Showcase that Njeremoto Biodiversity Institute (NBI-Zimbabwe) HLLM Approach helps **CO2 emission reduction**

The Njeremoto Biodiversity Institute (NBI-Zimbabwe) was established on 11th November 2004, registered in Zimbabwe as a Trust: Registration No MA 1434/2004 which has been amended on 24 April 2015 by MA 531/2015, as a non-profit organization (Not-for-Profit Organization) with a mandate to facilitate Sustainable Time Controlled Grazing in degraded Arid and Semi-arid Rangeland Ecosystems: Constitution available on request.

The Institute's work is committed to rehabilitation, regeneration and restoration of degraded arid and semi-arid rangeland ecosystems using Holistic Land and Livestock Management approaches. NBI Zimbabwe currently works with Smallholder Rural Communities in arid and semi-arid degraded rangeland areas of Shurugwi District in Zimbabwe. NBI has been successfully carrying out this work for the last four years.

To NBI, one of the biggest climate change problems, is the predominance of bare-ground as a result of unsustainable land use practices. This problem can be tackled through scaling up our work

The HLLM approach would clearly help **CO2 emission reduction:** Human activities and land use practices, cause greenhouse gas emissions. Greenhouse gases (GHGs) are believed to affect the atmosphere by trapping the sun's shortwave energy and re-emitting it as heat-producing long wave radiation, resulting in increased atmospheric temperatures. This has been identified as the major cause of global climate change, affecting food security and human livelihoods, mainly in the tropics. The GHGs mainly responsible for causing the greenhouse effect include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). Globally, three gases, CO_2, N_2O, and CH_4 contributed 66.5%, 17.2%, and 15.4% of GHG emissions, respectively (Buragienė et al (2015). In order to cope with the impacts of climate change, there is need to reduce the emission of GHGs and promote carbon storage mechanisms. In this regard climate change adaptation and mitigation strategies become inevitable. Carbon dioxide, which is the most abundant gas can be captured and stored in soil and in biomass. Through holistic land and grazing management practices atmospheric GHG concentrations can be reduced

significantly. The profiling of soil cover and biodiversity trends is important to fully implement adaptation and mitigation options. The determination of carbon storage in different flora can help regulate the capacity of biomass to store carbon. In small holder farming systems simple determination methods can be used to estimate GHG emissions by quantifying carbon emissions and the sequestration using measurements to model future trends. Weather data can be used to predict future productivity trends under a changing climate. Among others, NBI through the HLLM approach, addresses SDG 13: 'Climate action: Take urgent action to combat climate change and its impacts'.

Can Cows/Livestock Help Mitigate Climate Change? Yes, They Can!

Livestock emit greenhouse gases. They also can sequester carbon and boost biodiversity.

Livestock provide ecological services too great to warrant their complete removal from the landscape.

Sequestering carbon has become a topic essential to the broader conversation about how our planet might survive the escalating effects of climate change. Livestock are frequently demonized as the enemy of this process. That's partly because raising animals for meat and dairy accounts **for 5 percent of global carbon dioxide emissions**; unsurprisingly, study after study—including the United Nations' most recent, bleak **climate report**—affirms that humans need to reduce consumption of animal-based products in order to fend off planetary disaster. This has led to the advent of a booming industry cantered on plant-based "meats" and "milks," buoyed by a rallying cry from some quarters to abolish meat and cheese and butter and eggs from our diets wholesale.

Livestock farming such as Massy once practiced it—the way many farmers and ranchers continue doing it, by overgrazing of open grass- and rangelands, or by grazing lands not suited to the practice—can be an ecologically ruinous way to produce food. It can destroy soil health and biodiversity, emitting greenhouse gasses in the process, including carbon dioxide. And yet, research also confirms that livestock provide ecological services too great to warrant their complete removal from the landscape.

Properly managed under the right confluence of conditions, cattle, hogs, sheep, goats, and chickens can help mitigate degraded soils and restore healthy ecosystems, which helps lock carbon deep in the ground. About 40 percent of ice-free land on earth is considered grazing land, which sequesters about **30 percent of our planet's carbon pool**.

How Carbon Is Sequestered

Every plant plays the vital function of removing carbon dioxide from the atmosphere, via photosynthesis. Using sunlight's energy, the plant fuses that carbon with hydrogen and oxygen to make carbohydrates, which it moves into the soil through its roots. (It also maintains some carbon in its own leaves and shoots and stems.)

The roots feed the carbohydrates to dirt-bound fungi; in return, the fungi feed minerals back to the plant. As **Mother Earth News** describes it, "This invisible partnership…is the foundation of the terrestrial carbon cycle, as plants incorporate carbon from atmospheric carbon dioxide into carbohydrate biomass."

The longer a plant's roots, the deeper it can sequester carbon in the soil and the more efficiently it can hold it there. A healthy grassland, with a diversity of region-specific native grasses—on Massey's farm, some of which have roots that **extend four feet** into the ground—can create deep carbon sinks. Managing grasslands well also contributes to carbon storage other ways: by building up soil health to make land more resilient to extreme events, according to Marcia DeLonge, senior scientist in the Food & Environment Program at the **Union of Concerned Scientists**. This, she says, "can protect existing soil carbon to some degree, but perhaps more importantly may allow continued carbon sequestration. In other words, even when events like extreme heat, drought, fire, and floods don't significantly affect soil carbon immediately, they could affect the plants above ground that contribute to soil carbon in the longer term."

Trees generally capture and store more carbon than grasses and shrubs. Size, density and longevity all factor into this ability; tropical staple crop trees are especially good at it. And tropical forests sequester half our terrestrial carbon—about 470 billion tons worth.

Often working against these heroic efforts on the part of plants and trees, though, is agriculture. To produce some of the food we need in order to live, we disturb or destroy our carbon-storing

ecosystems. We run animals through them in unsustainable ways, or we chop them down and plough them up to raise monocultures of crops like corn and soy—some of them to feed livestock, others to produce the fake meat that's meant to replace real meat—that require still more ploughing, as well as the application of chemicals that kill beneficial soil bacteria, fungi, insects. The land becomes degraded, and carbon-poor.

Improbable and illogical as it may seem, livestock can help.

The Benefits of Animals: Managed Grazing

That disastrous storm on Massey's farm similar to the NBI experiences in Zimbabwe, was followed by five years of drought. Across Australia, over-cleared, over-grazed grasslands suffered, susceptible to dust storms and erosion. Massy and NBI-Zimbabwe, though, began to "swing toward ecological grazing and cropping," he says, educating himself by visiting other farmers who'd recognized the destructiveness of ranching-as-usual.

That swing meant rotating sheep and cattle more frequently from paddock to paddock, giving grasses and forbs a long rest in order to bounce back. It meant seeding in more and various plants adapted to the parched soil, including nitrogen fixers such as alfalfa. The trampling of the sheep's (livestock's) hooves mixes manure with soil, fertilizing it and depositing organic matter. This action opens up the soil, seeds it, and allows plant roots to go deeper–all without the destruction of tilling or ploughing. Over time, "native grasses, forbs, and legumes that seemed to have disappeared slowly returned," Massy says. So did many species of wildlife: "We now have over 140 bird species, four macropod species, and much else."

If managed grazing could be amped up worldwide, it could sequester over 16 gigatons of carbon by 2050.

According to Project Drawdown, livestock grazing occupies one-quarter of land area in the world—some 3.3 billion hectares. It estimates that 79 million hectares already employ managed grazing along the lines of what Massy and NBI now practices on his farm/communities, although it considers 1.3 billion hectares of the earth's plant-able surface

to be wet enough to be suited to this practice. If managed grazing could be amped up worldwide, it could sequester over 16 gigatons of carbon by 2050.

What managed grazing does not do, is eliminate methane and nitrous oxide emissions. And yet, Project Drawdown found that carbon sequestration more than offset them. "If we can figure out where the best places to have rangelands are, and make sure they're well managed, we can gain all these benefits," says DeLonge.

More Animal Benefits: Silvopasture

Massy has done another important thing across his rangelands over the past 10 years: He's planted 50,000 native trees and shrubs, building on efforts begun by his father in the 1960s. That is exactly what silvopasture is, and it increases soil biodiversity and the carbon-storing potential of animal husbandry. Eric Toensmeier, who researches Project Drawdown's food-supply land use, calls it "a powerful tool…that is not being taken seriously."

How powerful? Project Drawdown estimates that silvopasture can sequester almost two tons of carbon per acre per year, making it one of the most effective carbon-storing tools in agriculture. This power is already recognized in countries like Brazil, **Australia**, and Mexico, where governments give farmers financial incentives to transition to silvopasture systems. So far in the U.S and in Africa., though, it remains little-known and -understood.

With some notable exceptions—like on Steve Gabriel's 35 acres of once-nutrient-poor hay land outside Ithaca, NY. There, Gabriel, an agroforestry specialist in Cornell University's **Small Farms Program**, has been experimenting with silvopasture for the past five years. He wrote a **guidebook** to it for North American farmers interested in learning more about it, based partly on his own experience.

Finding flexible solutions to land usage, plus more good land on which to grow food, is essential to our survival.

Forests in their own right are critical to climate mitigation and carbon storage—tropical forest preservation ranks number five on the Project Drawdown list; temperate forest preservation is number 12. But in countries such as Ecuador, forest preservation can be at odds with the needs

of impoverished subsistence farmers, who often clear trees to raise crops. Teaching these farmers about silvopasture, then helping them **implement and maintain, say, goats** on their land, could help to keep forests more intact —and carbon stocks somewhat more secure.

As part of **diverse farming systems** in places like Argentina, on degraded land especially, silvopasture has also been found to be **more profitable for farmers** than pasturing alone, which might encourage people to adopt it—again, preventing them from cutting down forest for crops; the Argentine government has provided some **subsidies** to help farmers switch over. Toensmeier hopes financial incentives might one day be available to African and American farmers, to adopt carbon-friendly methods like adding trees to pasture. However, he says, "I would definitely not recommend paying people to convert forest to silvopasture for carbon reasons unless and until there is evidence that it actually results in net sequestrations, which I doubt for now." climate bonus when munched by livestock: Their tannins might slow down digestion, reducing methane emissions.

In the longstanding woodlands that surround his open pastures, Gabriel uses the sheep to clear out underbrush. This frees the ground up for shelter, and for the seeding in of forage grasses, which can lead to soil remediation and—potentially, in the long run—carbon storage.

On the other hand NBI in Zimbabwe uses community livestock to regenerate, rehabilitate and restore degraded arid and semi-arid rangeland ecosystems.

Resources

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