INTERNATIONAL MODEL FOREST NETWORK
LANDSCAPES · PARTNERSHIPS · SUSTAINABILITY

MAINSTREAMING FOREST LANDSCAPE RESTORATION AND BIODIVERSITY CONSERVATION:

CASE STUDIES FROM THE INTERNATIONAL MODEL FOREST NETWORK

1 Introduction

This document provides select case studies from the International Model Forest Network (IMFN) related to mainstreaming ecosystem restoration and biodiversity conservation. It has been developed as a supplement in support of a short-term action plan on ecosystem restoration for Parties to the CBD (UNEP/CBD/SBSTTA/20/12).

The three IMFN case studies focus on participatory governance models for conservation in a biodiversity hotspot in Ecudaor, landscape restoration around Lake Karago (Gishwati) in Rwanda, and moose conservation in central Canada.

As such, this document also broadly supports Article 8(f) of the Convention which calls on Parties to "rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, inter alia, through the development and implementation of plans and other management strategies."

2 The International Model Forest Network

The Model Forest concept was first developed by Canada in the early 1990s as a way to move from managing forests for timber alone to managing for multiple—and often competing—values found within and around forest landscapes.

Model Forests are based on a flexible ecosystem management approach that combines the social, environmental and economic needs of local communities with the long-term sustainability of large landscapes. The approach links a comprehensive mix of stakeholders within a given area who define what sustainability means in their own context, identify a common vision and set of goals, devise a governance structure and strategic plan, then work collaboratively to achieve the goals set out in that plan. In turn, the process nurtures a depth of trust and transparency among stakeholders and increases their willingness to implement innovative solutions. In short, Model Forests are designed to change relationships and behaviours.

Three aspects central to a Model Forest are:

- **Landscape:** A large-scale biophysical area representing a broad range of forest values, including environmental, social, cultural and economic concerns (a fully working landscape of forests, farms, protected areas, rivers and towns functioning as a 'living laboratory' for sustainable development)
- **Partnership:** An open, transparent and accountable governance structure that welcomes the voluntary participation of stakeholder interests and values
- **Sustainability:** Stakeholders are committed to the conservation and sustainable management of natural resources and the forest-based landscape

The Secretariat to the IMFN is hosted by Natural Resources Canada's Canadian Forest Service. Its small team provides central day-to-day coordination of support and development services to the Network and works to strengthen and expand it.

The IMFN works with a wide variety of international and regional organizations in delivery of its mission and is an active member of the Global Partnership on Forest Landscape Restoration (GPFLR), and the Landscapes for People, Food and Nature initiative (LPFN), as examples. IMFN also participates in international events such as the Global Landscapes Forum to communicate and advocate for multistakeholder partnerships. More information is available at **www.imfn.net**.

2.1 IMFN and the CBD Strategic Plan for Biodiversity

In **decision X/2**, the tenth meeting of the Conference of the Parties adopted a revised and updated Strategic Plan for Biodiversity, including the Aichi Biodiversity Targets, for the 2011-2020 period.

In that plan, partnerships at all levels are viewed as required for effective implementation, to leverage actions at the scale necessary, to garner the ownership necessary to ensure mainstreaming of biodiversity across sectors of government, society and the economy and to find synergies with national implementation of multilateral environmental agreements[1]. As noted above, mutistakeholder and multidisciplinary partnerships are fundamental to a Model Forest.

In addition, the Forest Ecosystem Restoration Initiative (FERI), currently being implemented by the CBD Secretariat, was welcomed by Parties in **decision XII/19**. It aims to assess the costs and benefits of restoration, identify degraded areas with potential for restoration, fund the implementation of restoration activities, and support the protection of the rights of different forest users. It is intended to enhance achievement of the strategic plan, specifically Aichi Targets 5, 14 and 15. The FERI also supports the Bonn Challenge.

According to **decision XII/19**, the FERI has four interrelated components: capacity-building, implementation support, technical support and cooperation, and expert processes. Model Forests and regional Model Forest networks could support these four components in collaboration with national governments by:

- Using their convening power to coordinate workshops, learning exchanges or discussion forums in participating countries
- Acting as national or sub-national pilot sites before scaling up
- Functioning as regional support hubs or coordinators among different groups and regions
- Providing expert advice

Also, 11 Model Forests in Latin America are part of the Ibero-American Model Forest Network's contribution to the 20x20 Initiative under the Bonn Challenge —a regional pledge to restore 20 million ha of degraded and deforested land by 2020. Restoration is also a common priority for six of the seven Model Forests in Asia.

1 **https://www.cbd.int/sp/elements/default.shtml**

3 Recommendations

Ecosystem restoration and biodiversity conservation help achieve not only the Aichi Targets, but also goals under the UNFCCC, the UNFF Global Objectives on Forests, the Bonn Challenge and the Sustainable Development Goals, among others. As the case studies demonstrate, priorities can also be advanced through a biodiversity lens.

While the following case studies feature Model Forests at differing levels of development and capacity, policy and land use decision makers may find the following recommendations from the case studies, and the broader IMFN, of interest:

- Trust building takes time but it is an essential foundation. Equally, a landscape or ecosystem approach to conservation or sustainable development is a process, not a project: be patient, be persistent. A key element to trust building is sustained dialogue, communication (listening and understanding) and engagement (not just consultation) of all stakeholders.
- Good governance regimes are as effective as partners allow it to be. The development of agreed-upon ground rules or operating principles goes a long way towards giving these regimes 'teeth', and may encourage new individuals and organizations to join thereby enriching the process and potentially attracting new resources.
- For restoration and conservation efforts to be successful we must meaningfully involve the people who live with the results in every stage of the process. Relatedly, use of traditional knowledge combined with science provides a powerful combination for policy development and practice.
- Economic and social incentives are required for FLR and biodiversity conservation to pay dividends.
- Forest landscape restoration planning should privilege local species and priority areas, such as biodiversity hot spots or riparian zones.
- Governments must seem themselves as beneficiaries as well as resource providers. Approaches such as Model Forests have no regulatory authority. Therefore, as demonstrated in the MBMF case study, a key requirement for success was a provincial government that was willing to support (philosophically and financially) research and monitoring programs facilitated by a large, multi-stakeholder committee, and to solicit and incorporate new ideas for the management of natural resources such as wildlife. In this instance, Manitoba had already mainstreamed biodiversity into their provincial planning process. The role of the Model Forest was to provide a shared risk environment to innovate and support broader policy objectives.
- Building capacity (to participate in a governance forum, technical training, or other) leads to enhanced engagement and empowerment to open doors to collaboration and new thinking that would otherwise be unavailable.
- Education and youth engagement are essential for long-term sustainability. Consolidating long-term governance processes around forest and landscape conservation and biodiversity is a process that can span generations; provide opportunities and technical tools for young people to be able to responsibly lead in participatory processes.

MAINSTREAMING BIODIVERSITY CONSERVATION IN THE CHOCO-ANDINO MODEL FOREST, ECUADOR

Summary

The Choco-Andino Model Forest is located in one of the most biodiverse and vulnerable ecosystems on the planet; the conservation of natural heritage is a priority. With high levels of fragmentation and degradation Model Forest stakeholders agreed that no single approach or organization can reconcile biodiversity conservation and economic well-being in rural Ecuador on its own. The Model Forest has adopted a mix of approaches to change people's behaviour so that the concepts, principles and techniques that support healthy ecosystems are viewed as an opportunity, and subsequently become part of the daily life of the local population. To that end, stakeholders agreed to pursue three key themes: joint environmental governance, sustainable landscape management, and integrated human development. Under these themes land tenure, sustainable natural resource management/production/use, research, communication and cultural reinforcement are priority areas of work seen as leading to sumac kuasay[1] *of local communities. They directly align with national and international biodiversity goals and commitments.*

1 The Indigenous Worldview of good living **"Sumak Kausay"**. It is a paradigm of the sustainable society based on the balanced and equitable link between economy and nature in a reciprocal relationship between human beings and nature.

Description of the area

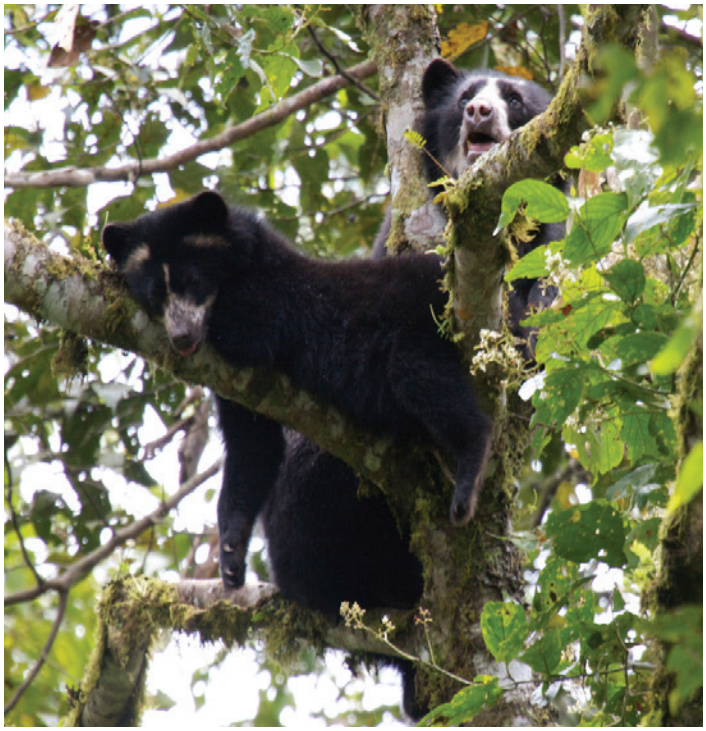
Ecuador is one of the 17 mega diverse countries of the world. Roughly 8% of amphibian species, 5% of reptile species, 8% of mammal species, and 16% of bird species in the world are found in a country which comprises only 0.2% of the world's land area[2]. Ecuador also suffers from high rates of deforestation.

The Choco-Andino Model Forest covers an area of 1,243 km^2 and is located north of the Equator, on the Pacific slope of the Andes Mountains in the province of Pichincha (northwestern end of the Metropolitan District of Quito (MDQ)). It encompasses 6 rural parishes: Calacalí, Nono, Nanegal, Nanegalito, Gualea and Pacto.

High levels of biodiversity and endemism are still found in the area. In fact, the Model Forest is located between two biodiversity hotspots: the Tumbes - Chocó - Magdalena hotspot and the Tropical Andes hotspot. For this reason the area is of global interest with respect to biodiversity conservation.

Topographically, altitude ranges from 500 - 4,700 m.a.s.l., resulting in a landscape characterized by a mosaic of ecosystems and uses. Eleven ecological systems ranging from the high mountain grasslands (Moors) to the Piemontanos rainforests have been identified, with rainforest predominating at about 65,000 hectares. Within this bio diverse territory, more than 60% is managed for conservation or sustainable use, including:

- 3 Areas of Conservation and Sustainable Use - ACSU[3] declared by the MDQ as Natural Area Heritage Reserves of the State[4]
- 8 Protected Forests
- 20 Private and Community Reserves
- The Ecological Corridor of the Andean Bear (*Tremarctos ornatus*)
- 3 important bird conservation areas: the Mindo, located on the western foothills of the Pichincha volcano, the Maquipucuna-Río Guayllabamba and the Mashpi-Pachijal



Principle economic activity includes small- and medium-scale agriculture (sugarcane, fruit, bananas, yucca, coffee, cocoa, palm, corn, beans, potatoes), timber plantations, flower production, and dairy and fish farming. Trade and ecotourism are considered growth categories. The majority of land is privately owned.

Fragmentation and destruction of wildlife habitat due to insufficient enforcement of laws and regulations, irresponsible logging practices, and agricultural expansion[5] are significant concerns. Insecure land tenure and urban expansion are also a key factors driving deforestation and represent major threats to forest conservation and landscape connectivity. Finally, gold and copper mining exploration is also currently underway in priority micro-basins for biodiversity conservation.

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2 **https://biodiversitygroup.org/documenting-biodiversity-ecuador/**

3 The ACSU are one of the management categories of the Metropolitan System of Natural Areas-MSNA of the Municipality of the Metropolitan District of Quito. This category includes sustainable production and ecosystem conservation goals in an integrated management model articulated with local stakeholders.

4 The Geobotanical Pululajua Reserve, unique in its category, was created in 1978 due to its particular geological history and biological wealth, especially its plants. It is a complex of 3,800 has formed by a large central caldera surrounded by domes and hills, which rise inside the crater. It is one of the few craters inhabited in the world (Oleas, 2015).

5 Environment Ministry of Ecuador 2015 - **https://www.cbd.int/doc/world/ec/ec-nr-05-es.pdf**

Objectives

The Choco-Andino Model Forest uses a blend of approaches to natural resource management—landscape, ecosystem, multisectoral and watershed—involving a broad stakeholder group comprised of local landowners, government authorities and decision makers, private industry, and non-governmental organizations (NGOs). The goal is to demonstrate that economic development and environmental protection are not mutually exclusive. It is hoped that this new approach will ensure a sustainable and autonomous supply of environmental goods and services over the long term.

Key themes the Choco-Andino Model Forest seeks to address with respect to the conservation and restoration of forests are organized as follows (the strategies used to support the key themes can be found in Annex A):

a) A **joint environmental governance model** that considers the conservation of natural heritage in its planning and administrative decisions: governments and communities together identify ways to build landscapes and identify livelihood opportunities with greater resilience capacity when faced with the effects of climate change. This involves building capacity for participatory governance and landscape planning, coordinating inter-institutional actions to improve environmental monitoring by national and local authorities, influencing municipal land use incentives, and addressing land ownership issues (i.e. updating the land registry, promoting mechanisms for payment of environmental services), among others.

b) **Sustainable land management:** from an economic perspective, dairy farming occupies the highest percentage of land covering about 27,500 hectares, fragmenting natural forests and impacting biodiversity. Stakeholders in Choco-Andino Model Forest are promoting the development of sustainable land management practices (such as organic agriculture, agroforestry and ecotourism), to reduce environmental impacts and reconcile enhanced production with conservation.

c) **Comprehensive human development:** To encourage a process of change towards sustainable practices the Model Forest seeks to integrate biodiversity into other dimensions of human activity, such as culture, science, education, and technology. A strong communication and outreach platform is integral to this goal.

Progress and benefits to date

While the Choco-Andino Model Forest is relatively new as an organizational platform (accepted as a member into the International Model Forest Network in 2016), it builds on a history of collective action and momentum around landscape level approaches to sustainability. The Model Forest continues this work by advocating that governments and landowners specifically account for biodiversity conservation (i.e. the creation of conservation areas, sustainable practices, the Andean bear corridor (*Tremarctos ornatus*), private conservation areas and protected forests) in their management plans.

Changing land use patterns and practices takes time. While many local economic activities are still carried out using traditional methods, often with negative impacts on biodiversity conservation, the Model Forest is working to shift the production paradigm towards sustainable alternatives. The following has been of benefit:

- Restoration of 16,000 hectares of forest and degraded land
- Training in organic farming, agroforestry, analog forestry, and sustainable livestock production
- Training in sustainable tourism, ornithology tourism
- Producer exchange tours
- Researchers attracted to the area have made important discoveries vis-a-vis the richness and abundance of species within the Model Forest area, including: olingo mist (*Bassaricyon neblina*), the torrenticola frog (*Hyloscirtus torrenticola*), and the electric fish (*Brachyhypopomus occidentalis*)
- Generating local awareness to promote environmental conservation

Policy relevance

Activities in the Model Forest directly and indirectly help deliver on both national and international biodiversity related goals, and assist in mainstreaming biodiversity. The main policies, programs and commitments include:

National

- *National Biodiversity Strategy and Action Plan 2015-2020*: The Model Forest supports implementation of this plan in a number of ways, including: increasing awareness and capacity among local populations; reducing pressures on, and unsustainable use of, biodiversity; incorporating gender considerations into decision making; encouraging sustainable agriculture; undertaking restoration; conserving natural heritage; protecting threatened species, and; creating spaces for regional dialogue, participation and integrated natural resource management[6], among others.
- *National Forest Incentive Program*: Choco-Andino Model Forest participates through the Forest Partner Program (10,000 hectares) and the Forest Restoration Program (4,000 hectares) under restoration.
- *National Plan for 'Good Living'*: This plan is a foundation document for the country and the instrument outlining how public investment should be directed. It includes an environmental component that is concerned with climate change, with guaranteeing a healthy and sustainable environment including fragile ecosystems, and with promoting the participation of stakeholders across sectors and at different scales (national, regional and territorial).

International:

- *Convention on Biological Diversity Aichi Targets*: Choco-Andino Model Forest activities directly contribute to Aichi Targets 3, 4, 5, 7 and 15.
- *Sustainable Development Goals*: activities also contribute to SDGs 8, 13, 15 and 16.
- *Initiative 20x20*: A regional commitment in support of the Bonn Challenge to bring 20 million hectares of degraded and deforested land in Latin America and the Caribbean into restoration by 2020. Ecuador has pledged 500,000 hectares.
- *UNFCCC Paris Agreement*: The forest sector and protected areas are captured in Ecuador's Intended Nationally Determined Contribution (INDC). Reforestation and restoration are key activities listed. Effective water management and sustainable agriculture also feature.

6 Page 52 of Ecuador's 5th National Report the CBD references national biodiversity objectives **https://www.cbd.int/doc/world/ec/ec-nr-05-es.pdf**

Next steps

The first step was, and will continue to be, the strengthening of multistakeholder governance structure as a foundational element in the longevity of the Model Forest. As well, current financial resources for the office of the Choco-Andino Model Forest are provided by each participating parish. With limited resources, stakeholders are seeking to mainstream the Model Forest approach through all levels of government (provincial and municipal) and society as an efficient way to build sustainable natural resource management considerations into land use planning over the long term.

Although there is a system for accountability and monitoring of Model Forest activities and impacts, there is no specific system that measures regional changes at the ecosystem level through environmental variables. The Model Forest has partnered with local NGOs to develop an integrated monitoring system that accounts for the effects of both production and conservation on the ecosystems within its territory. A monitoring system for plant biodiversity and forest productivity at different altitude levels has been created, and the installation of a water quality and quantity monitoring system for the watershed is planned.

Additional planned activities include:

- Restoring 5000 hectares of fragile ecosystems (mainly cloud and rain forest)
- Strengthening and integrating agricultural and non-timber forest product value chains
- Preventing agricultural and livestock activities in unsuitable areas
- Carrying out studies that demonstrate the relationship between agroforestry, carbon and biodiversity practices and disseminate results to stakeholders
- Better engaging women and youth to build future capacity for sustainable landscape management
- Conducting an analysis of the landscape and connectivity of forests to prioritize ecological restoration in the territory
- Monitoring of restoration areas and generation of baselines and technical information, and publication of a protocol to monitor ecological restoration areas in the Model Forest
- Realization of the *First Choco-Andino Regional Contest on Methods of Production and Sustainable Living*, a challenge to increase the value, dissemination and use of sustainable production and management practices to conserve of the cultural and natural heritage of Choco-Andino

Conclusion

The Choco-Andino Model Forest is unique in the country. It builds on and supports an effort already underway in the territory and is considered a platform that plays an important role in the promotion and validation of alternative land management approaches that are generating sustainable livelihoods and contributing to the conservation of biodiversity.

Ecosystem health and recovery depends on decision makers and natural resource users who, in one way or another, affect long term sustainability of an area. Promoting a bio-centric approach and encouraging a change in production methods has helped initiate change in landowner perspectives regarding the importance of forests and the environmental services they provide. These efforts are helping to mainstream biodiversity considerations at the local level while also supporting national and international objectives.

Annex

Key themes to promote biodiversity conservation and the strategies used to achieve it (as related to Objectives).

Key themes	*Strategy examples*
Joint environmental Governance	• Strengthen the internal governance model of the MF by contracting a technical manager. • Consolidate the dialogue platform of the MF that involves other government and strategic actors. • Influence in the application of municipal incentives for forest conservation (e.g. tax incentives). • Motivate the update or generation of new ordinances for joint landscape-level planning. • Strengthen local capacities of the Autonomous Decentralized Governments and grassroots organizations involved with the MF regarding environmental governance and integrated landscape management.
Promotion of sustainable land management (SLM)	• Promote the continuity of ecosystem restoration linking the National Restoration Program with other initiatives such as Initiative 20x20 and the Bonn Challenge. • Generate capacity for ecological restoration and boost the value chain around these activities (nurseries, seed production, etc.). • Generate cooperative agreements with other key players to projects that implement sustainable land management practices and systemize their results. • Create awareness in the MF population about the importance of sustainable use and management of natural resources (soil, water, biodiversity), and of the need to strengthen local and regional food security. • Carry out studies that demonstrate the relationship between agroforestry-carbon and biodiversity practices and disseminate results to stakeholders.
Comprehensive human development	• Promote communication through the creation of the On-line Community Radio of Choco-Andino MF and its information center. • Promote the exchange of experiences and networking with other MF. • Prepare future generations for sustainable land management, integrating youth into the production, research, and political and training projects.

RESTORATION OF KARAGO LAKE LANDSCAPE, NORTH-WEST RWANDA

Summary

The Rwandan forestry situation is complex, and for good reason, notably: 1) a high population density and widespread poverty exert enormous pressures on forest resources, and; 2) limited institutional support for local communities and sustainable natural resource management. As a result, increased soil erosion, deforestation, land degradation, reduced water quality and quantity, and other factors contribute to the loss of biodiversity.

To help address some of these issues, in 2012–13 national and international partners joined efforts in Rwanda to implement a Model Forest in the Karago Lake and watershed (Gishwati area, north-west) focused on conservation and sustainable natural resource management through agroforestry and forest landscape restoration (FLR).

The main driver behind creation of the Model Forest was an interest in promoting a participatory governance structure to develop a common vision and approach to managing natural resources in a highly fragmented and densely populated area. A need for improved land use practices to reduce soil erosion and improve water quality and livelihoods also figured prominently.

The results to date from the Karago Lake project directly support a number of Rwandan national and international policies and commitments related to the sustainable use and conservation of biodiversity through ecosystem restoration.

Description of the area

Rwanda is one of the poorest countries in the world with an annual per capita income of $540 per inhabitant[1]. It is also characterized by a very high population density—approximately 400 inhabitants per km^2 with some regions exceeding 1,000 inhabitants per km^2. The terrain around the developing Model Forest is mountainous and rugged, the highest peaks of which are the Karisimbi Volcano and Mount Muhe. The main water body, Lake Karago, extends over an area of 27 hectares (ha).

The climate is generally temperate. The zone has a mean temperature of 15°C and abundant precipitation, approaching 1,400 mm per year. In general, the dominant crops are potatoes, corn, wheat, beans, coffee, tea, flowers and peanuts. Dominant tree species include Eucalyptus, Cypress, Pine.

Wildlife has all but disappeared in the area, but in the remaining forests reptiles, a wide variety of bird species, and some small ruminants such as hares and jackal, can be found. Gishwati Natural Forest and Volcanoes National Park are also home to numerous animal and plant species.

The considerable pressures exerted on the natural resources of the six districts comprising the developing Northwest Rwanda Model Forest (Bulera, Musanze, Rubawu, Ngerorero, Rutsiro, and Nyabihu) is evidenced by high levels of soil and wetland degradation, deforestation and loss of overall biodiversity. In addition, economic development and industrialization / urbanization trigger demand for more transport thereby increasing energy demand (firewood, charcoal production, and gas) and associated carbon emissions contributing to climate change.

Objectives

Beginning in 2011, the African Model Forest Network (AMFN), IUCN, the World Agroforestry Centre (ICRAF) and the Rwandan Ministry of Natural Resources worked jointly to implement a project entitled “Forest Landscape Restoration and Model Forest Development in Rwanda”, funded by Natural Resources Canada through the International Model Forest Network (IMFN). Of Rwanda’s 26,338 km^2 of land, the developing Northwest Rwanda Model Forest (FMN-ORc in French) covers 3,931.06 km^2.

The main watershed management activities focused on the restoration of riparian zones around Karago Lake as central to improved community well-being and were to include creation of a -multi-stakeholder governance structure (a fundamental principle of a Model Forest), establishing nurseries for locally grown seedlings considering genetic resources (high quality seeds), and a train the trainers approach to improved silvicultural techniques. Tree species diversity was a key consideration for both locally preferred species, as well as those that would adapt well to the area, contributing to overall enhancement of biodiversity and climate change resilience. Organic fertilizers were used to avoid contamination of the lake.

These objectives were developed and analyzed during workshops to raise awareness of the Forest Model concept and develop the common vision. The workshops were held in each of the six districts involved in the project and used to identify FLR as a key concern and common activity.

1 according to the 2012 census

Progress and outcomes to date

Participatory governance is a process built on trust. Engaging in the process takes time and signals a willingness to do things differently. For this reason, managers of the Ministry of Natural Resources were sensitized to landscape level and participatory governance concepts as related to the Lake Karago restoration project. As a result, both the Environment and Forest Directorate, as well as the Forest Program of the Rwanda Natural Resource Agency, were appointed as national focal points for FMN-Orc signaling strong government support.

The Lake Karago restoration project was launched officially within the context of the 37th anniversary of the Rwanda reforestation campaign. More than 122,650 alder seedlings, 600,000 bamboo seedlings, 320 avocado and 500 Japanese plum trees were grown in five locally established nurseries. The seedlings were planted on a 36 ha buffer zone at critical sites bordering the lake where the degree of degradation required the planting of erosion and wind-resistant species. The selected species responded to the agricultural needs of the population as well as the government's forestry needs. In addition, a clear connection was established with the issue of food security and the recuperation of biological diversity.

In all, 72 training workshops were held where government officials, farmers, NGO representatives and rural communities learned about the Model Forest process, best practices in high quality seed production, erosion control and soil fertility management. Training was also provided on agroforestry techiniques, as well as how to combat the erosion of green spaces and soils to prevent sedimentation in the lake.

Gender considerations formed part of the planning process. For example, a study on women's involvement in the FMN-ORc with respect to producing the bamboo die Gataraga as a way to increase incomes was undertaken. The experience of Rwandan women on the use and valuation of bamboo has since been shared with women elsewhere in the Congo Basin.

Benefits and policy relevance

Forests are a national priority in Rwanda. Restoration of the landscape around Lake Karago is a complement to actions already underway under the National Forest Policy, deemed the world's most inspiring and innovative forest policy in 2011 by the World Future Council[2]. While the overall project was small, it has helped limit erosion and promote the rehabilitation of ecosystem services vital for regaining ecosystem functionality, in turn helping to support local communities.

Participating stakeholders perceive the ongoing Model Forest process as a tool to strengthen local capacity to achieve sustainable development, and an approach to connecting and networking with other Model Forests. The Model Forest process and Karago Lake project focus on objectives and priorities in which the Government of Rwanda has an interest with respect to the following commitments:

At the national level:

- Vision 2020 of the Government of Rwanda, which includes a 30% increase in forest cover by 2020.
- The Poverty Reduction Strategy, which is part of Vision 2020, focuses on addressing the immediate challenges facing rural development through agricultural transformation and human development based improving the living conditions of rural populations, as well as governance.
- The national policy environment as well as Organic Law No. 4 / .2005 DU8 / 4/2005 on the modes of protection and promotion of Rwanda's environment.
- Law No. 62/2008 of 10/09/2008 which establishes rules for the conservation, protection and use of water resource.
- The national decentralization policy which encorages local stakeholders to play a fundamental role in implementing government policy.
- In addition, the restoration of Gishwati is cited as an example of success in the Rwandan 2014 National Report to the CBD **https://www.cbd.int/doc/world/rw/rw-nr-05-en.pdf**.

2 **http://www.newtimes.co.rw/section/article/2011-09-22/35196/**

At the international level:

- The Convention on Biological Diversity (CBD): particularly Aichi Target 5 (slow the rate of loss of natural habitats and degradation and fragmentation is significantly reduced), Target 7 (areas under agriculture, aquaculture and forestry are sustainably managed, ensuring conservation of biodiversity), Target 14 (ecosystems that provide essential services…are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable) and Target 15 (…at least 15 per cent of degraded ecosystems are restored, thereby contributing to climate change mitigation and adaptation and to combating desertification).
- The Sustainable Development Goals: mainly the followings targets 8, 13, 15, 16 and 17.
- The Bonn Challenge: a global goal to restore 20 million ha of degraded and deforested land by 2020 (Rwanda pledged 2 million ha).

Next steps

The methodology to monitor and review progress was conceived to be shared among the Provisional Steering Committee of the FMN-ORc, the communities directly involved and the technicians assigned to the project, as well as the larger AMFN and IMFN. A participatory assessment of the project remains to be done but will be based on a systematization approach, including:

a. photographs of the reforested site

b. evaluation of species growth

c. collection of data in terms of silt reduction and return of ecosystem goods and services in the lake

d. stakeholder reflection/discussion workshops

e. course correction (if possible)

f. documentation of the process and reporting

Once the above actions are complete or underway, the goal is to increase in the area under restoration, strengthen the stakeholder 'buy in' for the initiative, and conduct studies related to the socioeconomic contribution of the project to local communities and the viability of a payments for environmental services scheme as a source of sustainable funding. Finally, formalization of the Model Forest and entry into the IMFN as a full member is the next step in the organizational process.

Other initiatives have been carried out in different Model Forests in Africa that may be of interest to readers of this case study. For example, in Cameroon, the use of healthy seeds, biofertilizers (mycorrhizae) and biopesticides has provided an opportunity for local communities to use modern agroforestry methods with low environmental and health impacts. Also in Cameroon, the introduction of unconventional livestock farming has reduced pressures on biodiversity in national parks (Campo-ma'an Model Forest).

Conclusion

The creation of a Model Forest in north-west Rwanda supports the broader national strategy for restoring land, soil, forests and water resources (and does so in an integrated manner) for the preservation and maintenance of biodiversity, and for the production of beneficial environmental services to the Rwandan population.

This case study demonstrates how changing local behaviours and practices, and engaging stakeholders in a meaningful way, can positively impact communities and the environments on which they depend, indirectly mainstreaming conservation values into forest management decision-making at the local level while setting the stage for broader impacts in the future.

MANITOBA MODEL FOREST:

CONSERVING BIODIVERSITY THROUGH STAKEHOLDER ENGAGEMENT & USE OF SCIENCE & TECHNOLOGY

Summary

Moose are an important wildlife species in eastern Manitoba. They are of significant cultural importance to Indigenous peoples, provide for recreational hunting opportunities, and are the subject of activities such as photography and eco-tourism. Moose are an important component of the overall biodiversity found in the boreal forest, including as a food source for predators such as wolves and black bear and are part of a complex food web that includes other species such as white-tailed deer and woodland caribou. Moose are the largest mammal in the boreal forest (weighing up to 600 kg) and the largest member of the deer family.

Manitoba Model Forest (MBMF) is currently leading an effort to reverse the decline in the moose population within its territory, which had dropped from about 2,400 moose in the year 2000, to only 800 moose by 2010. The factors responsible for the decline are numerous, complex and interrelated. Observations by trappers, wildlife managers, hunters and others indicated that the wolf population in the Manitoba Model Forest (MBMF) area had increased dramatically, particularly in the last 10 or more years, negatively impacting moose populations. Other factors are also likely responsible for moose population decline.

Through an interdisciplinary, multi-stakeholder approach to landscape level natural resource management, the moose population is slowly recovering, directly contributing to Canada's national and international targets for forest and biodiversity conservation and other commitments.

Description of the area

MBMF encompasses approximately 1 million hectares in eastern Manitoba (Figure 1). The majority of the MBMF territory is covered by boreal forest, one of the largest forest biomes in the world. A smaller part of the area includes agricultural land, much of which was formerly forested. The MBMF area has a small population relative to its size, with approximately 15,000 people residing there.

Starting in the 1920s and 30s, the main economic driver in the area was forestry, specifically the harvesting of spruce and pine taken from local lands being cleared for agriculture for the production of newsprint. In 2009, the newsprint mill closed. Today, the economy in MBMF is focused on agriculture, tourism and the generation of hydroelectricity. Traditional activities of hunting, fishing and trapping continue to be practiced by Indigenous peoples. In addition to industrial and recreational use of the forest, MBMF also contains several provincial parks, which contribute to the province's network of protected areas.

Biodiversity is rich in MBMF with several hundred species of birds, fish, amphibians and mammals. Despite its proximity to Manitoba's capital city (120 km to Winnipeg, population of about 800,000), MBMF remains an unspoiled oasis. Larger mammals in the MBMF area include black bear (*Ursus americanus*), wolf (*Canis lupus*), moose (*Alces alces*) and white-tailed deer (*Odocoileus virginianus*). Moose are a highly sought and valued by both Indigenous subsistence hunters and licenced (non-Indigenous) hunters. The MBMF is also home to the most southern range of woodland caribou (*Rangifer tarandus caribou*) in western Canada, a protected species designated as Threatened under Canada's Species at Risk Act.

Figure 1

About Manitoba Model Forest

Manitoba Model Forest (Inc.) was established as a non-profit, non-governmental organization (NGO) in 1992 and was one of the original Model Forests established under Canada's Model Forest Program. MBMF is managed by a large and diverse Board of Directors, reflective of the varied interests in the area. The Board includes representatives from towns, municipalities, Indigenous communities, industry, NGOs, universities and the Government of Manitoba.

The mandate of MBMF includes conducting ecological, social and economic research on all aspects of the boreal forest and using that knowledge to develop innovative and novel approaches to natural resource management. The Model Forest also develops and administers forest education programs for students, and creates provincially-accredited natural resource curricula for schools. Finally, the MBMF works with communities to identify economic opportunities from the forest. The MBMF has also worked with other Model Forests on projects in Canada, Chile, Costa Rica, Mexico and Indonesia.

Key biodiversity issue being addressed

Moose require a mixture of habitats of a variety of ages, which provide both protection and food, and their habitat requirements can overlap with those of other species such as deer and caribou. Forest harvesting creates important young habitat for moose, but the resulting network of access roads and trails from forestry operations and mining exploration activities can also create challenges for wildlife management as they provide easier access by hunters into formerly remote areas (where the moose are), and can facilitate the movement of other species such as wolves and deer into moose areas.

The MBMF is currently leading an effort to reverse a dramatic population decline in the moose population in Game Hunting Area (GHA) 26, which makes up a significant portion of the Model Forest land base. The moose population has declined from approximately 2,400 in the year 2000, to only 800 by 2010 (Figure 2). MBMF, and in particular, the MBMF Committee for Cooperative Moose Management (CCMM), have worked closely with the Manitoba government to research and understand the causes of the decline, and to develop solutions with a range of partners.

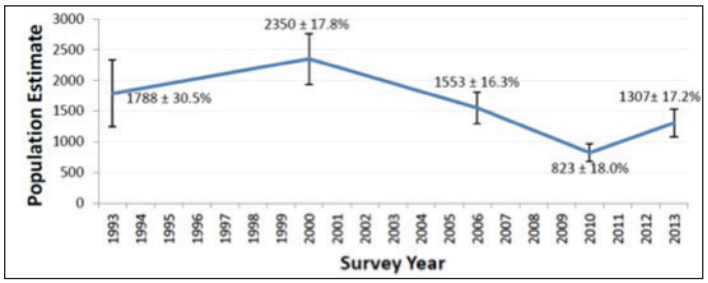

Figure 2

Manitoba Model Forest Committee for Cooperative Moose Management (CCMM)

The CCMM was established in 1995 as a multi-stakeholder committee of the Manitoba Model Forest to promote the conservation, recovery and sustainability of eastern Manitoba moose populations. Its purpose is "to provide a forum for people with a common interest in moose conservation to share information and ideas, participate in management projects and activities, and develop cooperative recommendations to Manitoba Conservation and Water Stewardship (MCWS), for the conservation and management of moose in eastern Manitoba, including advice and recommendations on moose recovery strategies and action plans". MCWS is the government agency responsible for managing the province's wildlife resource.

The CCMM operates under a set of core principles designed to foster inclusive stakeholder participation, including (*inter alia*): recognizing and maintaining all traditional, cultural, social and ecological values associated with moose; recognizing and respecting Indigenous and treaty rights and responsibilities; consideration for economic stakeholders; open and transparent communications, and; integrating western science with local and traditional ecological knowledge. Membership ranges from Indigenous communities to hunting/trapping associations, to hydro-electric companies, government representatives, conservation groups and forest industry.

The role of the CCMM in reversing the precipitous decline in the moose population in GHA 26 has been to 1) conduct research and monitoring to understand the factors responsible for the population decline, and 2) develop and facilitate the implementation solutions collaboratively with the Government of Manitoba. This is done through active participation of individuals and organizations that are members of the CCMM facilitated through the Model Forest.

Factors related to moose population decline

Factors such as predation, hunting, road access, and parasites and disease can have direct or indirect effects on the moose population. In addition, other factors such as habitat, climate and severe weather events can play a fundamental role in determining the capability of an area to support moose.

The main source of predation on moose in GHA 26 is wolves. Local observations, Aboriginal Traditional Knowledge and aerial surveys conducted by the CCMM indicate that the wolf population has increased over at least the last decade, and the population is sufficiently high in GHA 26 to negatively impact the moose population.

As wolves feed opportunistically, the presence of alternative prey species in an area can also influence the overall predation rate on moose. The relatively new appearance of white-tailed deer in GHA 26 is likely supporting the growth of the wolf population, particularly in the southern portion. Wolves also prey opportunistically on boreal woodland caribou, which are also found in GHA 26.

The CCMM has undertaken several landscape-level research and monitoring studies to understand the population distribution of wolves, moose and deer in the area. While moose were historically distributed throughout GHA 26, based on a combination of local observation and GPS data, researchers found an almost complete absence of moose in the southern part of area from 2010 and onward. This change may be a result of the increased deer population, which in turn increased and sustained the wolf population reducing the moose population in the south. The introduction of the brainworm parasite by deer and its fatal effects on moose may also be a contributing factor.

Researchers also examined the role of corridors (roads, trails, etc.) in the interaction and distribution of wolves and moose in the northern portion of GHA 26 using a global positioning system (GPS) collar on wolves – the first time the technology was used on wolves in Manitoba. Using a combination of the GPS data from the collared wolves, aerial survey data as well as track surveys, the study was able to clearly demonstrate spatial overlap of wolves with moose in the northern portion of GHA 26, negatively impacting moose populations there.

The advances in GPS collar technology and capabilities have also allowed researchers to study, in detail, seasonal habitat use, movements, home ranges and other attributes of animal behaviour (e.g., predation) of various wildlife species, such as moose. This has provided data that would otherwise be difficult to obtain through traditional field studies. When the GPS moose location data is combined with other spatial data (e.g., land cover, roads and trails, water bodies, industrial activities such as forestry and mining), it can provide a powerful landscape scale tool to understand how moose travel, use various habitats, and respond to human activities.

Action taken

In order to halt and reverse the decline in moose, the Government of Manitoba developed an incentive program (which ran from 2010-2015) for local trappers to increase their harvest of wolves with the goal of reducing, but not eliminating, the wolf population in GHA 26. Incentives to trappers included trapping workshops, provision of equipment and financial incentives. However, based on the number of wolves trapped through the program, information from wolf aerial surveys conducted by the CCMM, track studies, and other sources , the wolf population in GHA 26 was considered as having remained high enough to have the ability to significantly impact ungulate populations (such as moose) through predation[1]. A continued high density of wolves in GHA 26 could prevent or slow the recovery of the moose populations or reduce them to a level low enough that moose would become extirpated from the GHA. Additional work was needed.

Complementary initiatives have been developed by the CCMM partnership and implemented by the Government of Manitoba to reduce the deer population in GHA 26, such as increasing the number of deer hunting licenses an individual may hold, as well as extending the length of the fall deer hunting season. As a result, local observers report that the deer population in GHA 26 has declined over the last few years.

In addition, the brainworm parasite is a nematode worm that is carried by deer (but does not affect the deer) that can be transferred to moose, in which it is fatal. In 2012, the CCMM and provincial government began a brainworm monitoring study in GHA 26 in an effort to document levels and distribution of infection in white-tailed deer, as well as how it might be affecting moose in the area. Indeed, high levels of infection were found in GHA 26 deer. Therefore, the deer reduction strategy was designed not only decrease the main prey of wolves and therefore limit the wolf population, but also to diminish the transmission of brainworm to moose.

Finally, there are a significant number of access roads and trails in GHA 26, particularly forestry roads. Upon recommendation from the CCMM, and in partnership with local Indigenous communities, the province carried out road decommissioning work to restrict truck access, reduce ATV traffic and reduce hunting pressure on moose, especially during the vulnerable mating period[2]. In addition, perhaps one of the most visible and successful positive effects (on the moose population) of the activities of the CCMM and its partners has been the temporary moose hunting ban in GHA 26[3].

1 On an annual basis, the proportion of wolves harvested under the trapper incentive program varied from approximately 10% to 50%. The wolf population estimate of approximately 120 individuals (range of 106 to 136) for GHA 26 represents a density of 15 to 19 wolves per 1,000 km^2. This is considered to be a very high density. To put this in perspective, wildlife managers suggest that wolf densities in excess of 10 wolves per 1,000 km^2 have the ability to significantly impact ungulate populations through predation.

2 Decommissioning activities included removal of culverts and bridges, digging of trenches (i.e., ripping up sections of the road) and building of berms at strategic locations on roads, as well as placing barricades on roads at river crossings

3 The moose hunting closure in GHA 26 was implemented in 2 phases. In 2010, the entire area of GHA 26 was closed to licensed hunting. Hunting by rights-based hunters (Indigenous peoples) was allowed to continue throughout GHA 26 as formal government-to-government consultations occurred. Following these consultations, a conservation closure was also implemented, which prohibited hunting to rights-based hunters in certain areas, termed Moose Protection Zones. The closure to rights-based hunting of moose was initiated in January 2012. The total area of closure to moose hunting of rights-based hunters represents approximately 12% of GHA 26. These Moose Protection Zones represent areas in the GHA that still contained higher moose densities, younger regenerating forests (that provide high value habitat for moose) or areas where moose are particularly vulnerable to hunting (e.g., major roads). The remainder of GHA 26 (88% of the area, and termed Moose Conservation Zones, Figure 6) remains open to rights-based hunting for moose. Even though rights-based hunters are allowed to harvest moose in the Moose Conservation Zones, many have chosen not to, allowing the moose population to potentially recover even more quickly. This conservation ethic is to be applauded and demonstrates the value of such collaborative efforts towards the conservation of moose in the region.

Positive impacts of CCMM actions – Signs of recovery of the moose population

It is evident from the discussions in the previous sections that multiple research, monitoring and management actions have been underway for many years to understand the moose population in GHA 26, to determine the causes of the recent decline in the moose population and to not only halt that declining trend, but to reverse it. Credit must be given to the wide diversity of partners of the CCMM, who have worked tirelessly to ensure a sustainable moose population in GHA 26 and beyond. These collective efforts appear to be paying off. Following a 65% decline in moose population between the years 2000 and 2010, and after the initiation of diverse management actions, the moose population has grown to just over 1300 individuals by 2013, representing an increase of 60% from its population low in 2010.

In addition, improvements in other population indices (ratio of calves to cows, bulls to cows) also demonstrate that the moose population is beginning to recover. It will be important to see if these positive trends continue. An aerial survey for moose in GHA 26 was conducted in February 2016 in order to determine a new population estimate. The results are currently being tabulated. The CCMM and its partners are confident that the trend will continue to be positive.

Next steps

The Model Forest, through the CCMM, is currently developing a status report on the moose population in GHA 26 and a summary of all the research and monitoring work the committee has undertaken over the last 10-15 years. This status report will also contain an extensive list of recommendations for ensuring a healthy moose population in GHA 26. The report and associated recommendations will be submitted to the Government of Manitoba for its consideration, including recommendations on how to re-open the GHA to moose hunting, as well as setting a moose population objective. A key to the long-term success of the approaches developed by the CCMM will be the continued and on-going monitoring of wildlife attributes currently being studied, the ability to be adaptive in management approaches (i.e., the ability to respond and adapt to new threats or opportunities) and the continued functioning of the Committee.

The success of collaborative, multi-stakeholder approaches such as those undertaken by the CCMM through the Model Forest can serve as a template for other organizations, not just related to wildlife management, but across a wide variety of issues related to the management of forested landscapes.

Policy relevance: Helping to mainstream Canada's biodiversity commitments

Over the past 20 years, some management recommendations by the CCMM have required the Government of Manitoba to alter provincial legislation, for example, in a specific geographic area where the CCMM was undertaking a landscape-scape experiment and where road access needed to be closed to the public. In other instances, local communities altered their behaviours to take biodiversity considerations into account, such as the voluntary decision of rights-based hunters (Indigenous peoples) to halt moose hunting in certain areas of GHA 26 to allow for quicker species recovery.

The efforts of the Model Forest's CCMM not only contribute to the conservation and recovery of biodiversity at a local and regional level, but also help Canada deliver on its national and international commitments, including the Convention on Biological Diversity. Under the current (2011-2020) strategic plan for the Convention, a number of Aichi biodiversity targets have been developed. The work of the CCMM is helping to fulfill at least 4 of the Aichi targets and correlating nationally determined Canadian biodiversity targets. These include:

Target 1 *By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.*

Through its collaborative relationships, the Model Forest greatly elevates the understanding of all partners and stakeholders in the complexities of natural resource management, including biodiversity. Not only does the CCMM facilitate learning, but provides a mechanism for all stakeholders to participate in developing solutions to conserve biodiversity. While moose is a key wildlife species of consideration by the committee, the CCMM also takes a wider or landscape level view by incorporating the needs of other species such as boreal woodland caribou, which is a Threatened species under Canada's Species at Risk Act.

Target 4 *By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.*

The CCMM is in the process of developing recommendations for the management of moose and other wildlife species in eastern Manitoba. These recommendations will then form the basis for a moose recovery strategy that will be implemented by the province. An important component of this strategy will be the development of mechanisms to ensure that consumptive uses (e.g., hunting) are managed in a such a way as to ensure the long-term sustainability of the moose population, while recognizing and accommodating for the constitutionally-protected rights of Indigenous peoples to subsistence hunting. To achieve this goal, it will be necessary to ensure that all interested stakeholders are involved in identifying and implementing solutions.

Under Target 4, Canada has developed the following target: "By 2020, biodiversity considerations are integrated into municipal planning and activities of major municipalities across Canada". The moose recovery and sustainably strategy that is being developed for GHA 26 is one mechanism to fulfill Canada's obligation.

Target 18 *By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.*

A key mandate of the CCMM is to provide a venue where stakeholders can learn more about the management of natural resources (including biodiversity) and thus, build their capacity to participate in decision-making related to their conservation and sustainable use. Key players in the CCMM include local Indigenous and non-Indigenous communities, and the CCMM forum gives all these stakeholders (and others) an opportunity to influence decision-making by being a part of the process that creates solutions. The specific inclusion of Indigenous peoples on the CCMM also provides an added benefit of providing Aboriginal Traditional Knowledge.

Under Target 18, Canada has developed the following target: "By 2020, biodiversity is integrated into the elementary and secondary school curricula". The CCMM has developed a provincially-approved high school curriculum supplement focused on moose. This curriculum supplement includes information on moose biology and management, as well as traditional knowledge from Indigenous Elders who

participated in Traditional Knowledge interviews. The MBMF has also developed other biodiversity and natural resource curriculum supplements on a wide range of topics including boreal woodland caribou, forest ecosystems and glaciation. These documents are available on the MBMF website (**www.manitobamodelforest.net**).

Target 19 *By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.*

The CCMM actively promotes and uses the newest science and technology to understand the ecology of the boreal forest, including biodiversity, such as the first use of real-time GPS collar technology on wolves and moose in Manitoba. This valuable spatial data has been used to conduct habitat use analysis, as well as to understand the geographic spatial overlap of multiple wildlife species. The results of these analysis is promoted by partners through presentations at regional and provincial meetings, workshops and national and international conferences, including those of the International Model Forest Network. Some of this work has also been published in peer-reviewed journals.

Under Target 19, Canada has developed the following target: "By 2020, more Canadians get out into nature and participate in biodiversity conservation activities". The CCMM, and Model Forest more broadly, facilitates this by encouraging active participation of many diverse stakeholders in developing and implementing conservation solutions for moose. The CCMM also hosts field excursions in which members of the committee and other guests see firsthand some of the solutions being implemented on the ground (for example, road decommissioning activities). The MBMF has also developed two successful outdoor education programs that provide opportunity for educators and high school students to learn about the boreal ecosystem and the conservation and management of forests, wildlife, water and mineral resources, among other programs.

In addition to the Aichi and domestic targets, MBMF's work also contributes to two of the targets under Sustainable Development Goal 15:

15.5 *Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction threatened species*

Target 15.9 *By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts*

Based on population modeling by the CCMM, the moose population in GHA 26 would have been extirpated without immediate and significant management actions. The CCMM, though its diverse partner base, has helped to prevent the loss of a valuable boreal forest species. This was done through local (regional) planning, using participatory processes of the CCMM. As such, the activities of the CCMM directly support both targets under the Sustainable Development Goal 15.

Conclusion

While biodiversity values already form part of the provincial government's resource management planning and decision-making process, the Model Forests' CCMM provided a valuable mechanism to facilitate stakeholder input into that process, including input pertaining to biodiversity. By using science and technology as part of their research and monitoring initiatives, the CCMM is helping to understand the complex interactions within the boreal forest, with an ultimate objective of maintaining sustainable wildlife populations, including moose.

The long-term existence (more than 20 years) of the CCMM has allowed for the development of trust and effective working relationships amongst government, industry, community and NGO partners. This in turn has allowed for open and candid approaches to solving resource management issues.

The structure and functioning of the CCMM has allowed for a regional approach to conserving biodiversity, which helps support biodiversity conservation at a national level. The success of the committee has drawn the attention of stakeholders in other parts of the province, resulting in the relatively recent establishment of a similar moose committee in western Manitoba, further supporting the MBMF's goal to serve as a model for others.

4 Conclusion

While the above case studies are situated in different countries and contexts, the underlying commonality lies in use of the Model Forest approach—based on an inclusive and participatory governance framework—to define and collaborate on the realization of a locally driven vision for the sustainable development of their particular landscapes. Other examples from the IMFN involve Model Forests serving as platforms for inclusive protected area management planning (Costa Rica), as land planners for reducing forest fragmentation (Canada, India), and as concerned with carbon stocks and community vulnerability to climate change (Sweden, Chile), among others.

Through continued cooperation with and participation in international initiatives, processes and events such as the Global Partnership for Forest Landscape Restoration, the Global Landscapes Forum, the Bonn Challenge, and the upcoming CBD COP 13 in Mexico, the IMFN will continue to share important insights into landscape-scale approaches to strengthen collaboration and partnerships for the sustainable use and conservation of biodiversity.

Managing at a landscape or ecosystem scale, whether for FLR, biodiversity or other value, is fundamentally about changing our understanding of our individual and collective impacts on the landscape; the trade-offs that we make in our decisions, and our ability to manage impacts in light of this understanding. Mainstreaming biodiversity requires a culture change (in other words, changing the "business model") which is precisely what Model Forests are intended to do.

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