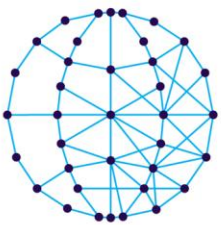


Cooperatives : The Power to Act
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THE ROLE OF FORESTRY COOPERATIVES IN CLIMATE CHANGE MITIGATION

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Abstract

This is a revised version of a paper first presented at the International Cooperative Alliance's Committee on Cooperative Research Conference in Finland in 2011. This version updates forest-related data from 2011 and presents information on the relationship between forestry cooperatives and the Paris Accord on Climate Change signed by all UN member countries in 2015 (Framework Convention on Climate Change, 2015).

The purpose of this paper is to present a strategic analysis of how forestry cooperatives can play an important role in reducing the emission of carbon dioxide into the atmosphere in both developing and developed countries. The paper makes the case that, over the next 20 years, forestry cooperatives could become the primary means by which the world's carbon emissions from deforestation are reduced and the storage of carbon in forests is increased. The underlying contention of the paper is that forestry co-ops have a unique ability to efficiently aggregate and mobilize large numbers of people and resources at the community level in order to increase net forest carbon sequestration.

The paper first presents a basic review of the international efforts currently underway and those in the planning process to reduce greenhouse gas emissions, and the role of forests in both contributing to and reducing these emissions. It then proposes how two different kinds of forestry cooperatives—forest owner cooperatives and forest user cooperatives—are particularly well-suited to reduce greenhouse gas emissions, especially carbon dioxide emissions. The paper then presents contextual examples from the United States, the European Union, Mexico, Senegal, and the Himalayan countries of Nepal and Bhutan that illustrate how carbon sequestration projects could be carried out by forestry cooperatives and similar organizations in very different ecological, economic, political, and land tenure contexts. The concluding section of the paper presents several steps that should be taken to increase the likelihood that forestry cooperatives will become an important means for addressing international climate change issues over the next 20 years.

Résumé

Cet article se veut une mise à jour d'une communication initialement présentée à l'occasion de l'International Cooperative Alliance's Committee on Cooperative Research Conference qui s'est tenue en Finlande en 2011. Il vient donc mettre à niveau les données forestières depuis 2011 et renseigne sur la relation entre les coopératives forestières et l'Accord de Paris sur le climat ratifié en 2015 par l'ensemble des pays membres de l'ONU (Convention-cadre des Nations unies sur le changement climatique, 2015).

Ce papier analyse stratégiquement comment les coopératives forestières peuvent jouer un rôle déterminant dans la réduction des émissions de dioxyde de carbone dans l'atmosphère, tant dans les pays en développement que dans les pays développés. Il montre qu'au cours des vingt prochaines années, les coopératives forestières pourraient devenir la principale source de réduction de dioxyde de carbone provenant de la déforestation, mais aussi la principale source d'accroissement des stocks de carbone dans les forêts. Selon l'argument invoqué, les coopératives forestières ont l'unique capacité de regrouper et de mobiliser, au niveau communautaire, de grandes quantités de personnes et de ressources afin d'augmenter la séquestration nette du carbone forestier.

Il offre d'abord un aperçu général des efforts internationaux qui ont cours en vue de réduire les émissions de gaz à effet de serre et qui contribuent, par la forêt, à la réduction de ces émissions. Il propose ensuite deux types distincts de coopératives forestières – coopératives de propriétaires forestiers et coopératives d'utilisateurs forestiers – qui sont notablement propices à réduire les émissions de gaz à effet de serre, en particulier de dioxyde de carbone. Cet article présente ensuite des exemples contextuels aux États-Unis, dans l'Union européenne, au Mexique, au Sénégal ainsi qu'au Népal et au Bhutan, situés dans la zone himalayenne, pour illustrer comment les projets de séquestration de carbone pourraient être réalisés par des coopératives forestières et organisations analogues dans différents contextes écologiques, économiques, politiques et de droits terriens. En conclusion, il décrit plusieurs des stades suivants afin d'augmenter les possibilités pour les coopératives forestières de jouer un rôle déterminant dans les solutions aux enjeux climatiques mondiaux au cours des 20 prochaines années.

Resumen

Esta es una versión revisada de un documento que se presentó por primera vez en la Conferencia sobre Investigación Cooperativa del Comité de la Alianza Cooperativa Internacional realizada en Finlandia en 2011. Esta versión actualiza los datos relativos al sector forestal desde 2011 y presenta información acerca de la relación entre las cooperativas forestales y el Acuerdo de París sobre Cambio Climático firmado en 2015 por todos los países miembros de la ONU (Convención Marco sobre el Cambio Climático, 2015).

El objetivo de este trabajo es presentar un análisis estratégico acerca de cómo las cooperativas forestales pueden cumplir una función importante en la reducción de la emisión de dióxido de carbono en la atmósfera tanto en los países desarrollados como en los que están en vías de desarrollo. Este documento argumenta que, en el transcurso de los próximos veinte años, las cooperativas forestales podrían convertirse en el medio principal a través del cual se reduzcan las emisiones de carbono mundiales debido a la deforestación y se aumente el depósito de carbono en los bosques. La afirmación implícita del trabajo es que las cooperativas forestales tienen la capacidad singular de agrupar y movilizar de manera eficiente a grandes cantidades de personas y recursos a nivel de la comunidad para aumentar la fijación neta de carbono forestal.

Primero, se presenta un resumen de las medidas internacionales que se llevan a cabo en la actualidad con el fin de reducir las emisiones de gases de efecto invernadero y la función de los bosques, tanto en el aporte a como en la reducción de estas emisiones. Luego, se explica cómo dos tipos diferentes de cooperativas forestales —las cooperativas de propietarios forestales y las cooperativas de usuarios forestales— están particularmente bien posicionadas para reducir las emisiones de gases de efecto invernadero, sobre todo, las de dióxido de carbono. Más adelante, se desarrollan ejemplos en contexto de los Estados Unidos, la Unión Europea, México, Senegal y los países himalayos de Nepal y Bhután, que ilustran de qué manera las cooperativas forestales y otras organizaciones similares pueden realizar proyectos de fijación de carbono en entornos muy diferentes en términos ecológicos, políticos y de tenencia de tierras. Como conclusión, se exponen varios pasos que deberían seguirse para aumentar la probabilidad de que las cooperativas forestales se transformen en un medio importante para abordar las cuestiones relativas al cambio climático en los próximos 20 años.

Climate Change and Forests

In 2016, the global mean carbon dioxide concentration in the Earth's atmosphere is over 400 ppm (National Oceanic and Atmospheric Administration, 2016).¹ This is more than 100 ppm greater than the

pre-industrial concentration, and from 2014 to 2015 the increase was the highest on record at over 3 ppm (National Oceanic and Atmospheric Administration, 2016). This trend must be reversed if there is any hope of meeting the United Nations' goal of limiting warming to 2°C in the 21st century and reducing the negative consequences of the average world temperature increase, including more frequent droughts, floods, and other severe weather events. Anthropogenic carbon dioxide emissions come primarily from burning fossil fuels, deforestation, agriculture, and other land-use changes (World Resources Institute, 2011). There is a lot of truth to the adage that trees are the lungs of the planet. In addition to "inhaling" carbon dioxide and "exhaling" oxygen, forests also store carbon, thus keeping carbon dioxide out of the atmosphere.² Forests constitute 3.999 billion ha, about 31% of the Earth's total land area (Keenan et al., 2015), and store 256 gigatonnes (Gt) of terrestrial carbon (FAO, 2015). According to the Global Partnership on Forest Landscape Restoration: "1.5 billion hectares have been lost to deforestation. Much of what are croplands today were once covered with forest. Another 1.5 billion hectares have been degraded in the sense that they are significantly less dense than their biological potential" (The Global Partnership on Forest Landscape Restoration, 2011).

The United Nations Program, Reducing Emissions from Deforestation and Forest Degradation (REDD), asserts that stabilizing global temperatures "will be practically impossible to achieve without reducing emissions from the forest sector, in addition to other mitigation actions" (UN-REDD, 2016). Deforestation and forest degradation, primarily in tropical forests, release about 3.93 Gt of carbon dioxide each year (Federici et al., 2015), or about 11% of total anthropogenic carbon dioxide emissions (IPCC, 2014). In contrast to the net carbon emissions from tropical forests, temperate forests in Asia, Western Europe, and elsewhere are increasing the amount of stored carbon and thus offsetting some of the carbon dioxide emissions into the atmosphere; however, overall, forests are net emitters of 0.79 Gt/yr (factoring in stored carbon, as well as deforestation and degradation effects) (Federici et al., 2015). The world's temperate regions could be storing far more carbon than they are through improved forest management, longer harvesting rotations, and afforestation (Gorte, 2009). There is broad agreement among scientists and political leaders that, if effective international policies and incentives are put in place during the next 20 years, the world's forests could become a major source of increased carbon storage and one of the most cost-effective ways to slow the amount of carbon dioxide going into the atmosphere (FAO, 2007). According to one analysis, over 20% of current yearly global carbon dioxide emissions could be offset via sequestration in forests by 2030, and it concluded that forest carbon sequestration could and should account for 30% or more of all carbon abatement in the remainder of the 21st century (Sohngen, 2009).

A key concept that is often discussed in relation to forest carbon sequestration is "payment for ecosystem services" or PES. PES programs provide a "source of income for land management, restoration, conservation, and sustainable use activities" (The Katoomba Group, 2008). Similar to other goods and services, storage of carbon in forests is a product that can be bought and sold. Landowners and land managers can be paid to maintain or increase the amount of carbon stored in forestland. On a worldwide scale, these payments can be the cornerstone of an international initiative to sequester billions of additional tons of carbon in forests.

There are many questions related to forest carbon sequestration that will not be addressed in this paper. These include estimates of the cost of mitigating carbon through changes in forestry policies and practices, mechanisms for funding forest carbon programs, and methods for measuring the impact of

these programs. All of these issues are actively being researched,³ but are beyond the scope of this paper.

Forestry Cooperatives

In reviewing the forest carbon sequestration literature, there is one topic that appears to have received little attention: The question of how forest carbon sequestration programs will be implemented on the ground. The lack of focus on this issue is a serious oversight, especially considering the worldwide scope of the proposed changes in forest policy and practices that will be required to produce measurable changes in carbon emissions over the next 20 years and through the remainder of the 21st century.

Instead, most of the discussion is on the development of international and national policies and financial incentives to reduce deforestation, increase afforestation, and improve forest management. Ultimately, however, actually changing forestry practices is a local activity. Unless a range of strategies is developed that causes people to change their practices related to forest carbon storage at the local level, all of the national and international research and policymaking on this subject will be for naught.

This is where the critical role of forestry cooperatives (and similar community-based organizations) comes into play.⁴ These are the on-the-ground groups of people who will make forest carbon sequestration feasible or not. The remainder of this paper focuses on key issues related to these local forestry groups.

The paper distinguishes between two basic kinds of forestry cooperatives: cooperatives of forest owners and cooperatives of forest users.

As the name indicates, forest owner cooperatives are owned and democratically controlled by individuals, families, and organizations that own forestland. They provide a variety of services to their landowner-members, especially forest management services and timber marketing services. They have a long history in Western Europe and can also be found in Canada, the United States, Japan, and other developed countries.⁵ Some agricultural cooperatives also provide forestry services to their members.

Forest user cooperatives, often referred to as community forest management groups, comprise local community residents who make use of state-owned or communal forests for firewood, charcoal, timber, non-timber forest products, hunting, eco-tourism, and other activities. For the most part, these groups are committed to sustainable forest management. They are most likely to be found in Central and South America, Africa, and Asia.⁶ It is important to note that most of these groups are not registered as cooperatives although they generally meet the basic cooperative criterion of being owned and democratically controlled by the members. The issue of formal versus informal forestry cooperatives is addressed in the concluding section of the paper.

Before presenting the five regional and national examples that illustrate the potential for the role of forestry cooperatives in sequestering carbon, it is important to identify the special attributes that both forest owner cooperatives and forest user cooperatives provide to the carbon sequestration process that no other type of entity provides. These attributes can be summarized as follows:

1. **Cooperative members either own or manage the land on which carbon sequestration services are to be provided.** Thus, co-op members are in the best position to ensure that the services are provided, and they can be held accountable for their provision.
2. **Cooperatives group together large numbers of landowners or land managers into a single business entity** and thus can enter into legally binding carbon sequestration and other agreements that represent thousands or tens of thousands of hectares.
3. **Members of primary cooperatives often form secondary and tertiary cooperatives** that further increase their ability to provide economies of scale and improve operating efficiency.
4. Because cooperatives are democratically owned and controlled by their members and the benefits to members are based on their economic participation in the cooperative, **there is a strong incentive for the member-owners to achieve contractually agreed-upon objectives.**
5. Carbon sequestration agreements generally have very long time spans of 50, 100 or more years. **Cooperatives are a form of organization capable of entering into multi-generational agreements.**

Examples and Potential Examples in Selected Countries and Regions

This section of the paper presents overviews of the potential for forestry cooperatives to provide carbon sequestration services in five different countries and regions of the world.

a. United States

About one-third of the land area of the United States, approximately 300 million hectares, is forested (USDA Forest Service, 2001). Excluding Alaska and Hawaii, there are about 250 million forested hectares in the conterminous United States. Almost 160 million hectares of this forestland, or nearly two-thirds, is privately owned. Over 110 million hectares of the private forestland are owned by about 10 million family forest owners (Butler and Leatherberry, 2004).

Forestry cooperatives have never been a widespread phenomenon in the United States. Examples date back at least to the early 20th century; however, their numbers have always been small and have ebbed and flowed over time (Rickenbach, 2006). There are currently about 10 forestry co-ops in the country, representing a miniscule percentage of private forestland.⁷

In contrast, farm supply and marketing co-ops have been a large part of the agricultural economy of the United States for well over 100 years. More than 2,500 cooperatives account for about a third of both total farm sector revenue and input purchases (University of Wisconsin Center for Cooperatives, 2009). Many of these co-ops serve farmers who also have forestland and many of them are located in geographical areas where there are concentrations of forest owners who are not co-op members.⁸

A key reason why forestry cooperatives have not proliferated in the United States is the lack of demand for traditional forestry services, especially timber harvesting. Survey data consistently show that most forest owners in the United States are not interested in managing their forests or generating revenue from timber harvests (National Woodland Owner Survey, 2011). Also, there is little incentive for forest

owners to be part of a cooperative where they would utilize its services only every 25 years when it's time for a timber harvest. In agricultural cooperatives, farmers use the services of their cooperatives multiple times per year when purchasing inputs and agronomic services and marketing agricultural products.

If ecosystem services become a business activity from which forest owners and farmers can benefit, there is the potential for a major shift in the role that both forestry and agricultural cooperatives play in the United States. As businesses owned by landowners, these cooperatives have the potential to become the dominant contracting agents for reducing forest and farm greenhouse gas emissions and for storing carbon.

In order for this to happen, however, there needs to be a strong, reliable market for carbon sequestration services. The voluntary markets of the past decade or so have provided some opportunities to experiment with carbon sequestration agreements, but payments and contract volumes have been low, and agreements have been criticized for not being adequately rigorous (Hausfather, 2008).

At the national level, a federal carbon tax program or cap and trade program in the United States appears unlikely in the next several years primarily because of resistance by Republicans in the US legislature.

However, the State of California, with a population of 37 million and an economy that is equivalent to the eighth largest country in the world,⁹ has already been operating a mandatory carbon cap and trade program since 2012. In the California program, qualifying carbon credit projects anywhere in the country will be eligible to enter into agreements with California utilities and other manufacturers that need to offset their carbon emissions. Forest carbon sequestration, including afforestation and increased carbon storage through appropriate forest management practices, is an eligible source of carbon credits for this program (California Environmental Protection Agency Air Resources Board, 2010).

b. European Union

Forest and other wooded land in the EU cover approximately 177 million ha (over 40% of the EU territory). As a result of afforestation programs and due to natural regeneration on marginal lands, forest cover in the EU has increased over the past few decades. An estimated 16 million primarily small-scale forest owners own 60 percent of EU forestland (European Union, 2013).

Many European countries require owners of forestland to have management plans and to keep forestland in forests. As a result, interest in forest management and involvement in forestry cooperatives and associations is much higher than in the United States (Idem).

The Confederation of European Forest Owners conducted a survey of "European Forest Owner Organisations" in 2008, which presented data from 14 countries. Most of the organizations surveyed were cooperatives. The study concluded that: "Forest owners' economic cooperation is a strong force in Europe and strongly contributes to sustainable forest management among large, medium-sized, and small forest owners across Europe." (Confederation of European Forest Owners, 2008).

Western Europe also has a well-established agricultural cooperative system. According to COGECA

(General Committee for Agricultural Cooperation in the European Union), there are about 40,000 farmers' cooperatives in the EU responsible for over 50 percent of agricultural input and marketing revenue.¹⁰

The European Union also has the world's largest carbon-trading system, the European Trading Scheme (ETS), which was developed as a means to carry out the requirements of the Kyoto protocol and, as of this year, is beginning to implement the Paris Agreement on climate change.¹¹

Despite the tremendous potential for increased carbon storage in Europe's forests and on its farms, there is a critical condition that must be met in order for this potential to be realized: The support of European forestry and agricultural cooperatives and other organizations for mechanisms that promote payments for ecosystem services, including forest carbon sequestration.

This point may need a little elaboration. There appears to be some resistance from European forestry and agricultural cooperatives about entering into carbon sequestration and other ecosystem service agreements because these services are perceived by some to conflict with the current markets of these cooperatives. For example, if a forestry cooperative is heavily involved in timber harvesting, marketing, and processing, an increased commitment to carbon sequestration may negatively impact these timber-related activities. On the other hand, there are many forest owners in Western Europe who are not members of forestry cooperatives, in part because they are not focused on timber marketing. Opportunities for carbon sequestration services may be of interest to this latter group of forest owners. Thus, carbon sequestration and other ecosystem services may provide a major growth opportunity for some forestry and agricultural cooperatives in Western Europe, if they choose to emphasize ecosystem services as a business activity and if they reach out to both member and non-member forest owners.

Forestry and agricultural cooperatives in the European Union could become an international leader in increasing sequestration of forest carbon in the next two decades. Whether or not they will take on this role depends, to a large extent, on the economic and environmental priorities set by the European Union, the cooperatives and their members.

c. Mexico

Mexico has about 65 million ha of forestland, approximately one-third of the country's total land area. Between 1990 and 2010, Mexico lost about 8% of its forest cover due to deforestation, primarily from conversion to agricultural land and timber harvesting (Mongabay, 2010).

Mexico has a unique system of land tenure that has its origin in the pre-colonial Aztec period and also reflects major agrarian reforms of the 20th century. Today, over 75% of Mexico's forests are democratically controlled by local communities, either ejidos or comunidades (The Economist, 2010). Ejidos are characterized by individual ownership of agricultural land and collective ownership of forestland. Comunidades are indigenous communities that, in most cases, own all land collectively (Alix-Garcia, 2011).

These two organizational forms are similar to cooperatives because of their democratic ownership and control of economic resources. Some of them have formed primary and secondary cooperatives for specific activities such as coffee growing and marketing and other agricultural businesses.

Some ejidos and comunidades are already engaged in contracts for ecosystem services, particularly hydrological services. Through these agreements with the Mexican government, they carry out

sustainable forest management practices in order to improve water quality and increase water supply to nearby urban communities. They receive payments for these services (Idem). This experience with hydrological service contracts can be applied to forest carbon sequestration agreements.

Some of these community-based organizations are also developing plans to participate in REDD+ and carrying out pilot projects, such as tree planting and using portable sawmills that minimize forest damage (The Economist, 2010).

Because of the extensive, long-term involvement of ejidos and comunidades in sustainable forest management and the experience of many communities in hydrological service agreements, Mexico is in an excellent position to be an international leader in developing community-based programs for forest carbon sequestration.

d. Senegal

The forest area in Senegal is almost 9 million hectares or about 45% of the total land area. Between 1990 and 2005, forest loss was about 7%. Deforestation is mostly the result of clearing for fuelwood, charcoal, and logging (Mongabay, 2010).

Virtually all forestland in Senegal is owned by the state. As with many other developing countries, Senegal is devolving rights and responsibilities for forest management to local community organizations.

One example is the Wula Naafa¹² Program in which villages and groups of villages develop and implement community forest management plans. The program was established in 2003 with support from The United States Agency for International Development. The first phase was completed in 2008. During this phase, about 77,000 ha of forestland were put under community management. In exchange for sustainably managing forestland, residents of participating communities are able to extract wood and other forest products for their livelihood. A key feature of the program is the local, democratic decision-making that ensures that various groups who depend on the forest for their livelihood are treated fairly while the forest's resources are sustained. The second phase ran from 2009-2013. This program is intended to serve as a model for sustainable community forestry throughout Senegal (USAID-Senegal, 2012).

The community forest management groups involved in Wula Naafa are in an excellent position to provide carbon sequestration services on a fee-for-services basis. Payment for the services could be structured so that multi-village groups receive payments for increases in carbon storage and specific sub-groups, for example tree planting cooperatives, receive targeted payments for the services they provide. Many of these groups and sub-groups could be registered as cooperatives in order to facilitate their involvement in a variety of business activities including purchasing seedlings and other inputs, and marketing forest products. The formation of primary and secondary cooperatives among these forestry groups would also improve their ability to enter into carbon sequestration contracts.

As with Mexico, payment for carbon sequestration services will primarily be contingent on the implementation of the international climate change accord and the development of a greenhouse gas emission fund in which they can participate.

e. Himalayan Region

The Himalayan countries of Bhutan and Nepal have similar topographies and community forestry programs.

Bhutan has an area of national forest land of almost 2.8 million hectares, which is 72% of the land area. The country is experiencing no net deforestation, but some forest degradation. Bhutan has about 270 community forest management groups involving approximately 13,000 households that manage 32,000 ha—slightly more than 1% of the national forest land (Schmidt and Temphe, 2010).

Nepal has an area of national forest land that is almost 6 million ha, or about 40% of the total land area. The deforestation rate is about 1.4% per year. There are approximately 14,300 community forest user groups involving about 1.7 million households and managing about 1.2 million hectares or about 21% of the national forest land area (Id.).

In Nepal's and Bhutan's community forest programs, local community groups use, conserve, and develop parcels of state-owned forest land according to government-approved management plans. Both countries are in the process of developing strategies for enrolling their community forests into forest carbon sequestration programs under REDD+ (Ibid.). Bhutan is also in the early stages of implementing a cooperative and farmer's group registration program with plans to include forest management groups among the co-ops to be registered.¹³

In both countries, the development of forest management groups that comprise local residents has set the stage for effective means to enter into and implement forest carbon sequestration agreements.

Conclusions and Recommendations

This brief paper has covered a lot of ground. It has summarized the role of forests in climate change and climate change mitigation, presented a case for forest owner and forest user cooperatives as an important means for sequestering carbon during the next 15 years and beyond, and it has provided examples of how cooperative sequestration programs have strong potential in five different political, economic, and social contexts.

An underlying theme of the paper is that, while carbon and other greenhouse gases are increasingly creating problems on a world scale, many of the solutions to these problems need to be local. Cooperatives have unique strengths in providing these local solutions. Due to the fact that they are rooted in communities, are democratically owned and controlled, and are able to integrate vertically and horizontally with other cooperatives, they have the ability to mobilize hundreds of millions of forest owners and forest users to reduce forest carbon emissions.

However, there are a number of obstacles that must be overcome before this potential can be realized. Following is a list of recommendations intended to clear the way for forestry cooperatives to take a leadership role in sequestering carbon and helping to mitigate catastrophic changes in the earth's climate in the 21st century.

1. **Effective implementation of the forestry component of the Paris Agreement** (Framework Convention on Climate Change, 2015). The Agreement has made great strides in bringing the world's countries together to agree to mitigate the effects of climate change, but now there is a lot of on-the-ground work to be done.

Article 5.1 specifies that Parties to the Agreement “should take action to conserve and enhance [...] sinks and reservoirs of greenhouse gases [...] including forests[...] Parties are encouraged to take action to implement and support, including through results-based payments,[...] policy approaches and positive incentives 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[...] (Ibid.)”

As this paper attests, forestry co-ops are particularly well suited to address this component of the Paris Agreement.

2. **National and international financial mechanisms.** Article 9 of the Agreement includes the following statement: “As part of a global effort, developed country Parties should continue to take the lead in mobilizing climate finance from a wide variety of sources, instruments and channels, noting the significant role of public funds, through a variety of actions, including supporting country-driven strategies, and taking into account the needs and priorities of developing country Parties. Such mobilization of climate finance should represent a progression beyond previous efforts (Ibid.)”
3. **This “mobilization of climate finance” should include effective incentive programs for forest carbon sequestration activities by cooperatives.** Different countries and regions may choose to use different financial mechanisms, for example greenhouse gas taxes or cap and trade programs, in order to provide incentives for increased forest carbon storage or other means to reduce forest carbon emissions. However, without substantial financial sanctions for carbon emissions and rewards for sequestering carbon, the forestry component of the agreement will be meaningless.
4. **Local forest carbon programs.** Much more attention needs to be focused on the organizations and individuals who are in the best position to carry out forest carbon sequestration activities – local community groups and local community residents. To date, there have been very few detailed analyses of how local communities can be mobilized to address carbon change problems. This paper has stressed the role of forestry cooperatives and similar organizations as the best means to carry out local forest carbon projects. Forestry cooperatives need to be given much more attention by researchers and policy makers as a delivery mechanism for carbon-related services in order to turn rhetoric on local involvement into practical strategies.
5. **Support by the International Cooperative Alliance and national apex cooperative organizations.** The cooperative community—especially the International Cooperative Alliance and Alliance member organizations—needs to go on record and state why forestry cooperatives should be a key part of climate change strategy in the 21st century.
6. **Pilot projects.** Meaningful change often takes place based on learning from pilot projects. The community of cooperative researchers and developers can play a very important role in promulgating an agenda in which forestry co-ops become a major part of climate change mitigation. They can do this through identifying examples of forestry cooperatives that are carrying out carbon sequestration projects, participating in pilot projects, and preparing analyses of the feasibility of forestry and agricultural cooperatives to broaden their activities into the area of ecosystem services, including



7. carbon sequestration. During the 21st century, climate change will fundamentally alter the planet in ways that are harmful to humans, other animals, and plants. Based on the principles that we in the cooperative community espouse—especially our commitment to economic democracy, cooperation among cooperatives, and fostering sustainable communities and a sustainable world—we can and should play a major role in lessening the life-altering impact of these changes.

The language of the Paris Agreement related to the role of forests in addressing problems caused by climate change creates an important opportunity for the cooperative community. But we need to act on this opportunity.

As many of us know, 2011 was the International Year of the Forest and 2012 was the International Year of Cooperatives. What better time than now to promote the role of cooperatives in sustainably managing the world's forests for carbon sequestration.

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Notes

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- 1 The paper focuses on carbon storage (also referred to as carbon sequestration) and carbon dioxide emissions. Carbon stored in forests is equivalent to about 3.7 times as much carbon dioxide (by weight) when released into the atmosphere. There are other greenhouse gases responsible for climate change, especially methane, nitrous oxide, and ozone. The emission impacts of all greenhouse gases can be calculated in terms of their carbon dioxide equivalent or CO₂e. Human emissions currently account for about 30 Gt (gigatonnes, or billion metric tons) of CO₂ per year.
 - 2 In more technical terms, photosynthesis is the “process in green plants and certain other organisms by which carbohydrates are synthesized from carbon dioxide and water using light as an energy source. Most forms of photosynthesis release oxygen as a byproduct.”
<http://www.thefreedictionary.com/photosynthesis>
 - 3 For example, the UN REDD program, referred to above, which is now called REDD+, has been expanded to include “the role of conservation, sustainable management of forests and enhancement of forest carbon stocks” as well as deforestation and forest degradation. How to implement REDD+ is currently the subject of intense international research and policy development.
<http://www.un-redd.org/AboutREDD/tabid/582/Default.aspx>.
 - 4 This paper uses the phrase “forestry cooperative” to connote a broad array of locally based, forestry-related organizations. Not all of them are registered as cooperatives nor do they all subscribe to the seven cooperative principles, but most share the basic definition of a cooperative: an organization that is owned and democratically controlled by the people who use its services. See, for example, <http://www.rurdev.usda.gov/co/coop-svs.htm>.
 - 5 For example, Digby and Edwardson (1976).
 - 6 For example, World Resources Institute (2008).
 - 7 Unpublished research conducted by the author in March 2011.
 - 8 For example, unpublished research conducted by the author in 2008 on farm supply cooperatives in Wisconsin and Minnesota.
 - 9 “Comparing US states with countries” (2011), The Economist,
http://www.economist.com/blogs/dailychart/2011/01/us_equivalents.
 - 10 From the organization’s website: www.copa-cogeca.be.
 - 11 The EU Emissions Trading System, http://ec.europa.eu/clima/policies/forests/index_en.htm.
 - 12 Wula Naafa means “benefits of the forest” in a local Senegalese language.
 - 13 The author was an advisor to the Bhutanese government and assisted in developing its co-op implementation strategy in 2010.

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