

Evidences

Study #4062

Contributing Projects:

- P795 - 14. Agroecology
- P793 - 11. Silvopastoral Systems
- P945 - 2. Plantations and tree crop commodities

Part I: Public communications

Type: OICR: Outcome Impact Case Report

Status: On-going

Year: 2020

Title: ShadeMotion: Applications of an open-source canopy shade-modelling software in post-secondary curricula, short-term training workshops, and demonstration farms across Latin America for climate-resilient agroforestry practice

Short outcome/impact statement:

The Tropical Agricultural Research and Higher Education Center's (CATIE) ShadeMotion innovation is an open-source technology that models tree shade and can inform tree-planting practices to improve crop yields, enhance agroforest sustainability, and support climate adaptation of both farm and agro-ecosystems. ShadeMotion is intended for use by researchers (including students), farmers, and practitioners (e.g., extension staff, technicians). Integration of ShadeMotion in post-secondary curricula, training, and application in demonstration farms in Latin America supports capacity development and more sustainable agroforestry practices.

Outcome story for communications use:

Agroforestry management requires understanding of how to optimize the benefits of light and shade for crops like coffee and cocoa. Sophisticated modelling systems for light and tree growth dynamics are available (e.g., plant-geometry physiology models), requiring intensive and complex field data for calibration, which may act as a barrier. The Tropical Agricultural Research and Higher Education Center's (CATIE) ShadeMotion offers an alternative shade-modelling system more accessible to end-users, with simpler data inputs and open-access Internet-based software enabling interactive and customizable simulations [1]. Users can explore different tree-planting configurations, mixtures of tree species, and optimal shade canopies for a specific location for one moment in time or a full planting cycle [1]. When combined with knowledge of a crop's shade tolerance, ShadeMotion can guide the design and management of an agroforestry system's biological and financial productivity.

ShadeMotion is taught as part of capacity-building activities across several projects in Latin America for farmers via farmer field schools [6,7] and demonstration farms [8], as well as training workshops for researchers and practitioners (e.g., extension staff, technicians) [5,11,14,15,32,35,36]. In the Chocolate4All Project, over 450 Honduran farmers learned to use ShadeMotion to improve shade canopy design for enhanced cocoa management and yields [6,7]. ShadeMotion was applied to optimize farm layout and management in 150 livestock farms in the International Climate Initiative Trees on Farms Project [38]. Since 2016, the Korean-Latin American Food and Agriculture Cooperation Initiative trained 44 extension staff and tested ShadeMotion and other agronomic-agroforestry technologies in 32 demonstration coffee farms across eight countries [8,11,12,13,14]. In 2019, 54 extension staff received ShadeMotion training as part of a project led by the Nicaraguan Ministry of Family, Community, Cooperatives and Associative Economy [32,33,34]. In 2020, 125 extension staff across Latin America were trained as part of the Maximizing Opportunities for Coffee and Cocoa in the Americas (MOCCA) Project [36,38]. Since 2009, CATIE's Cacao Technical team led training workshops for 372 practitioners on ShadeMotion [5,15]. Collectively, these capacity-building efforts help farmers and practitioners make context-specific decisions for sustainable and climate-resilient agroforestry.

As part of CATIE's postgraduate program, ShadeMotion features in the Master's in Agroforestry and Sustainable Agriculture [4] and short-term trainings on cocoa/coffee and agroforestry [15]. Since 2009, an average of 15 students register in the Master's program each year and build technical capacities for the ShadeMotion technology [38]. Several graduates are now professors in Colombian universities (e.g., Universidad de Nariño, Universidad del Tolima) and have integrated ShadeMotion into their curricula on agronomy and forestry [16,17,18,19].

Links to any communications materials relating to this outcome: <Not Defined>

Part II: CGIAR system level reporting

Link to Common Results Reporting Indicator of Policies : No

Stage of maturity of change reported: Stage 2

Links to the Strategic Results Framework:

Sub-IDOs:

- Increased resilience of agro-ecosystems and communities, especially those including smallholders

Is this OICR linked to some SRF 2022/2030 target?: Too early to say

Description of activity / study: Agroforestry system development requires understanding of how to best plant trees in order to optimize the benefits of light and shade for crops and livestock. The ShadeMotion innovation can inform best tree-planting practices for shade to support the sustainability and climate adaptation of both farm and agro-ecosystems.

Geographic scope:

- Regional

Region(s):

- Latin America and the Caribbean

Comments: Some indications of global awareness of the innovation can be gleaned from Google Analytics: for example, the top ten countries' visitors to the shademotion.net website originate from Colombia, Costa Rica, USA, Brazil, Spain, Guatemala, Peru, Mexico, Honduras, and Argentina.

Key Contributors:

Contributing CRPs/Platforms:

- FTA - Forests, Trees and Agroforestry

Contributing Flagships:

- FP2: Enhancing how trees and forests contribute to smallholder livelihoods

Contributing Regional programs: <Not Defined>

Contributing external partners:

- UDENAR - Universidad de Nariño

CGIAR innovation(s) or findings that have resulted in this outcome or impact:

ShadeMotion

Innovations:

- 2130 - Shademotion software for tree shade modeling, Version 5.0 (<https://tinyurl.com/2levjswt>)

Elaboration of Outcome/Impact Statement:

Over thirty years, the Tropical Agricultural Research and Higher Education Center (CATIE) developed and advanced ShadeMotion to inform best tree-planting practices for agroforestry development, management, and climate adaptation [1].

To influence practice, CATIE engaged Latin American farmers and practitioners in capacity-building activities via field schools [6,7], demonstration farms [8], and training workshops [5,11,14,15,32]. At the community-level, farmers are expected to learn about agroforestry systems, climate change, and shade management [7]. Farmers are expected to apply and use ShadeMotion to inform practice. To date, 500 Honduran farmers [6,7], 150 livestock farms in Honduras [38], and 32 demonstration farms across Latin America [8] applied ShadeMotion. As a result, farm management and agroforestry practice are expected to become more sustainable and climate-resilient. At the practitioner-level, extension staff and technicians are expected to learn about shade management and climate-smart agricultural practices [5] and build ShadeMotion technical skills. Since 2009, 372 cacao practitioners participated in ShadeMotion training [5,15] and 44 extension staff received training since 2016 [11,12,13,14]. In 2019, ShadeMotion was taught to 54 Nicaraguan extension staff to support a ministry-led project [32,33,34]. In 2020, Project MOCCA trained 125 extension staff to manage cocoa agroforestry systems [36,38]. Practitioners are expected to apply ShadeMotion to inform practice and promote the innovation. Over time, widespread adoption will improve crop quality, yields, and livelihoods.

To influence education and research, CATIE teaches ShadeMotion in postgraduate courses (e.g., Masters in Agroforestry and Sustainable Agriculture [4]) and short-term trainings (e.g., specialized courses on cocoa/coffee and agroforestry [15,32,33,35,36]). Students are expected to build ShadeMotion skills; over 150 students received training to date [38]. Program graduates are expected to apply ShadeMotion learning in their future careers. Several graduates, now professors at Colombian universities (e.g., Universidad de Nariño (UDENAR), Universidad del Tolima (UTOLIMA)), have integrated ShadeMotion into their curricula, expanding student exposure [16,17,18,19]. Approximately 240 UDENAR and 40 UTOLIMA students build skills in ShadeMotion each year [38]. In alliance with Universidad EARTH, Project MOCCA supported ShadeMotion training for 40 Costa Rican students [35,38]. In addition to education, CATIE disseminates ShadeMotion through peer-reviewed publications [3,23], conferences (e.g., 2019 World Agroforestry Congress [24], 2020 FTA Science Conference [10]), and its website. The website has 3544 users running 5496 sessions, indicating returning usership. Collective academic exposure is expected to build wider awareness of ShadeMotion and support uptake of ShadeMotion in new research areas [9,20,21,22,25,26,27,28,29,30,31,37]. Over time, researchers are expected to initiate new projects using ShadeMotion.

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Quantification: <Not Defined>

Gender, Youth, Capacity Development and Climate Change:

Gender relevance: 0 - Not Targeted

Youth relevance: 1 - Significant

Main achievements with specific **Youth** relevance: There are CATIE activities associated with the ShadeMotion innovation that involve young people (e.g., graduate students) [4, 16, 17, 18, 19] .

CapDev relevance: 2 - Principal

Main achievements with specific **CapDev** relevance: There are CATIE activities dedicated to capacity development of the ShadeMotion innovation among intended user groups (e.g., farmers, graduate students, researchers, extension staff) [4, 5, 6, 7, 8, 12, 13, 14, 15, 32, 33, 35, 36].

Climate Change relevance: 1 - Significant

Describe main achievements with specific **Climate Change** relevance: ShadeMotion can be applied as a tool to inform climate-smart agricultural practice and enable communities to increase their climate resiliency by adapting agroforestry practices to accommodate the effects of climate change on their local system [3, 4, 5, 6, 7, 24].

Other cross-cutting dimensions: <Not Defined>

Other cross-cutting dimensions description: <Not Defined>

Outcome Impact Case Report link: [Study #4062](#)

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