10. STRATEGIES TO IMPROVE SEEDLING QUALITY IN SMALLHOLDER FORESTRY IN THE PHILIPPINES: A SYNTHESIS OF FINDINGS FROM A SYSTEMS RESEARCH PROGRAM

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Project ASEM/2006/091 and earlier forestry projects in the Philippines funded by the Australian Centre for International Agricultural Research (ACIAR) have identified the prevalence of low quality forestry seedlings. A research strategy involving systems modelling to identify intervention measures, and progress in applying these measures, are described. This has involved developing a seed centre, identifying superior mother trees, developing nursery best management practice guidelines, and assisting the national government to trial these guidelines. Recommendations are made to increase the extension and training effort in production of high quality seedlings, and to conduct further research into watershed restoration utilizing hiqh quality germplasm of indigenous tree species.

INTRODUCTION

High quality seedlings are fundamental to the successful establishment of forests, for both timber production and reforestation of degraded land. However, in the Philippines, the quality of tree seedlings raised in most nurseries is generally low (Tolentino et al. 2002; Gregorio et al. 2010a; Edralin et al. 2010). Prior to ACIAR project ASEM/2006/091, there was little recognition of the importance of seedling quality by nursery operators or by those purchasing seedlings. It was common for most seedlings to have poor root structures (e.g. root coiling, J-rooting) and etiolated stems, and many seedlings were often overgrown. Seedlings were often not sun-hardened before being planted out in the field, resulting in high mortality rates. Disease and nutrient deficiency was also common in seedlings in many nurseries.

Project ASEM/2006/091 was implemented in the Philippines under the auspice of the Australian Centre for International Agricultural Research (ACIAR). The aim of this project was to improve the economic efficiency and policy environment of the Philippines tree seedling nursery sector. Some of the key project results are outlined in the next section. Some reflections are then made about the usefulness of the 'systems' approach that was applied in the project. Finally, research conclusions are presented, followed by recommendations for further actions based on project results.

Key Project Results

One of the first activities of the project was to analyse the structure of the tree nursery industry in the Philippines and the related policy environment. This included undertaking a comprehensive survey of approximately 160 nurseries in Mindanao and Leyte (reported in Gregorio et al. 2010a; Edralin et al. 2010). Simultaneously, a comparative study of the seedling production policies for smallholder and community plantations in three selected south-east Asian countries was undertaken to identify policies and initiatives that may be applied to the Philippines (reported in Mercado et al. 2009; Harrison and Gregorio 2009).

Based on information generated from these two initial project activities, a policy assessment model was developed and then used to analyse the institutional issues surrounding the Philippine nursery sector (reported in Gregorio et al. 2010b, these proceedings). That analysis revealed a complex mix of factors that influence both seedling quality and nursery effectiveness, many of which are interrelated. Working in partnership with key stakeholders, team members identified a number of key areas in which to pilot test initiatives that were most likely to result in substantial improvements in seedling quality. These initiatives included the development of best seedling nursery practice guidelines suited to the Philippines, and the design, implementation and testing of an information, education and communication (IEC) campaign. The 'Q-Seedling' brand was developed as part of these initiatives and proved highly effective in communicating the benefits of producing high quality seedlings. Demonstration activities including the establishment of a demonstration nursery at the Visayas State University, Department of Environment and Natural Resources, local government units and another in partnership with a large private company. Outplanting demonstration sites and 'hands-on' training also proved to be effective means of conveying key messages about seedling quality. The project also pilot-tested the establishment of seed centres located at VSU, DENR Region 10 and in conjunction with Sagittarius Mining Incorporated (SMI) to supply high quality germplasm for commonly planted timber species. The project also developed mother tree program to identify sources of germplasm for both common exotic timber species and difficult-to-grow native species. Both initiatives appear to have been successful in improving the access of nursery operators to high quality germplasm. A capstone activity of the project was to develop and pilot test a nursery accreditation scheme at the local level. The accreditation program incorporated or drew upon elements of various project initiatives, including the IEC activities, extension materials, best practice guidelines, training, and use of high quality germplasm from seed centres. Accredited nurseries were then allowed to use the 'Q-seedling' brand in marketing their seedlings. Accredited nurseries were able to increase both their sales volume and the average price obtained per seedling. The local accreditation program was used as a basis to draft a national policy which was subsequently incorporated into DENR Departmental Administrative Order 2010-1 *Revised Regulations in Governing Tree seed and Seedling Production, Collection and Disposition*. In effect, this DAO institutionalised the national policy on forest nursery accreditation developed in ASEM/2010. Through DAO 2010-11, the project will have a major impact on the quality of seedlings produced in the Philippines in coming years.

Some Reflections on Using a Systems Approach

The factors affecting the quality of tree seedlings and the effectiveness of the nursery industry in producing high quality seedlings are complex. There are many factors that affect both seedling quality and nursery effectiveness. Many of these were previously identified in ACIAR project ASEM/2003/052. However, there is a critical knowledge gap relating to understanding the relative influences of (and interactions between) technical, biophysical, socio-economic, institutional, policy and management factors (drivers) on the outcomes of improved seedling quality and nursery effectiveness. The seedling enhancement project used a systems approach to address this critical knowledge gap. The development of a policy assessment model was a fundamental part of this approach.

To illustrate, a similar approach was used in ASEM/2006/091 to identify initiatives to pilot test which would improve the quality of tree seedlings produced in the Philippines. One of the key factors influencing seedling quality was that few nursery operators were using high quality germplasm, apparently because no such germplasm was available. A simple solution was to establish a seed supply centre that had stocks of common exotic species in high demand. However, by understanding the interactions between various interventions, the project team were able to predict ex ante that simply providing access to improved

germplasm would be ineffective. The analysis with the policy assessment model indicated the need to simultaneously:

(1) improve the technical skills of nursery operators (some of the species needed special propagation procedures);
(2) ensure that nursery operators had knowledge about the benefits of using improved germplasm; and
(3) ensure nursery operators could afford to purchase the seed.

In response, a training program was established that addressed points 1 and 2 and provided the initial supply of seeds from the seed centre to nursery operators without cost. The combined initiatives were highly effective in improving the quality of seedlings produced in participating nurseries. In addition, the survey on which the model was based revealed a very high demand for seedlings of native tree species, for which seeds of most were difficult to obtain and store. In response, a program of marking 'mother trees' of high demand native species was established and details about location and fruiting patterns were provided to nursery operators wanting to propagate these species (reported in Gregorio et al. 2010c, this proceedings; Gregorio et al. 2010d). The requirement to use high quality germplasm was subsequently incorporated into a national nursery accreditation program implemented by the DENR. Previously germplasm quality was not recognised by the DENR as being important.

The above example of how a systems approach facilitated an integrated approach to addressing one of several key drivers for seedling quality illustrates the power of 'systems' approaches to address highly complex issues. This technique has wide applicability to address a range of complex natural resource management issues.

CONCLUSIONS

The implementation of ASEM/2006/091 was timely and corresponded with an increased demand for high quality seedlings for reforestation. In 2004, there were nearly 21,000 ha reforested by government and smallholders in the Philippines (DENR-FMB 2006), which roughly equates to 63 M seedlings being planted per annum. Since ASEM/2006/091 commenced in 2007, the Philippine Government has implemented the Upland Development Program in 2009, with the intention of reforesting over 51,000 ha in that year. Even more recently, in February 2011 President Aquino announced the establishment of the National Greening Program (NGP), which will reforest 1.5 M ha over the coming five years. There will be about 1.5 billion seedlings required for this program. Improved seedling quality through the implementation DAO 2010-11, which was developed based on project outputs, will be used to guide the production of these 1.5 billion seedlings. The seedlings produced following the guidelines set out in DAO 2010-11 will meet basic quality standards which will then result in better outcomes of reforestation efforts, including reduced mortality and improved growth on outplanting.

The initial research revealed that factors influencing seedling quality and nursery effectiveness are highly complex and there are many interactions between various factors. A systems approach was used to help deal with this complexity. Various systems thinking tools were applied that allowed quantitative information from the survey and qualitative information from stakeholders to be integrated to produce a visual representation (model) of the nursery sector in the Philippines that identified the major interactions between key elements. Working in partnership with key stakeholders, team members then used this policy assessment model to identify a number of key areas in which to pilot test initiatives that were most likely to result in substantial improvements in seedling quality. This approach proved highly effective and has great potential for application to other complex problems in the agricultural and natural resource management fields.

The project has developed many extension products that have the potential for much broader distribution, and which will help nursery operators produce seedlings of high physical and genetic quality. The best practice guidelines set out in simple terms the basic requirements to produce high quality seedlings and offer a simple manual for nursery operators to follow to assist in improving the physical infrastructure and the propagation techniques they use. In addition, the project has produced many posters and DVDs (in English, Cebuano and Waray) that highlight important aspects of seedling production. The demonstration activities, including demonstration nurseries and 'hands-on training' have proven to be effective in educating nursery operators about better practices and can be used as a template for an expanded program. In addition, it appears that the field outplanting trials in two municipalities in Leyte have been effective in demonstrating the benefits to both buyers and nursery operators of using superior germplasm; the difference in growth of trees from improved germplasm is apparent, even at a relatively young age. Initial indications are that the seed centres and mother tree programs have been highly effective in improving access to germplasm by nursery operators. There is great scope for expansion of these programs to other regions within the Philippines.

RECOMMENDATIONS

Recommendation 1
ACIAR and project staff approach AusAID to fund the outscaling of the project extension materials and training programs to other areas in the Philippines. This could be done in conjunction with the development of the National Greening Program.

Justification
Since the Phase 1 application for a new project was prepared, President Aquino has announced the National Greening Program (NGP) through Executive Order 26 issued in March 2011. This is a very large commitment to reforestation in the Philippines. About 1.5 billion seedlings will be planted under the NGP. The various project outputs have great relevance to the production of those seedlings. In addition, this would allow the Australian Government to demonstrate a strong commitment to assisting the Philippines in addressing its substantial problems with highly degraded watersheds through funding the implementation of a training program based on previous research it has funded through ACIAR

Recommendation 2
Develop a new ACIAR project aimed at improving the way in which reforestation is undertaken within the Philippines.

Justification
Past efforts in watershed rehabilitation in the Philippines have had limited success, largely due to the failure of programs to adequately address the key socio-economic and institutional issues. The NGP will face similar challenges unless a better understanding of the factors that contribute to the success and failure of rehabilitation is gained. The methodology and approach used in ASEM/2006/091 has great potential to be applied in a similar manner to address the complex issues that affect the success of reforestation efforts. In addition, much of the research undertaken in previous ACIAR projects (e.g. Project ASEM/2003/052 – Improving financial returns to smallholder tree farmers in the Philippines) highlighted the need for watershed restoration using indigenous tree species in critical catchments, with a particular focus on the socio-economic, policy and technical issues.

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