4.9 Increasing local capacities in rural Panama

JACOB L. SLUSSER, ALICIA CALLE
and EVA GAREN

The Republic of Panama contains high levels of biodiversity due to its geological history and geographic location. With only 77,082 km^2 of land, Panama contains 10,400 species of vascular plants, 259 mammal species and 957 bird species (Holdridge 1971; ANAM 2006).

The country's diverse forests were estimated in 2010 to cover approximately 3.4 million hectares (ha) — 45% of total land area — but the country lost more than 30% of its forest cover from 1950 to 2000 (ANAM 2008; FAO 2010). The deforestation rate has slowed since 2000 due to increased enforcement of environmental laws, and to efforts to reforest and regenerate secondary forests (Wright and Samaniego 2008). Forests continue to be degraded by unsustainable land-use practices, however. According to the World Bank (2014), only 7.4% of Panama's surface area is suitable for crops and livestock, but more than 30% is dedicated to agricultural production. Agricultural expansion continues to be a primary driver of deforestation in Panama (Mozejko 2009; Peterson St-Laurent, Gelinas and Potvin 2013).

Silvopastoral systems at the farm and landscape level improve productive capacity and ecological integrity.

The emergence of cattle ranching

Cattle ranching in Panama began in the early 16th century with the arrival of the Spanish colonists. During the 20th century, agriculture expanded into wetter regions of the country (Connelly and Shapiro 2006).

Cattle ranching has been incentivized by the country's Agrarian Code. It grants all unoccupied territory owned by the state, including forests, to those who convert the land to productive uses (Connelly and Shapiro 2006; Peterson St-Laurent, Gelinas and Potvin 2013). International development agencies, such as the World Bank and the Inter-American Development Bank, have invested millions of dollars in Panama over the past

Jacob L. Slusser works for the Smithsonian Tropical Research Institute and the Environmental Leadership and Training Initiative (ELTI), Panama; **Alicia Calle** works for the University of California-Santa Cruz, California; and **Eva Garen** works for ELTI, Yale University, New Haven, Connecticut.

several decades to promote cattle ranching (World Bank 1973; IDB 2014). The country's primary lenders also grant credit to farmers to establish cattle pastures (Mozejko 2009). Some speculate that local banks view cattle ranching as being able to yield profits even during drought years, when farmers can lose 100% of their crops (Ariosto 2009; Wright and Samaniego 2008). Generally speaking, government incentives in Panama promote foreign investment and economic development at the expense of natural resources (Mozejko 2009). The country is a critical link in global trade via the Panama Canal.

By the late 1990s, the Azuero Peninsula was an agricultural mosaic of deforested land used for agriculture and cattle ranching, with forest patches and trees scattered throughout the landscape. Research shows, however, that the farmers who deforested the region also protect native forests and plant native trees in their pastures; their reasons include providing food and shade for cattle and restoring ecosystem services (Garen et al. 2009; 2011).

Although cattle ranching generates significantly less revenue than agriculture, the practice is deeply ingrained in Panamanian culture and is a central component of rural livelihoods (Heckadon-Moreno 1984, 1997; Wright and Samaniego 2008). According to Heckadon-Moreno (1984, 1997), this is because cattle are less vulnerable to pests and drought and can be sold when cash is needed. Cattle are also a low-cost investment, since they can feed on grass and require minimal care (Connelly and Shapiro 1996). Although labour costs have recently doubled in the Azuero Peninsula due to tourism development, cattle pasture can be easily managed with fire and cheap, accessible agrochemicals.

Alternatives: silvopastoral systems

As is common throughout Latin America, cattle farmers in Panama cut and burn trees to plant exotic aggressive grasses, which they manage by annual burning and extensive applications of herbicides. Grazing pastures are perpetually overgrazed due to a lack of rotations. The environmental impacts of these practices include loss of biodiversity and soil carbon, decline in soil fertility, soil erosion and compaction, reduced water infiltration and regulation capacity and watershed contamination (Steinfeld et al. 2006). Stocking rates are lower than one animal per ha (Connelly and Shapiro 2006).

These consequences are particularly severe in the dry forest ecosystem of the Azuero Peninsula. With an annual rainfall range of 1,054–1,678 mm and a dry season lasting five to six months, the region's extreme climate variations compound the stresses of unsustainable land-use practices and challenge efforts to restore the ecosystem (ANAM 2004; Wishnie et al. 2007). As the climate continues to change, vulnerability in the region increases.

Advances in ecological restoration knowledge have led to strategies to restore tropical forests and native tree cover, including native species reforestation and agroforestry.

Such strategies have the potential to reverse these trends (Chazdon 2008; Chazdon et al. 2009; Lamb, Erskine and Parrotta 2005). Silvopastoral systems (SPSs), which combine trees, forage shrubs and grasses with livestock production, can increase biodiversity and ecological integrity while complementing traditional livelihood practices (Palmer 2014). SPS can improve on-farm productivity by increasing edible biomass, producing timber and non-timber forest products and diversifying production systems (Murgueitio et al. 2011). Intensive silvo-pastoral systems (ISSs), which integrate a high density of fodder shrubs with timber species, short grazing periods and lengthy pasture recovery times, can deliver even greater productivity benefits (Murgueitio and Solorio 2008).

At a landscape scale, SPSs can increase the diversity of shrub and tree species through the establishment of living fences and wood lots, protection of riparian zones and integration of trees in pastures, which can promote higher levels of biodiversity and connectivity between remnant forest patches (Harvey et al. 2005; Murgueitio et al. 2011).

Increased vegetation cover also improves the provision and regulation of ecosystem services. SPSs can decrease soil erosion, improve nutrient cycling, enhance soil fertility, reduce watershed contamination, improve hydrological cycling and increase carbon sequestration, crop pollination and pest management, all of which are vital to ecosystem services (Chazdon et al. 2009; Calle, Montagnini and Zuluaga 2010; Murgueitio et al. 2011).

SPSs are virtually absent from the Panamanian landscape. There are three primary reasons for this:

- The government provides no incentives for SPSs, which require substantial up-front investments in labour and materials. Although legislation passed in November 2013 promised an 85% reimbursement for investments in the cattle ranching sector, including SPSs, the program remains unfunded (Diaz 2013).
- Farmers in the region are not familiar with SPSs and most agricultural extension workers have no training beyond conventional practices. Furthermore, there is little capacity to propagate and cultivate the native tree species utilized in SPSs — more than 75% of Panama's reforestation efforts in the past decade have focused exclusively on exotic tree species (Wishnie et al. 2007).
- Many farmers prefer not to have trees on their farms, believing that they shade out grasses and compete for scarce water supplies.

The adoption of SPSs at a landscape scale requires a strategy that demonstrates to land-holders how the system can increase on-farm productivity and resilience. Only when farmers appreciate the productive advantages of SPSs will they be likely to adopt them. Successful on-farm examples can encourage farmers to work together to seek funding and pressure government agencies for technical assistance. This is particularly relevant in the

Azuero Peninsula, where SPSs could deliver profound increases in farm productivity during the dry season.

A new approach to landscape restoration

Recent advances in research and practice related to SPSs have failed to reach the people who make land-use decisions in Panama. To address this gap, the Environmental Leadership and Training Initiative (ELTI)[1] provides capacity-building opportunities and leadership support to land-holders, extension agents, local authorities, policy-makers and business leaders, who make decisions about land use in multiple-use, human-modified landscapes. ELTI's goal is to conserve and restore tropical forests and native tree cover using strategies that respond to the local needs and realities of landholders. ELTI also offers financial assistance for professional development and mentoring and technical assistance to develop and implement local projects.

In 2009, ELTI implemented a field course in the Azuero Peninsula for land-holders and environmental authorities on native species reforestation, agroforestry and SPSs. The course was inspired by an analysis of native tree planting and protecting practices in the region (Garen et al. 2009; 2011), which revealed that the majority of landholders were interested in learning about agroforestry and SPSs. ELTI coordinated a four-day field trip to visit SPS model farms that had been established with technical assistance from Colombia's Center for Research in Sustainable Agricultural Production Systems (CIPAV). The primary goal of the field trip was to facilitate farmer-to-farmer interactions about experiences with SPSs.

As a result, several farmers decided to test SPSs as an alternative to their conventional practices. ELTI linked the farmers to the Global Environment Facility's (GEF's) Small Grants Program (SGP), which was interested in supporting SPSs in the Azuero region, and helped the farmers establish a legally recognized association (as required by the SGP). Once established, the Association of Livestock and Agro-Silvopastoral Producers of Pedasí (*Asociación de Productores Pecuarios y Agrosilvopastoriles de Pedasí*, or APASPE) developed a grant proposal with the support from ELTI and CIPAV. In 2010, APASPE received funding to implement the first SPS demonstration farms in the region. Despite initial issues with fund management and starting a new group, the APASPE members enjoyed many successes. They received more funding to establish additional SPSs and other sustainable farming activities.

During the programme's second phase (2014–16), APASPE's goal is to transform conventional farming practices into more environmentally sustainable systems with multiple functions in order to increase farm productivity and restore watersheds and water resources. After only three years, two of the APASPE model farms have shown significant increases in overall forage biomass for cattle, forage production throughout the dry season and milk production (30% increase).

Although it is too early to tell what APASPE's impacts will be at the landscape scale, their initial success is inspiring other landholders to explore SPSs and other conservation and restoration activities. APASPE's SPS initiative will be scaled up from five ha of SPSs on two farms to more than 80 ha on 20 farms. Moreover, APASPE members have hosted more than 500 visitors on their model farms, advised two farmer cooperatives in the preparation of SPS funding proposals and shared their experiences in 25 public forums. If provided with adequate support, these efforts could lead to a growing number of landholders working together at the landscape level for conservation and sustainable agriculture goals.

Conclusions

Despite significant scientific advances in ecological restoration in the context of agricultural landscapes, unsustainable land-use practices continue to cause severe environmental degradation throughout Panama. Conventional cattle ranching threatens the ecological integrity of the Azuero Peninsula and the rural livelihoods of the local people; this will only worsen with climate change. SPSs can help address both ecological integrity and human well-being, but socio-political, economic and cultural factors in Panama have prevented it from being adopted. Addressing these issues will require financial incentives, training in SPS and long-term leadership support for land-holders. Investing time and resources in organizing and developing community groups is one way to help accomplish these goals. It is hoped that APASPE will continue to consolidate this alternative model, eventually linking with other local and national policy processes.

Lessons learned

Building the technical and leadership capacity of community organizations and land-holders, especially when government assistance and interventions for restoration are lacking, can help to initiate and scale up initiatives that restore ecological integrity and improve human well-being within agricultural landscapes.

A range of different activities can contribute to forest restoration and increased native tree cover in multiple-use, human-modified landscapes in the tropics. Restoration projects and programmes with local communities and landholders must therefore address local needs and interests and build on traditional knowledge and practice.

Emerging community-based organizations may require frequent support during the initial stages of development. Issues that seem trivial can morph into larger problems and can break groups apart. The presence of an on-site practitioner who understands the local culture and can provide context-specific technical and leadership assistance can be instrumental to the success of a project during its initial stages.

A training-of-trainers model that is integrated with capacity and leadership training at the local level can help to develop community-level environmental leaders. They can lead efforts to scale up landscape restoration initiatives such as SPSs by communicating best practices to other land-use decision makers.

Endnote

1. ELTI is a programme of the Yale School of Forestry and Environmental Studies (F&ES) in collaboration with the Smithsonian Tropical Research Institute (STRI).

References

Ariosto, D. 2009. *Rainforest clash in Panama signals larger debate.* http://edition.cnn.com/2009/WORLD/americas/04/21/panama.deforestation.

ANAM *(Autoridad Nacional del Ambiente)*. 2008. National report to the forest law compliance and governance process. Workshop, FAO/ITTO, Accra, Ghana.

ANAM *(Autoridad Nacional del Ambiente)*. 2006. *Indicadores Ambientales de la República de Panamá.* Panama City: ANAM.

ANAM *(Autoridad Nacional del Ambiente)*. 2004. *Programa de Acción Nacional de Lucha contra la Desertificación y Sequía en Panamá.* www.unccd.int/ActionProgrammes/panama-spa2004.pdf.

Calle, A., F. Montagnini and A.F. Zuluaga. 2009. "Farmers' perceptions of silvopastoral system promotion in Quindío, Colombia." *Bois et Forêts des Tropiques* 300 (2): 79–94.

Chazdon, R.L. 2008. "Beyond deforestation: restoring forests and ecosystem services on degraded lands." *Science* 320, No. 5882: 1458–1460.

Chazdon, R.L., C. Harvey, O. Komar, D.M. Griffith, B.G. Ferguson, M. Martínez-Ramos, H. Morales, R. Nigh, L. Soto-Pinto, M. van Bruegel and S. Philpott. 2009. "Beyond reserves: a research agenda for conserving biodiversity in human-modified tropical landscapes." *Biotropica* 41 (2): 142–153.

Connelly, A. and E.N. Shapiro. 2006. "Smallholder agricultural expansion in La Amistad Biosphere Reserve: Perceived vs. real impacts of cacao and cattle." *Journal of Sustainable Forestry* Vol. 22 (1/2): 115–141.

Diaz, S. 2013. *Leyes agropecuarias a la espera de implementación. El Financiero. La Prensa Panamá, 10 de diciembre, 2013*. www.martesfinanciero.com/history/2013/12/10/dossier.asp.

FAO (Food and Agriculture Organization). 2010. *Evaluación de los Recursos Forestales Mundiales 2010. Informe Nacional. Panamá.* Rome: FAO. www.fao.org/docrep/013/al595S/al595s.pdf.

Garen, E., K. Saltonstall, P.M.S. Ashton, J. Slusser, S. Mathias and J. Hall. 2011. "The tree planting and protecting culture of cattle ranchers and small-scale agriculturalists in rural Panama: opportunities for reforestation and land restoration." *Forest Ecology and Management* 261: 1684–1695.

Garen, E., K. Saltonstall, J. Slusser, S. Mathias, P.M.S. Ashton and J. Hall. 2009. "An evaluation of farmers' experiences planting native trees in rural Panama: implications for reforestation with native species in agricultural landscapes." *Agroforestry Systems* 76: 219–236.

Harvey, C.A., C. Villanueva, J. Villacís, M. Chacón, D. Muñoz, M. López, M. Ibrahim, R. Taylor, J.L. Martínez, A. Navas, J. Sáenz, D. Sánchez, A. Medina, S. Vílchez, B. Hernández, A. Pérez, F. Ruiz, F. López, I. Lang, S. Kunth and F.L. Sinclair. 2005. "Contribution of live fences to the ecological integrity of agricultural landscapes in Central America." *Agricultural Ecosystems Environment* 111: 200–230.

Heckadon-Moreno, S. 1997. Spanish rule, independence, and the modern colonization of frontiers. In A. Coates (ed.). *Central America: A Natural and Cultural History.* New Haven, CT: Yale University Press.

Heckadon-Moreno, S., 1984. *Cuando se acaban los montes: los campesinos santeños y la colonización de Tonosí, Panamá.* Editorial Universitaria Carlos Manuel Gasteazoro and the Smithsonian Tropical Research Institute.

Holdridge, L.R. 1971. *Forest environments in tropical life zones: A pilot study.* London: Pergamon Press.

Inter-American Development Bank (IDB). 2014. Country Projects. www.iadb.org/en/news/news-releases/2014-03-29/central-americacaribbean-renewable-energy,10783.html.

Lamb, D., P. Erskine and J. Parrotta. 2005. "Restoration of degraded tropical forest landscapes." *Science* 310 (5754): 1628–1632.

Mozejko, A. 2009. Sustainability, climate change, and carbon sequestration in Panama. Master's thesis: Faculty of Science, University of Bern.

Murgueitio, E., Z. Calle, F. Uribe, A. Calle and B. Solorio, B. 2011. "Native trees and shrubs for the productive rehabilitation of tropical cattle ranching lands." *Forest Ecology and Management* 261: 1654–1663.

Murgueitio, E. and B. Solorio. 2008. *El sistema silvopastoril intensivo, un modelo exitoso para la competitividad ganadera en Colombia y México. V Congreso Latinoamericano de Agroforestería para la Producción Pecuaria Sostenible* (Proceedings). *Universidad Rómulo Gallegos, Universidad Central de Venezuela, Universidad de Zulia.* Maracay, Venezuela.

Palmer, L. 2014. "In the pastures of Colombia, cattle, crops and timber coexist." *Yale Environment* 360. http://e360.yale.edu/feature/in_the_pastures_of_colombia_cows_crops_and_timber_coexist/2746.

Peterson St-Laurent, G., N. Gelinas and C. Potvin, C. 2013. "Diversity of perceptions on REDD+ implementation at the agriculture frontier in Panama." *International Journal of Forestry Research* Vol. 2013, Article ID 657846. doi.org/10.1155/2013/657846.

Steinfeld, H., P. Gerber, T. Wassenaar, V. Castel, M. Rosales and C. de Haan. 2006. *Livestock's Long Shadow: Environmental Issues and Options.* Rome: FAO.

Wishnie, M., D. Dent, E. Mariscal, J. Deago, N. Cedeno, D. Ibarra, R. Condit and P.M.S. Ashton. 2007. "Initial performance and reforestation potential of 24 tropical tree species planted across a precipitation gradient in the Republic of Panama." *Forest Ecology and Management* 243: 39–49.

Wright, J. and J.M. Samaniego. 2008. "Historical, demographic, and economic correlates of land-use change in the Republic of Panama." *Ecology and Society* 13 (2): 17. www.ecologyandsociety.org/vol13/iss2/art17.

World Bank. 2014. *World Bank Country Data of Panama.* www.tradingeconomics.com/panama/indicators-wb.

World Bank. 1973. Report and recommendation of the president to the executive directors on a proposed loan to the Republic of Panama for a livestock project.