pimentel et al., *supra* note 16, at 1118.
[181] *Id*.
[182] *Id*.
[183] Pimentel et al., *supra* note 169, at 416.
[184] *Id*.
[185] *Id*.
[186] COP/MOP-1 Report-Part Two, *supra* note 51, at Decision 16/CMP.1 Annex Definitions A(1)(a).
[187] *See generally id*.
[188] Pimentel et al., *supra* note 169, at 419.
[189] *Id*.
[190] Pimentel et al., *supra* note 16, at 1119 ("In the US, where 2.5 cm of soil are lost every 16.5 years, soil has been lost at about 17 times the rate at which it has formed.").
[191] Coe et al., *supra* note 16, at 1.
[192] *Id*.
[193] *Id*.
[194] Axel Kleidon & Martin Heimann, *Deep-Rooted Vegetation, Amazonian Deforestation, and Climate: Results from a Modeling Study*, 8 Global Ecology & Biogeography 397, 399 (1999), http://www.bgc-jena.mpg.de/bgc-theory/uploads/Pubs/1999-GEBL-Amazonia.pdf.
[195] Coe et al., *supra* note 16, at 1.
[196] *Id*.
[197] *Id*.
[198] Kleidon, *supra* note 194, at 400.

[199] *Id*. at 399.
[200] *See id*. at 401 (elaborating on why the "evapotranspiration (and thus for water storage) is considerably increased . . . : (1) less atmospheric moisture (drier air) increases the water vapour pressure deficit; (2) higher air temperatures (warmer air) further enhances the dryness of the air and the water vapour pressure deficit; and (3) longer dry periods will require more storage of plant available water in the soil.").
[201] *Id*.
[202] COP/MOP-1 Report-Part Two, *supra* note 51, at Decision 16/CMP.1 Annex Definitions A(1)(a).
[203] Kleidon, *supra* note 194, at 400.
[204] Coe et al., *supra* note 16, at 1.
[205] *Id*.
[206] Kleidon, *supra* note 194, at 399.
[207] *See generally* COP/MOP-1 Report-Part Two, *supra* note 51, at Decision 16/CMP.1 Annex Definitions A(1)(a).
[208] Kleidon, *supra* note 194, at 404.
[209] Lindsey, *supra* note 16.
[210] *Id*.
[211] *Id*.
[212] Yumiko Uryu et al., WWF Indonesia, Deforestation, Forest Degradation, Biodiversity Loss and CO_2 Emissions in Riau, Sumatra, Indonesia: One Indonesian Province's Forest and Peat Soil Carbon Loss Over a Quarter Century and its Plans for the Future 43 (2008), http://assets.panda.org/downloads/riau_co2_report__wwf_id_27feb08_en_lr_.pdf.
[213] Pimentel et al., *supra* note 169, at 421.
[214] *Id*.
[215] *Id*.
[216] *Id*. at 416.
[217] Stickler et al., *supra* note 161, at 2806.
[218] *Id*.
[219] *Id*.
[220] *Id*.
[221] Mark Schapiro, *Climate Change: Better REDD Than Dead*, Mother Jones (Nov. 2009), http://motherjones.com/environment/2009/11/better-redd-dead.
[222] Stickler et al., *supra* note 161, at 2806.
[223] *Id*.
[224] *Id*.
[225] COP/MOP-1 Report-Part Two, *supra* note 51, at Decision 16/CMP.1 Annex Definitions A(1)(a).
[226] Bruce Henderson, *Groups Oppose Genetically Engineered Eucalyptus Trees*, Charlotte Observer (Aug. 19, 2010), http://www.charlotteobserver.com/2010/08/19/1630893/groups-oppose-genetically-engineered.html.
[227] COP-16 AWG-LCA, *supra* note 57, at III.C; Good Practice Guidance for Land Use, Land-Use Change and Forestry, *supra* note 106.
[228] van Noordwijk et al., *supra* note 110, at 2; 2006 IPCC Guidelines for National Greenhouse Gas Inventories, *supra* note 107, at 1.5.
[229] *See generally* Kyoto Protocol, *supra* note 45.
[230] *United Nations Conference on Environment and Development (1992)*, United Nations, http://www.un.org/geninfo/bp/enviro.html (last updated May 23, 1997).
[231] Convention on Biological Diversity, June 5, 1992, 31 I.L.M. 818, http://www.cbd.int/doc/legal/cbd-en.pdf.
[232] United Nations Framework Convention on Climate Change, May 9, 1992, 1771 U.N.T.S. 107 [hereinafter UNFCCC], http://unfccc.int/resource/docs/convkp/conveng.pdf.
[233] Kyoto Protocol, *supra* note 45.
[234] *SBSTTA 6 Recommendation VI/7,* Convention on Biological Diversity, http://www.cbd.int/recommendation/sbstta/?id=7038 (last visited Feb. 27, 2011).
[235] Secretariat of the Convention On Biological Diversity, CBD Technical Series No. 10, *Interlinkages Between Biological Diversity and Climate Change, Advice on the Integration of Biodiversity Considerations into the Implementation of the United Nations Framework Convention on Climate Change and its Kyoto Protocol* (2003), http://www.cbd.int/doc/publications/cbd-ts-10.pdf.
[236] Conference of the Parties to the Convention on Biological Diversity, May 19-30, 2008, *Decisions Adopted by the Conference of the Parties to the Convention on Biological Diversity at Its Ninth Meeting*, Decision IX/16, *Biodiversity and Climate Change*, U.N. Doc. UNEP/CBD/COP/9/29 (June 30, 2008),
[237] COP-9 Decision IX/16, *supra* note 78, at A(e).
[238] Conference of the Parties to the Convention on Biological Diversity, Oct. 18-29, 2010, *Decisions Adopted by the Conference of the Parties to the Convention on Biological Diversity at is Tenth Meeting*, *Biodiversity and Climate Change*, U.N. Doc. UNEP/CBD/COP/DEC/X/33 (Oct. 29, 2010), http://www.cbd.int/climate/doc/cop-10-dec-33-en.pdf.
[239] *Id*. ¶ 8(p).
[240] UNFCCC, *supra* note 232, at 1, art. 2.
[241] COP-16 AWG-LCA, *supra* note 57, at Annex I 2(e).
[242] *Id*.
[243] *See* U.S. Gov't. Accountability Office, *supra* note 67, at 2-3 (reviewing the issues of additional, measurement, verification, and permanence); Ramseur, *supra* note 67, at 21 (discussing the issue of leakage).
[244] Ramseur, *supra* note 67, at 21
[245] van Noordwijk et al., *supra* note 110, at 2.
[246] Pimentel et al., *supra* note 16, at 1118-19; Coe et al., *supra* note 16, at 1; Lindsey, *supra* note 16.
[247] *Market Failures and Externalities, supra* note 13.
[248] Smith, *supra* note 3, at 70-75.
[249] Miller, *supra* note 9, at 19.
[250] van Noordwijk et al., *supra* note 110, at 2.
[251] Wilde, *supra* note 1.