Developing Community-Based Forest Monitoring Systems through Action Research

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ABSTRACT: This APN project set out to test the ideas that communities can provide accurate forest measurements to estimate and monitor forest C stocks, and that action research is an appropriate approach to develop community-based forest monitoring systems. Research collaborators in Indonesia, Cambodia, Lao PDR, Viet Nam and Papua New Guinea trained local facilitators on forest monitoring and community engagement concepts and techniques. The facilitators in turn provided training and ongoing support on biomass assessment to participating communities. The monitoring systems were elaborated to reflect locational, cultural, institutional and other context-specific factors. Action research was found to be a suitable approach for developing the community-based forest monitoring systems. Community understanding of carbon and of biomass assessment protocols and techniques was built gradually over several years of their engagement in measuring their forests, recording the data and discussing the results with the facilitators. This resulted in some communities taking initiative to promote their forest monitoring within and outside their villages. The action research also provided strong evidence that with appropriate training and ongoing support, communities can provide accurate forest measurements for reliable C stock estimates.

KEYWORDS: *REDD+, community participation, forest carbon stock monitoring, action research*

Introduction

REDD+ is a global mechanism that is being developed by Parties to the United Nations Framework Convention on Climate Change (UNFCCC) for financing the management of forests in developing countries to protect and enhance forest carbon (C) stocks. REDD+ is a performance-based financing scheme, meaning that developing countries must demonstrate results to receive payments. This requires that forest C stocks and safeguards that have been agreed for REDD+ are monitored, reported and verified.

But, who should monitor forest C stocks? It is commonly assumed that forest biomass assessment can only be conducted by people who have formal training in forestry. This is because to produce accurate estimates of forest biomass requires expertise in forest sampling, mapping and stratification, sample plot sizing and silting, selection of C pools, use of measurement instruments, and on how to minimise errors and present uncertainties (Pearson, Walker, & Brown, 2005).

Because of this complexity, usually little thought is given to involving local people in forest assessments, beyond the menial tasks of carrying equipment, cutting tracks, etc. However, local communities often have traditional and local knowledge of the forests in their areas that is useful for biomass assessment, and some of the key tasks associated with C stock monitoring, such as the setting up and measurement of sample plots, seem well within community capacities. Further, being locally-based, communities can readily observe forest disturbance and removals, and how REDD+ actions impact safeguards such as biodiversity conservation. Engaging communities as forest monitors could be useful not only for biomass assessment and safeguard monitoring, but also for increasing local understanding of the REDD+ concept and how to ensure REDD+ actions and safeguards are sustained in the future (Scheyvens, 2012).

Based on these considerations, the APN project Participatory Approaches to Forest Carbon Accounting to Mitigate Climate Change, Conserve Biodiversity, and Promote Sustainable Development set out to develop and test participatory approaches to involve local communities in forest C monitoring. The basic research problem identified was that communities lack sufficient information about their forests to consider alternative/new management options, such as REDD+. The objective of community-based forest monitoring is to provide this information. The research questions included: (1) What is an effective strategy to develop community-based forest biomass monitoring systems? (2) Can community-based forest monitoring provide comparable C stock estimates to that of expert assessments?

HIGHLIGHTS

- With appropriate training and ongoing support, communities can provide accurate forest measurements for the assessment and monitoring of forest carbon stocks.
- Action research is a valid and effective approach for researchers and local communities to collaboratively identify problems associated with natural resources and ecosystem services and to propose and test solutions to these problems.
- Communities can play greater roles in forest management than is often thought, and their involvement in REDD+ will contribute to its success as a climate mitigation instrument.

Methodology

In conventional problem solving research, the researcher identifies the problem, gathers data, does the analysis and proposes solutions. If communities are involved, they may be the subject of the research and/or a source of information. Such an approach was considered ill-suited to this APN project for two reasons. First, community institutions and capacities vary widely, meaning that any community-based monitoring system needs to be tailored to local specifics. This tailoring can only be done through an interactive approach that embraces flexibility. Second, local communities may be able to provide ideas for improving the monitoring and they may wish to include additional forest values in the monitoring; hence, an approach that encourages their inputs into the design of the monitoring system is desirable.

With these points in mind, action research was selected as the methodological approach to be tested for developing community-based forest monitoring systems. Action research consists of a set of phases involving planning, acting, observing and reflecting in each research cycle. As a research paradigm, action research takes a markedly different stance from more conventional research approaches by recognising communities as research partners, rather than as research subjects. In action research, the communities contribute to defining the research problem, proposing the action to overcome the problem, conducting the action, reflecting on the results, and designing the next cycle of problem-solving research (Chatterton, Fuller, & Routledge, 2007; Greenwood, Whyte, & Harkavy, 1993). Figure 1 depicts how each of the action research phases was initially envisioned for this APN project.

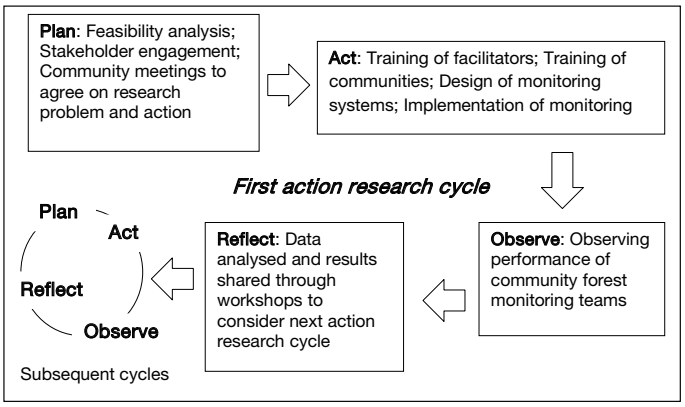

Figure 1. Phases initially envisioned for the action research.

Plan

In some of the research sites, project collaborators had built good working relationships with the communities through their ongoing activities. Where these relationships did not exist, feasibility assessments were conducted to ensure only local communities with a commitment to long-term forest management and some of the basic institutions required to achieve this participated. Key stakeholders at each research site were identified and were engaged through workshops and meetings to ensure their support for the action research. Workshops were then held in the candidate communities for researchers and the communities to agree on the research problem, i.e. that without knowledge on biomass, the communities would not be in an informed position to decide on management options, including REDD+, for their forests. To overcome this problem, the researchers and communities agreed on the "action", i.e. designing and implementing a community-based forest monitoring system, to be taken.

Act

Local level facilitators were foreseen as playing a key role in working with the communities to build the monitoring systems, and it was understood that the facilitators would have to be skilled in both biomass assessment and community facilitation. Recognising that there are few people who possess this combination of skills, building competent facilitation teams was understood to be a key part of the research process. Developing and conducting a training programme for local level facilitators in each country was thus the first step in the "act" phase of the action research.

The second step involved the local level facilitators training the participating communities on the fundamentals of biomass monitoring. For this, the facilitators had to produce an initial biomass sampling design. The local facilitators were instructed to use standard forest inventory manuals only as guides and to work closely with the participating communities to test various measurement protocols and instruments. From this, it was expected that they would produce inventory manuals best suited to forest characteristics and community capacities at the research sites. For example, the national guidelines for community forestry in Cambodia prescribe the use of large rectangular sample plots, but the researchers felt that variable radius circular plots would be statistically more efficient in estimating C stocks and hence proposed they be used for the monitoring.

The community trainings consisted of some "classroom" work on concepts, protocols, etc., but focused mostly on practical measurement exercises. During the training, the facilitators observed what measurement instruments the communities were able to use competently and adjusted the monitoring system accordingly. For example, some qualified foresters felt that the communities would not be able to use handheld Global Positioning System (GPS) devices and thus that they could not take on the responsibilities of locating sample plots and demarcating forest boundaries. However, it was found that after well thought out training exercises were conducted, the communities were able to use GPS competently and so could take on these roles.

Observe

The "act" and "observe" phases of the action research were interlinked insofar as the communities set up and measured some of the sample plots during the training and the facilitators were able to observe how well they conducted these activities. At some of the research sites the communities went on to set up and measure additional sample plots and the researchers were able to observe the quality of the monitoring from the field sheets submitted by the community teams.

Reflect

Reflection was conducted through workshops with the local communities and in some cases also at district level involving district governments, line agencies and other district level stakeholders. In some cases the reflection led to adjustments in the monitoring systems, e.g. in PNG a decision to increase the size of sample plots in order to increase sampling efficiency, and in other cases to an entirely new cycle of action research, e.g. in Indonesia the decision by researchers and the communities to begin preparing a project design document for the voluntary carbon market.

Results and Discussion

Appropriateness of Action Research as an Approach

Action research was found to be a suitable approach for developing community-based forest monitoring systems. Community understanding of carbon and of biomass assessment protocols and techniques was built gradually over several years of their engagement in measuring their forests, recording the data and discussing the results with the facilitators. The enthusiasm generated among the participating communities through this process can be seen in their initiatives to promote the forest monitoring within and outside their villages. For example, village leaders at the research sites in Indonesia used village radio to share lessons from their biomass monitoring activities and monthly women's group meetings to raise awareness on climate change and encourage more women to be involved in the monitoring.

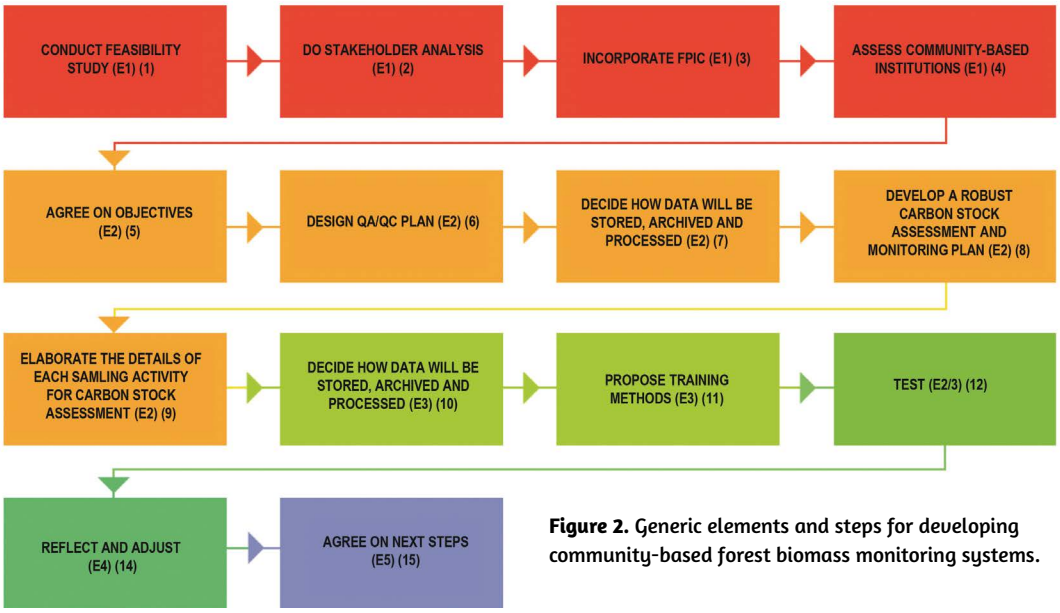

Figure 2. Generic elements and steps for developing community-based forest biomass monitoring systems.

Action research also enabled the communities to improve their forest management and explore new management opportunities. For example, in Indonesia the results of the forest monitoring were used by the facilitators and communities to discuss the idea of delaying the harvesting of trees to increase income as well as time-averaged C stocks. In Viet Nam, with support from the facilitators, the communities have begun planting indigenous tree species and are now monitoring their growth and quality.

Further, because the action research evolved in accordance with context specific factors, such as forest types, forest management and tenure arrangements, and community values, institutions and livelihoods, it generated a better understanding on the generic steps for developing community-based forest monitoring systems through action research. The process is more complex than was initially envisioned. These steps are depicted in Figure 2 and guidance on them is provided in a comprehensive training manual[1]. Figure 2 thus provides in summary form an answer to the first research question "What is an effective strategy to develop community-based forest biomass monitoring systems?"

Scientific Credibility of Community-Based Forest Monitoring

Observation is an important part of action research. Once the monitoring systems were established, the monitoring conducted by the communities was observed directly in the field by the facilitators and researchers as well as by reviewing the data generated. From these observations, and in answer to the second research question "Can community-based forest monitoring provide comparable C stock estimates to that of expert assessments?," the action research provided strong evidence that with appropriate training and ongoing support, communities can provide accurate forest measurements for the assessment and monitoring of forest C stocks. The reliability of the estimates was checked by comparing them with estimates for similar forest types in the literature, and in some cases by having plots re-measured by the trainers.

Table 1 shows that the project produced mean per hectare C stock estimates similar to those in the literature, when differences in C pools and measurement parameters are taken into account. The mean per hectare C stock estimates from the research sites in Cambodia and Indonesia are very close to published estimates for the same forest types. The estimate from the research sample plots in PNG are 20% higher than those from one published study, but this can partly be accounted for by sampling of a smaller minimum tree diameter and inclusion of the lying deadwood C pool (~7% of tree C pool).

Table 2 provides estimates of C stocks in Acacia mangium plantations in Cao Phong, Viet Nam from plots measured separately by the trained community teams and by the trainers. The mean of the differences in the C stock estimates is negligible (0.017%). The sign of the differences for each plot does not indicate any tendency by the community teams to underestimate or overestimate the C stocks; however, further checking of how communities are using the measurement equipment appears desirable, given that the difference is as much as 5% for some plots.

Communities at all sites were trained on tree height estimation using a variety of instruments. It was found out that there are considerable differences in tree height estimates from community teams and trainers using Blume Leiss and SUNNTO clinometers at research sites in Lao PDR. This is not surprising as tree height is a particularly difficult parameter to estimate consistently, especially in dense forest. At sites where tree height estimation is difficult, diameter-height relationships can be developed; this approach was adopted for the research site in Cambodia.

The data collected suggests that community-based forest biomass monitoring is just as reliable as monitoring by conventional teams. However, there are limitations to this concept that need to be recognised. First, when community institutions are not so strong and/or community experience with measurement protocols is limited, even after a well-designed training programme has been implemented, it may desirable that a qualified forester or similar expert continues to

Table 1. Carbon stock estimates from project sites compared with those in published literature.

Project sites	Forest type	Estimates from community measurements	Estimates in literature
Mondulkiri Province, Cambodia	Deciduous forest	75.5 ± 19.6 (SD) tC/ha (rectangular plots) 72.2 ± 23 (SD) tC/ha (circular plots)	73.8 ± 8.6 (SE) tC/ha (Vathana, 2010) Same forest patch
Yogyakarta & Central Java Provinces, Indonesia	Home gardens	34.2 ± 20.6 (SD) tC/ha	35.3 ± 21.2 (SD) tC/ha (Roshetko, Delaney, Hairiah, & Purnomosidhi, 2002) Different province
Madang Province, PNG	Lowland and montane primary moist tropical forest	127.7 ± 40 (SD) tC/ha Biomass estimate for living trees with DBH > 5 cm and lying deadwood	106.3 ± 22.7 (SD) tC/ha (Fox et al., 2010) Same province and forest type Biomass estimate for living trees with DBH > 10 cm

[1]The manual can be downloaded from http://pub.iges.or.jp/modules/envirolib/view.php?docid=4999

Table Header	Communities		Expert		Difference		
	Average DBH (cm)	Biomass (tC/ha)	Average DBH (cm)	Biomass (tC/ha)	Average DBH (cm)	Biomass (tC/ha)	% difference tC/ha
Ru3-01	8.84	7.18	8.81	7.2	0.03	-0.02	-0.3%
Ru3-02	11.09	13.11	11.17	13.55	-0.08	-0.44	-3.2%
Ru3-03	4.02	1.87	4.13	1.96	-0.11	-0.09	-4.6%
Ru4-02	8.75	15.44	8.66	15.16	0.09	0.28	1.8%
Ru4-03	4.92	3.92	4.8	3.73	0.12	0.19	5.1%
Ru4-05	5.84	3.96	5.8	3.91	0.04	0.05	1.3%
						Mean	0.017%

Table 2. Plot measurements by communities and experts, Cao Phong, Viet Nam.

guide the teams during future monitoring. Second, there are some aspects of biomass monitoring that require a high level of expertise that is beyond community capacities. Examples include setting out the sampling design and measuring/estimating soil and wood product C pools. Researchers, facilitators and communities thus all have important roles to play in community-based forest biomass monitoring.

Conclusion

This regional project spanning a number of countries, forest types and forest management arrangements as well as a variety of communities concluded that with appropriate training and ongoing support, communities can provide accurate forest measurements for the assessment and monitoring of forest C stocks, as is required for REDD+ results-based payments. Action research was found to be a valid and effective approach for researchers and local communities to collaboratively develop community-based forest monitoring systems. Action research evolves in a sometimes unpredictable manner in accordance with community institutions, capacities and expectations and according to a timeline that suits the communities. While for the researcher this means not having the comfort of working with a tightly defined research plan, it can provide a meaningful research outcome by engaging communities in defining research problems that affect them and testing solutions to these.

References

Chatterton, P., Fuller, D., & Routledge, P. (2007). Relating action to activism: Theoretical and methodological reflections. In S. Kindon, R. Pain, & M. Kesby (Eds.), Participatory action research approaches and methods: Connecting people, participation and place (Routledge .). London: Routledge.

Fox, J. C., Cossey, K. Y., Nimiago, P., Oavika, F., Pokana, J. N., Lavong, K., & Keenan, R. D. (2010). Assessment of aboveground carbon in primary and selectively harvested tropical forest in Papua New Guinea. *BIOTROPICA, 42*(4), 410–419.

Greenwood, D. J., Whyte, W. F., & Harkavy, I. (1993). Participatory Action Research as a Process and as a Goal. *Human Relations, 46*(2), 175.

Pearson, T., Walker, S., & Brown, S. (2005). Sourcebook for land use, land-use change and forestry projects. BioCarbon Fund, Winrock International.

Roshetko, J. M., Delaney, M., Hairiah, K., & Purnomosidhi, P. (2002). Carbon stocks in Indonesian homegarden systems: Can smallholder systems be targeted for increased carbon storage? *American Journal of Alternative Agriculture, 17*(2).

Scheyvens, H. (2012). Community-based Forest Monitoring for REDD+: Lessons and reflections from the field. Hayama: IGES.

Vathana, K. (2010). Carbon storage of tropical deciduous forests in Mondulkiri Province Cambodia. In International Conference on Managing Forest Resources for Multiple Ecosystem Services under Robust and Fragile Environments. Phnom Penh.

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Project Publications

Edwards, K., Scheyvens, H., Stephenson, J., & Fujisaki, T. (2014). Community based forest biomass monitoring: A manual for training local level facilitators (Research Report 2014/3.). Hayama: IGES.

Ibarra, E. G., Scheyvens, H., & Lopez-Casero, F. (2012). Community Forest Management and REDD+: Opportunities and Challenges. In Greening Governance in Asia-Pacific: IGES White Paper IV 2012 (pp. 85–114). Hayama: Institute Global Environmental Strategies.

Scheyvens, H. (2012). Community-based forest monitoring for REDD+: lessons and reflections from the field. IGES - Policy Brief, (22), 10 pp. Retrieved from http://enviroscope.iges.or.jp/modules/envirolib/upload/4124/attach/PB_22_E_final.pdf

Scheyvens, H., Ibarra-Gene, E., Yamanoshita, M., & Hyakumura, K. (2012). Participatory approaches to forest carbon accounting to mitigate climate change, conserve biodiversity and promote sustainable development. APN Science Bulletin, 2012(2).

Scheyvens, H., Fujisaki, T., & Yamanoshita, M. (2012). Forestry: Importance of local participation in REDD+. In K. Koakutsu, K. Usui, A. Watarai, & Y. Takagi (Eds.), Measurement, Reporting and Verification (MRV) for low carbon development: Learning from experience in Asia (pp. 122–127). Hayama: Japan.

Scheyvens, H., Yamanoshita, M., Fujisaki, T., Avtar, R., Bun, Y. A., Winai, M., … Nhan, M. T. (2014). Community-based forest biomass monitoring: Action research in PNG, Cambodia, Indonesia, Laos and Vietnam (Research Report 2013/5). Hayama: IGES.

Scheyvens, R., Scheyvens, H., & Murray, W. E. (2014). Working with Marginalised, Vulnerable and Privileged Groups. In R. Scheyvens (Ed.), Fieldwork and Development Studies: A Practical Guide – 2nd Edition. Sage Publications.

PROJECT INFORMATION

Title:	Participatory Approaches to Forest Carbon Accounting to Mitigate Climate Change, Conserve Biodiversity and Promote Sustainable Development
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