



National Strategy for
Agroforestry
Research in Indonesia
2013-2030



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Agroforestry
Research in Indonesia
2013-2030

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Second Edition (English Version)

Foreword



All praises and thanks always go to Allah SWT for the publication of this National Strategy for Agroforestry Research. This book comes at the right time. Next year, FORDA will enter the final year of the implementation period its 2010 - 2014 Integrative Research Program. Starting in 2015, the scope of FORDA's research activities will refer to the new five-year research program. With the publication of this book, research and development activities in the field of agroforestry have had a clear direction.

Moreover, this strategy is not intended only for research and development activities within the Ministry of Forestry, but also to direct agroforestry research and development activities at national level. Various parties who also conduct agroforestry research and development activities could use this book as guidance.

This strategy has been through long and participatory processes, involving experts from various disciplines. The consultation process to various resource persons have been conducted by the Team of Authors in preparing the first manuscript. The manuscript was then discussed with team of experts in several workshops. As such, this book is satisfactorily perfect as a reference in preparing agroforestry research and development activities.

Even so, it does not mean that the improvement over this strategy is no longer needed. The timeframe that has been set for the implementation of this strategy was long enough, namely 2013-2030. Various events often occur in a dynamic and unpredictable, that make some necessary adjustments are valid to the strategy in order to cope with new directions.

On behalf of the Forestry Research and Development Agency, we greatly thank to the Team of Authors, Team of Experts and resource persons who have completed the writing of this strategy. Special thanks should be directed to the World Agroforestry Center (ICRAF), who has supported the long process in writing of this strategy. We would like also to thank any other parties who have contributed in the formulation of this strategy. May all of the efforts will provide benefits for the development of agroforestry research in Indonesia.

Jakarta, July 2013

Head of Forestry Research and
Development Agency,



Dr. Ir. Iman Santoso, M.Sc.



Preface from Director General of World Agroforestry Centre (ICRAF)



For generations, agroforestry has been practised by local communities in various parts of diverse Indonesia. Indonesia is also one of the few countries that has a dedicated state agroforestry research centre and now a national strategy on agroforestry research as outlined in this publication. As we celebrate 100 years of forestry research in Indonesia and ICRAF's two decades of collaborative partnership, this strategy will guide our joint endeavors. Indeed, the context of pre and post-independence research and forest management has been very different, and the demands of today are much more challenging than when forest research started. But, there also are similarities and there was foresight in the growing importance of forest, trees and agroforestry research a hundred years ago that we salute.

Over the last year, we have had the privilege of being engaged in the formulation and the development of this research strategy. We commend the Forestry Research and Development Agency (FORDA) of the Ministry of Forestry, Indonesia, for the very participatory and inclusive process that it undertook with multi stakeholder engagements, inputs from pivotal partners and collaborators, and key experts and resource people of the country in developing this research strategy. I have full confidence that the ministry along with its partners will be able to operationalize and implement this strategy effectively and efficiently.

Internationally, the development of agroforestry policies is now on the agenda with the new FAO guidebook¹. It quotes positive examples from Indonesia as inspiration for other countries, but is realistic about the many challenges remaining. As has been pointed out in the national strategy document, the promotion of agroforestry contributes to sustainable livelihoods, environmental sustainability, employment generation and poverty alleviation, and biodiversity and environmental conservation. Agroforestry has contributed to the Millennium Development Goals and is clearly seen as contributing to a green economy and a climate-smart agriculture and landscape approach. Trees in agricultural landscapes play multiple roles and there is increasing understanding now of how agroforestry can directly contribute to reducing the adverse impact of climate change, adapting to the changes, and also to enhancing food security and better nutritional intakes.

We have high hopes for the fulfillment of the national strategy's research priorities, namely, i) Smallholder production systems and markets for agroforestry practices; ii) Community-based forest management in state forest areas; iii) Harmonization of agroforestry practices with global climate change, and iv) Enhancing agroforestry practices for environmental services. At ICRAF, we have also refreshed strategy with three strategic goals, namely, i) Build livelihoods by generating knowledge, choice and opportunities; ii) Improve landscapes and their sustainability

¹ Agroforestry on the policy agenda: a guide for decision-makers. Agroforestry Working Paper no. 1. Rome: Food and Agriculture Organization of the United Nations. - See more at: <http://blog.worldagroforestry.org/index.php/2013/07/31/how-to-grow-an-agroforestry-policy-at-home/#sthash.67wlsMsE.dpuf>

by better managing their complexity; and iii) Transform agroforestry impacts to large-scale through policy, innovations and partnerships.

Indonesia's recently developed agroforestry research strategy as embodied in this document and ICRAF's own strategy are very complementary and do reinforce one another. We congratulate FORDA for this milestone achievement in formulating the first ever agroforestry research strategy for this country and we wish FORDA and all collaborators the very best and look forward to continuous partnership between ICRAF and Indonesia.



Dr. Tony Simons

Director General
World Agroforestry Center (ICRAF)

List of Contents

Foreword	iii
Preface from Director General of World Agroforestry Centre (ICRAF).....	v
List of Contents.....	vii
List of Tables.....	ix
List of Figures	ix
List of Abbreviations	xi
1. Introduction.....	1
1.1 The Importance of Agroforestry in Indonesia	3
1.2 Research Status of Agroforestry in Indonesia	6
1.3 Position and Role of the National Strategy in the Agroforestry Research Planning System.....	9
2. Challenges and Opportunities in Agroforestry Research.....	13
2.1 Challenges	15
2.2 Opportunities	24
3. Priority Research Topics	27
3.1 Smallholder Production Systems and Markets for Agroforestry Products	29
3.2 Community-Based Forest Management in State Forest Areas	33
3.3 Harmonization of Agroforestry Practices with Global Climate Change	36
3.4 Enhancing Agroforestry Practices for Environmental Services	38
4. Research Implementation Strategy	41
4.1 Research Approach.....	44
4.2 Dissemination Strategy for Research Results.....	46
4.3 Capacity-Building.....	49
4.4 Research Funding.....	53
4.5 Impact Pathways.....	55
References.....	57

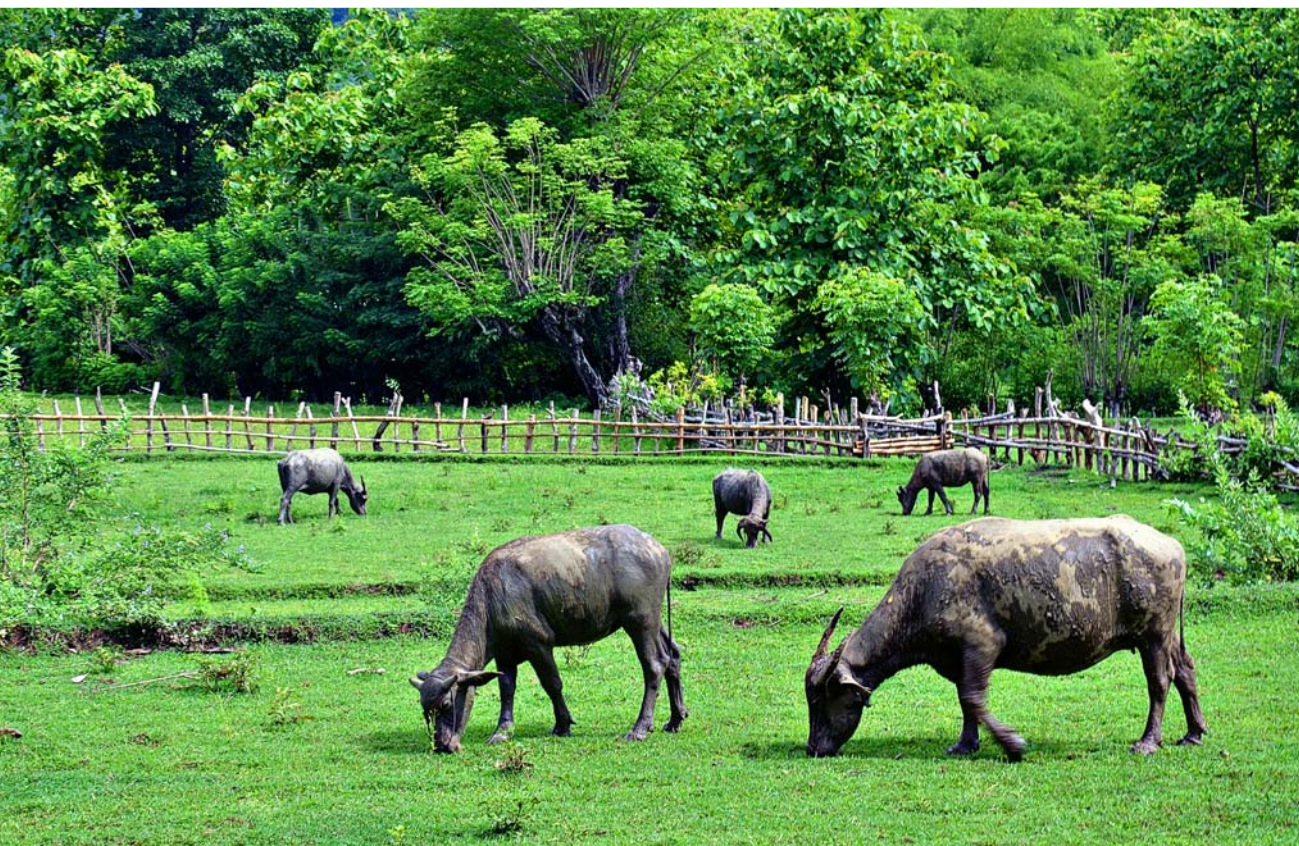


List of Tables

1. Distribution of different dimensions of agroforestry research in Indonesia.....	8
2. Potential partner organizations for conducting agroforestry research in Indonesia.....	26
3. Variety of media for disseminating research findings.....	48
4. The series of strategies for building agroforestry research capacities in Indonesia.....	51

List of Figures

1. Different terminologies for agroforestry practices within different forest types in Indonesia (de Foresta et al. 2000; Sardjono et al. 2003)	3
2. Position and roles of the National Strategy for Agroforestry Research within the national forestry research planning system.....	10
3. The poverty rate in Indonesia from 2004–2011 (BPS 2012)	16
4. Numbers of villages located inside and outside forest areas in some provinces in Indonesia (Badan Planologi Kehutanan, 2007)	17
5. Land-based conflict map in Indonesia (HuMa 2011).....	19
6. The framework of research implementation strategy (Li <i>et al.</i> 2008).....	44
7. Key elements of capacity building (DFID 2010).....	50
8. Illustration of the synergy between research, extension, and education components for improving capacities of the targeted actors	52
9. The impact pathway of the agroforestry research strategy	56



List of Abbreviations

APBD	: Anggaran Pendapatan dan Belanja Daerah
APBN	: Anggaran Pendapatan dan Belanja Negara
ASFN	: <i>ASEAN Social Forestry Network</i>
BPDAS	: Balai Pengelolaan Daerah Aliran Sungai
CGIAR	: <i>Consultative Group on International Agriculture Research</i>
HD	: Hutan Desa
HKM	: Hutan Kemasyarakatan
HPH	: Hak Pengusahaan Hutan
HTI	: Hutan Tanaman Industri
HTR	: Hutan Tanaman Rakyat
ICRAF	: <i>The World Agroforestry Centre</i>
LSM	: Lembaga Swadaya Masyarakat
PMDH	: Pembinaan Masyarakat Desa Hutan
PPMPBK	: Pengembangan Perhutanan Masyarakat Pedesaan Berbasis Konservasi
REDD	: <i>Reducing Emission from Deforestation and Forest Degradation</i>
RKTN	: Rencana Kehutanan Tingkat Nasional
SKSHH	: Surat Keterangan Sah Hasil Hutan



Vision

“Agroforestry is widely adopted by communities as an integrated land use system that can bridge the efforts in enhancing the productivity of agricultural land and forests to meet the demand for food, shelter, energy and other environmental services as a buffer of life, which is based on the development of science and technology in accordance with local wisdom”





Mission

1. To undertake research and development activities in agroforestry to contribute to the achievement of National Forestry Planning (RKTN 2012–2030) targets;
2. To develop partnerships and engagements between stakeholders (farmers, managers/owners of industries, policy makers and development agencies) in the development of agroforestry science and technology in Indonesia;
3. To mainstream agroforestry into forestry development practices and to promote the role of agroforestry as a bridging function between agriculture and forestry, through broad adoption of research-based recommendations by policy-makers and wider communities in Indonesia.





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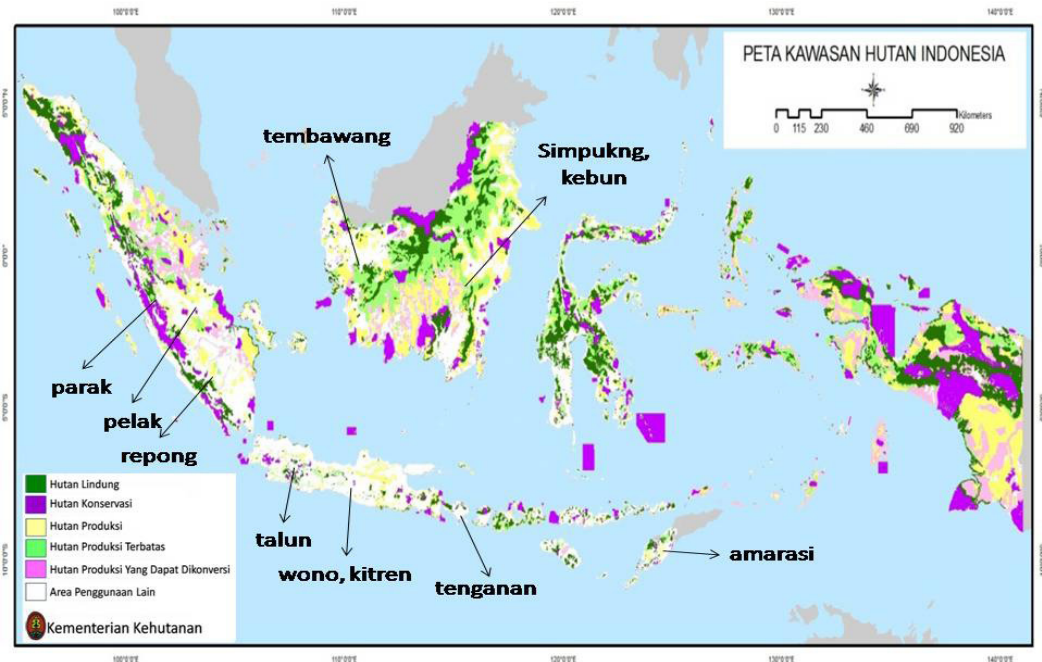
Introduction





1.1 The Importance of Agroforestry in Indonesia

Agroforestry has long been practiced in Indonesia. It may even have been in existence since the occurrence of a major shift from hunting to farming. Some historical records state that the use of home gardens for planting, which can be categorized as agroforestry, has been known since 7000 BC (BPDAS Pemali Jratun 2010). Different models of agroforestry, with their own characteristics, have been applied in different regions in Indonesia. These farming system models are known by different terminologies according to the localities of their practice. These include: “parak” in Maninjau, West Sumatra; “pelak” in Kerinci, Jambi; “repong damar” in the Krui area, Lampung; “tembawang” in West Kalimantan; “simpukng” and “kebun” in East Kalimantan; “talun” or “dudukuhan” in West Java; “wono” and “kitren” in Central Java; “tenganan” in Bali; and “amarasi” in the East Nusa Tenggara region (de Foresta et al. 2000; Sardjono et al. 2003). Figure 1 shows the various existing terms for agroforestry practices in different forest types in Indonesia.



Notes: The forest area map is based on National Forest Planning (RKTN 2011–2030)

Figure 1. Different terminologies for agroforestry practices within different forest types in Indonesia (de Foresta et al. 2000; Sardjono et al. 2003)

Experts define the term agroforestry from different perspectives. Nair (1993) defines agroforestry as an integrated land use system in which social and ecological aspects are embedded in the system. It entails a combination of trees and agricultural crops and/or livestock, either simultaneously or successively, so that one unit of land can yield multiple plant and animal products in an optimal and sustainable way. Lundgren and Raintree (1982) define agroforestry as a collective term for various land use systems and technologies, which are designed for a single unit of land. It is applied by combining woody plants (trees, shrubs, palms, and bamboos) and agricultural crops or animals (livestocks and/or fish), simultaneously or consecutively to promote ecological and economic interactions among the components. Garrity (2004) states that agroforestry is the practice of incorporating trees with annual crops and other agricultural activities.

Based on the variety of definitions in the examples above, and also taking into account the current development of agroforestry practices, the term agroforestry in this National Strategy covers several meanings as follows:

1. It is a collective term for various land use systems and technologies, which are designed for a single unit of land and applied by combining woody plants (trees, shrubs, palms and bamboos) and agricultural crops or animals (livestock and/or fish), simultaneously or consecutively, in a way that promotes ecological and economic interactions among the components.
2. It is an integrated land use system, based on an understanding of multidisciplinary science, that a) maintains the balance between production and environmental conservation activities; b) applies a combination of food crops, livestock, and trees; and c) plays a social role, reducing potential land use conflicts.

Depending on the components that are applied, various forms of agroforestry are practiced. These include: agrosilviculture (a combination of agriculture crops with timber plantation), silvofishery (fish cultivation in a mangrove ecosystem), silvopasture (a combination of forestry and livestock farming), apiculture (honeybee cultivation), sericulture (natural silk cultivation), and cultivation of medicinal plants within tree plantations. These diverse models indicate that an agroforestry system is not only associated with a forest domain, but also with various agricultural development programs, including plantations, animal husbandry, fisheries, and health. Furthermore, agroforestry also covers upstream and downstream areas and connects to the industrial and trade sectors.

As a land use system that has been adapted to indigenous knowledge, agroforestry can contribute to national development strategies by providing employment opportunities (*pro job*), elevating people's livelihoods above the

poverty line, which currently includes about 30 million people (*pro poor*), and contributing to economic development in remote areas (*pro growth*). All of these development goals are in accordance with current government policies.

Apart from their economic contribution, agroforestry systems have positive impacts on environmental conservation. An agroforestry system is able to maintain soil fertility, protect water catchment areas, contribute to carbon sequestration, support biodiversity conservation, and contribute to landscape restoration efforts. For example, the positive role of *repong dammar* in biodiversity conservation is evidenced by the sustained presence of hundreds of rare species such as epiphytic flora, fungi, and various herbs (de Foresta and Michon 1994). In addition, *repong dammar* also serves as a habitat for 92 species of birds and 46 species of mammals, including 17 protected species (ICRAF 2001). Studies by Fernández (2004) and Fernández *et al.* (2003) have shown that agroforestry systems in North Sumatra also contribute to biodiversity conservation and maintain the surrounding natural forest resources for orangutan habitat. In another case, *dudukuhan*, which is a common agroforestry system practiced in West Java, was shown to play an important role in regional economic activities and in preserving various kinds of forest plants and fruits (Manurung *et al.* 2008).

Sabarnurdin *et al.* (2011) confidently predict that agroforestry systems can provide solutions for various social and environmental problems such as global poverty issues, global warming, and environmental degradation. Agroforestry systems offer a solution to the challenge of scarcity of the four basic human needs: food, shelter, energy, and water. Agroforestry is an appropriate option and an important strategy for improving productivity of forest lands as it provides a bridging function of fulfilling the need for agricultural land and expanding the local economy, while preserving forest resources.

In the context of food security, the forestry sector has three main functions as: 1). a provider of environmental services that make sustainable food production possible; 2). a provider of genetic resources to strengthen food production; and 3). a provider of land for farming activities. Through agroforestry, forest lands can be further optimized to support food security programs.

The above description indicates that agroforestry is an efficient land use system that can contribute to both community and national development. Despite this, it is yet to become an important mainstream component within forestry development policy. In fact, agroforestry has been relatively neglected in Indonesia's legal system. Through the implementation of this National Strategy, it is expected that the concept of agroforestry will strongly influence

decision-making processes in forest resource management systems in Indonesia to support sustainable development.

1.2 Research Status of Agroforestry in Indonesia

Research in agroforestry has evolved from the practical knowledge of farmers (Nair 1998). According to King (1987), this practical knowledge originally developed in Europe during the Middle Ages. During this period, people cleared and burned degraded forests, cultivated food crops for extensive periods, and then planted trees. This habit was widely practiced in Finland until the end of the twentieth century, and in Germany until the late 1920s. Towards the end of the nineteenth century, the practice of planting crops under teak stands, known as *taungya*, was developed in Myanmar. At the same time, this practice, entailing cultivation of food crops in teak plantation areas, was also developed in Java, and is known as *tumpangsari* (Sabarnurdin *et al.* 2011).

When the social forestry concept began to spread in the 1970s, forestry was positioned as an important component of rural development. In 1978, the involvement of communities in forest management was taken up as a major issue at the World Forestry Congress in Jakarta. Since then, the term agroforestry has been widely disseminated to the public.

The International Council for Research in Agroforestry (ICRAF) was created in response to a visionary study in the mid-1970s led by forester John Bene of Canada's International Development Research Centre (IDRC). The study coined the term 'agroforestry' and called for global recognition of the key role trees play on farms. This led to the establishment of ICRAF in 1978 to promote agroforestry research in developing countries. During the 1980s ICRAF operated as an information council focused on Africa. It joined the Consultative Group on International Agricultural Research (CGIAR) in 1991 to conduct strategic research on agroforestry at a global scale, changing its name from Council to Centre. In implementing this strategy, the Centre expanded into South America and Southeast Asia while strengthening its activities in Africa. In 2002, the Centre acquired the brand name the 'World Agroforestry Centre'. However, the 'International Centre for Research in Agroforestry' remains its legal name.

Triggered by an international focus on empowering communities within and adjacent to forests, agroforestry research in Indonesia commenced in the early 1980s. Parallel to international experiences, agroforestry research activities in Indonesia were initially carried out by documenting various agroforestry practices that had been developed by communities. One of the products of

these initial research activities was a book by de Foresta *et al.* (2000) that described various types of agroforestry practices in Indonesia.

Research on agroforestry in Indonesia continues to expand along with various government programs that support community involvement in forest management. In the early 1990s, the *Pemberdayaan Masyarakat Desa Hutan* (PMDH) program or Forest Village Community Development program was introduced. Based on a decree by the Ministry of Forestry (MoF) (SK. Menhut. No. 691/Kpts-II/1991, which has been amended by SK. Menhut. No. 69/Kpts-II/1995), forest concession holders (HPH) were encouraged under the PMDH program to enhance rural livelihoods in their surrounding forest areas. Community rights in forest management have since been expanded through the introduction of *Hutan Kemasyarakatan* (HKm), or the Community Forestry program, in accordance with another MoF decree, SK. Menhut. No. 622/Kpts-II/1995, which has been continuously updated through successive MoF regulations (Permenhut No. P.37/Menhut-II/2007; Permenhut No. 18/Menhut-II/2009; Permenhut No. 13/Menhut-II/2010; and lastly Permenhut. No. P.52/Menhut-II/2011).

In 2003, the government launched *Perhutanan Sosial* or Social Forestry as a national program, which became an umbrella program for forestry development in the country. This policy, which was mainly aimed at improving the welfare of local communities and fostering sustainable forest management, was strengthened in 2004 through a further regulation (Permenhut No 01/Menhut-II/2004). It has been implemented, along with other policies, through forest rehabilitation programs (Wardoyo 2003). Besides the HKm program, which was introduced earlier, a variety of community-based forest management schemes are now in progress such as *Hutan Desa* (HD) or Village Forests and *Hutan Tanaman Rakyat* (HTR) or Community Forest Plantations. In addition, people in various parts of the country have been developing *Hutan Rakyat* (HR) or Farm Forests on their private lands. Agroforestry concepts have been applied within these models of forest management, and can be further developed within Indonesia's forest management system.

Due to its multi-disciplinary approach, agroforestry research has involved various disciplines as well as research institutions. The Research Institute of Agroforestry Technology undertook a review of completed agroforestry research activities in Indonesia in 2011. A summary of the review findings is presented in Table 1 (see also a more specific explanation in Annex 1). There are four key dimensions of agroforestry research activities: silviculture, environment, social, and economic. A review of 440 research articles indicated that while these four research dimensions have received relatively equal

attention, silviculture accounted for the largest proportion (28%), whereas the social dimension seems to have comprised the lowest proportion (22%).

Technical aspects still dominate research activities in agroforestry. A number of studies on silviculture aspects have been exploring the interaction between the land and plants in terms of soil conditions and productivity. In addition, planting trials of different combinations of species have been completed. Research has also examined different agroforestry practices implemented by communities, mainly through descriptions of biophysical characteristics such as species composition, canopy stratification, and the impacts of agroforestry on soil, water and species diversity.

Research findings on the silviculture dimension have led to proposed recommendations to improve the business performance of agroforestry systems. These recommendations include, among others, better proportioning of the selected plants and best silvicultural practices to increase productivity. Research findings have also established the positive contribution of agroforestry systems to soil fertility, water balance, as well as provision of a suitable habitat for flora and fauna development. In a broader context, research findings also indicate that agroforestry systems can improve the quality of the environment and serve as an important tool in climate change mitigation and adaptation.

Table 1. Distribution of different dimensions of agroforestry research in Indonesia

No	Dimensions	Research themes	Number of publications	%
1	Silviculture	Species selection strategy (species trials and productivity, and species interaction); silviculture techniques (land preparation, planting, maintenance, fertilizing, pruning); community agroforestry models	121	28
2	Environment	Effect of agroforestry systems on abiotic and biotic components; biodiversity; conservation and rehabilitation functions of agroforestry; and dynamics of land use.	109	25
3	Social	Agroforestry practices, social capital, and local wisdom; decision-making and socio-economic factors in agroforestry: adoption patterns (perception, motivation, social acceptance, participation); gender analysis; community development; tenure.	98	22
4	Economic	Income, financial analysis, job opportunities, marketing, agroforestry and regional economy.	112	25
Total			440	100

In terms of the socio-economic dimension of agroforestry, the research has reviewed various factors that influence agroforestry development as well as the impacts of agroforestry practices on socio-economic conditions of communities. Research on this dimension is still dominated by feasibility analyses of agroforestry business systems. However, some research activities have also examined broader aspects of agroforestry such as the contribution of agroforestry to household incomes, the relationship between agroforestry practices and labor, and marketing problems regarding agroforestry products.

Research on the social dimension has been dominated by local knowledge based on agroforestry practices. The research has included analyses of social factors that influence adoption, participation, and decision making processes, as well as role distribution of family members in the farming system. A small portion of the research has addressed the role of policies and institutions. In general, it can be concluded that research on the social dimension is relatively limited compared with other dimensions, and is being challenged to respond to many pertinent issues relating to the development of agroforestry systems such as institutional and gender issues, and land tenure security.

1.3 Position and Role of the National Strategy in the Agroforestry Research Planning System

The preamble to the Forestry Act No. 41/1999 states that sustainable forest management, which also addresses international concerns, should be able to accommodate the dynamics of communities' aspirations and participation, culture, and social values. The preamble asserts the importance of acknowledging the existence of communities in forest areas. Forest administration cannot be effective without considering the activities of communities, especially of those living within and around the forests. The Act further states that forestry research and development activities are intended to enhance the ability of the forest administration to achieve sustainable forest management and increase value addition (Forestry Act No. 41/1999 article 53). Thus, agroforestry research that focuses on forest community involvement has a strategic legal basis in Indonesia's legislation system.

The macro level of forest management is defined in the National Forestry Plan (RKTN) 2012-2030 (Permenhut. No. 49/2011). The Plan provides general directions on the utilization of forest lands. Its target is to achieve sustainable forestry development within the next twenty years.

Sustainable forestry development builds on the synergy between the ecological, economic, and social bases. The National Forestry Plan states that the ecological basis lies in increasing productivity of conservation forests and

improving biodiversity of forest areas. The economic base lies in the creation of growth and equity in the utilization of forest areas and functions, while the social basis lies in increased community participation and the creation of sustainable institutions for the utilization of forest areas and functions. Forestry development guidelines are consistent with the concept of agroforestry as defined in this National Strategy. Specifically, the term “agroforestry” was included for the first time in the Indonesian regulatory system in Permenhut No. P. 19/Menhut-II/2012. This MoF regulation provides opportunities for developing agroforestry in areas of industrial plantation forests or *Hutan Tanaman Industri* (HTI) and in community plantation forests or *Hutan Tanaman Rakyat* (HTR).

At the level of the Forestry Research and Development Agency (FORDA), a road map of forestry research has been established, providing guidelines for conducting research and development activities in the forestry sector. This road map is under implementation in the form of FORDA’s Integrative Research Plans or *Rencana Penelitian Integratif* (RPI), which are in place until the end of 2014. A Master Plan for Agroforestry Research (RIPA), which focuses on research in agroforestry is included among the 25 RPIs.

This National Strategy is intended as a guide for forestry research activities in the field of agroforestry, particularly for improving the agroforestry research program embodied in RIPA 2012–2025. The position of the National Strategy for Research in Agroforestry 2012–2030 within the framework of national forestry research planning is depicted in Figure 2.

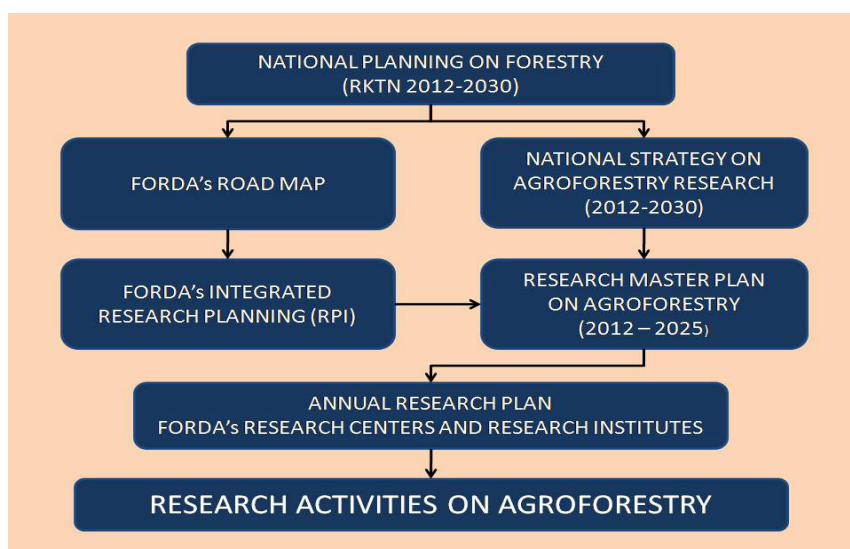


Figure 2. Position and roles of the National Strategy for Agroforestry Research within the national forestry research planning system

The National Strategy for Agroforestry Research 2012–2030 has been formulated to achieve the following development vision:

“Agroforestry is widely adopted by communities as an integrated land use systems that can bridge the [sic] efforts in enhancing the productivity of agricultural land and forests to meet the demand for food, shelter, energy and other environmental services as a buffer of life, which is based on the development of science and technology in accordance with local wisdom”.

The Strategy has three main missions, which are:

1. To undertake research and development activities in agroforestry that contribute to the achievement of the National Forestry Planning (RKTN 2012–2030) targets;
2. To develop partnerships and engagements between stakeholders (farmers, managers/ owners of industries, policy-makers and development agencies) in the development of agroforestry science and technology in Indonesia;
3. To mainstream agroforestry into forestry development practices, and to promote the role of agroforestry as a bridging function between agriculture and forestry through broad adoption of research-based recommendations by policy-makers and wider communities in Indonesia.



2

Challenges and Opportunities in Agroforestry Research





A good research strategy should consider future challenges and opportunities. Current global, national, and regional issues that dominate public debates should also be anticipated in the formulation of the strategy. These issues cover biophysical, social, economic, and institutional aspects. Some priority issues, however, need more attention such as poverty, land tenure, farmers' livelihoods, protection and utilization of environmental services, climate change, and forest governance. Challenges and opportunities related to these issues, in particular, should be anticipated in the formulation of an agroforestry research strategy.

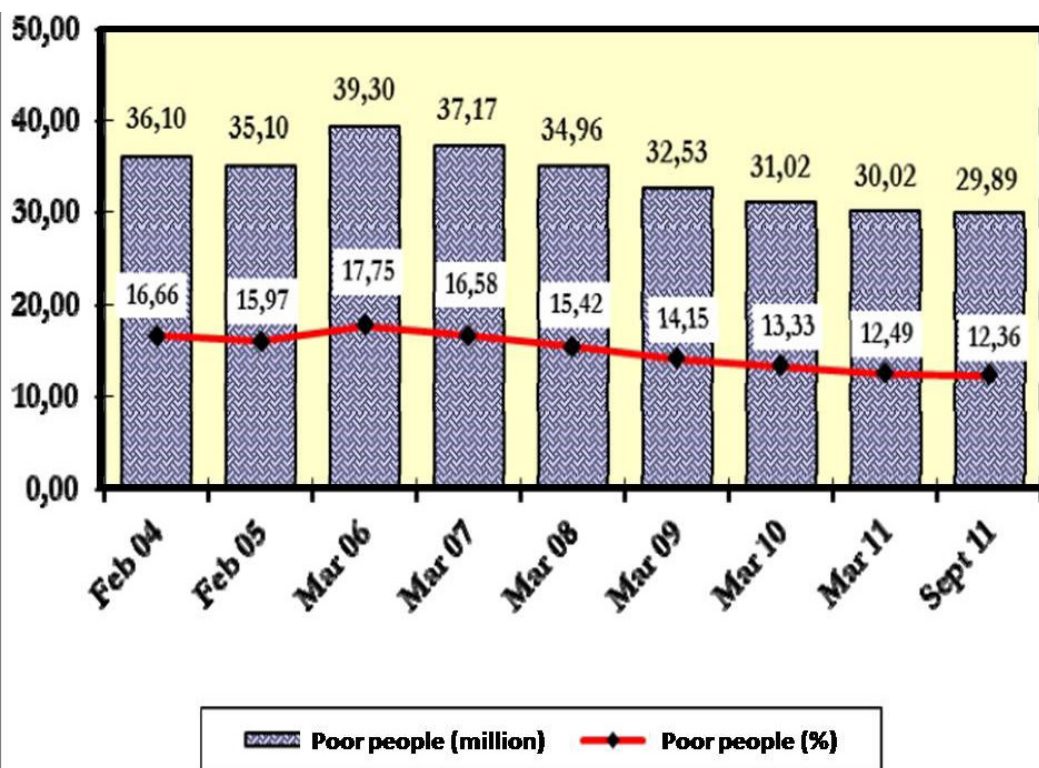
2.1 Challenges

Future challenges in agroforestry research are varied and complex. They cover substantial and operational challenges. The substantial challenges are related to research themes. Some of them such as poverty, land tenure conflict, the tradeoff between conservation and development in the utilization of forest resources, and the impacts of changing patterns of forest resources management are of higher priority.

The operational challenges are related more to organizational problems in conducting research activities such as a partial research approach, lack of coordination among research organizations, and lack of adoption of research findings by the users. In fact, there are complex, cross-cutting challenges covering both substantial and operational aspects. Some of the future challenges that should be prioritized in the formulation of an agroforestry research strategy are presented below.

2.1.1 Poverty

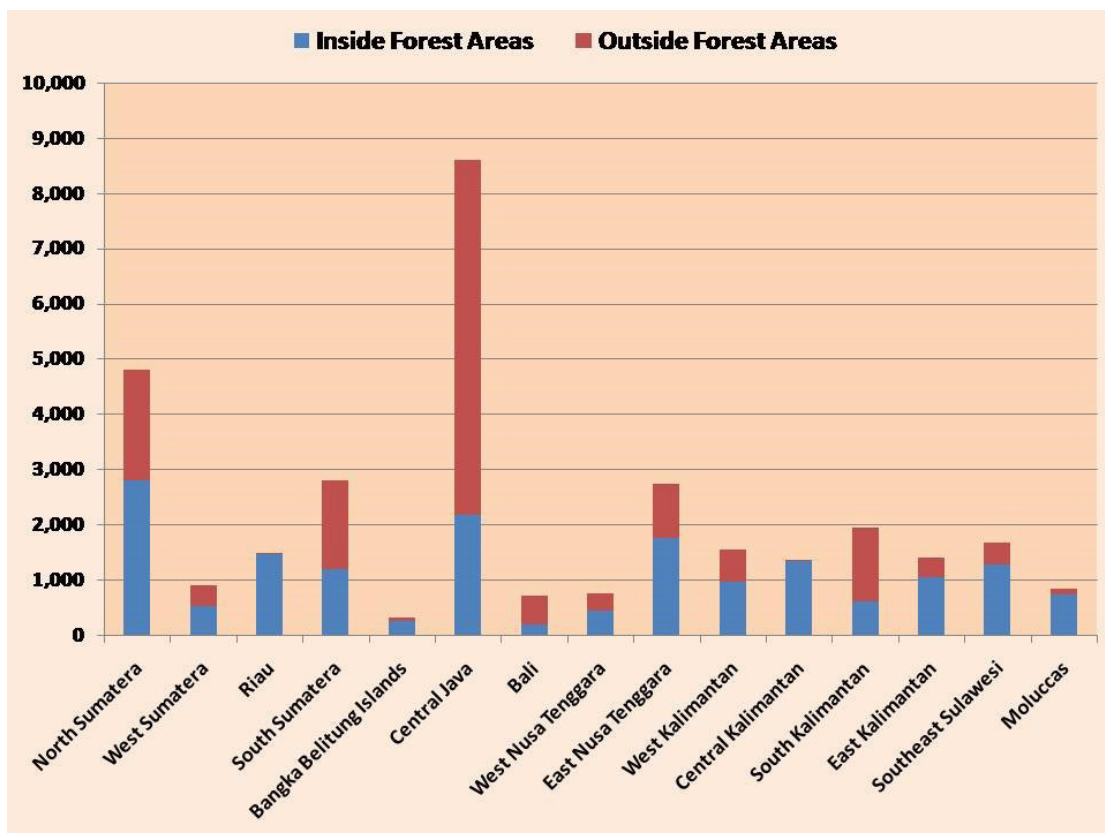
Poverty remains a serious challenge faced by the Indonesian nation. The Central Bureau of Statistics (BPS 2012) reports that currently 30 million people in Indonesia are living in poverty. Even though, the poverty rate has been decreasing for the last several years (see Figure 3), the number is still high. Poverty with all of its dimensions poses the greatest challenge for national development. Therefore, there are high expectations that the application of agroforestry in land use management will become an effective tool in poverty alleviation efforts.



Source: BPS 2012

Figure 3. The poverty rate in Indonesia from 2004–2011 (BPS 2012)

Pockets of poverty are located in rural areas (BPS 2012). A survey of the 31,864 villages in the country, conducted by the Central Bureau of Statistics in cooperation with the MoF (Badan Planologi Kehutanan, 2007), reported that a total of 16,760 (52.60%) villages were located inside forest areas (see Figure 4). Proportions of villages located inside protected areas and conservation forests were 19.59% and 7.12%, respectively, whereas the remaining villages could be found inside areas of other forest functions. These facts indicate the significant challenges associated with poverty alleviation in Indonesia, and how they relate to sustainability of forest resources. They also signify the expected roles of agroforestry in poverty alleviation and in sustaining forest resources.



Source: Badan Planologi Kehutanan 2007

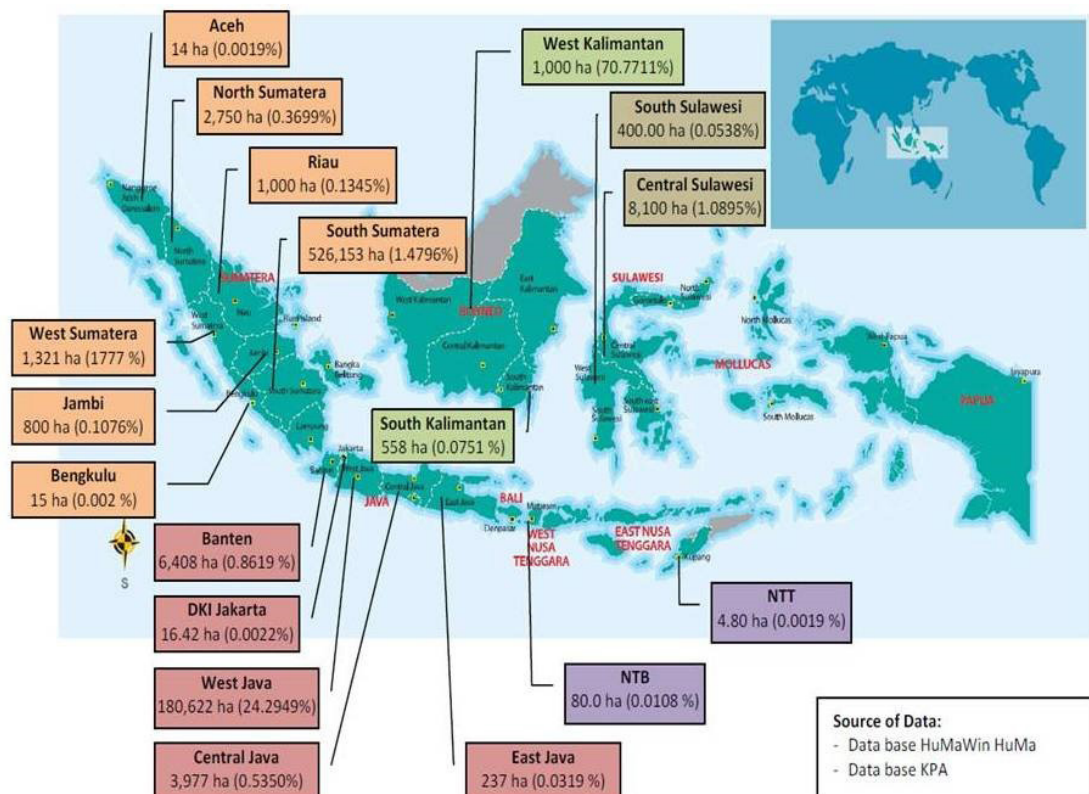
Figure 4. Numbers of villages located inside and outside forest areas in some provinces in Indonesia (Badan Planologi Kehutanan, 2007)

2.1.2 Forest tenure conflicts and forest resources degradation

Forest degradation in Indonesia has reached an unprecedented level in recent decades. One of the main causative factors is tenure-based social conflict. For example, Mushi (1998) recorded 19,807 tenure-based conflicts that occurred with regard to forest concessions, industrial forest plantations, Perhutani's forest (a state-owned company operating in Java), and national parks. Accordingly, the types of conflict in these cases varied and included illegal logging, overlapping land status, land reclaiming, land occupation, and forest burning.

HuMa, an NGO focusing on community-based legal reforms and environmental protection, has mapped land-based conflicts in Indonesia as presented in Figure 5 (Huma 2011). According to HuMa, most of the conflicts (68%) occurred due to the existence of industrial forest plantations covering an area of 1.8 million hectares. Furthermore, 27% of the conflicts took place in forest land covering an area of 75 thousand hectares, whereas the rest resulted from other factors such as irrigation, mining, and transmigration.





Source: HuMa

Figure 5. Land-based conflict map in Indonesia (HuMa 2011)

Multiple factors that trigger land-based conflicts in forest areas are as follows:

1. The land is required for development of other sectors such as agricultural farming, estate crops, municipal areas, and fisheries.
2. The land is required for producing forest commodities such as wood, rattan, bamboo, and resin.
3. Unclear forest boundaries lead to an “open access” condition that triggers exploitation of forest products and land occupation while neglecting the sustainability of forest resources.
4. Inappropriate land use management (spatial planning) and low participation among related stakeholders lead to uncertainty of authority and responsibility in managing forest resources, particularly between central and regional governments.

At the level of the forest management unit (FMU), these conflicts occurred due to overlapping claims over similar locations. This condition arose due to different laws and norms that were applied to the same claims. For example, one party may claim rights based on formal regulations, while communities claim rights that are based on their *adat* (customary) laws.

Future agroforestry research faces challenges in resolving these conflicts. Since agroforestry conceptually accommodates the multiple interests of stakeholders in landuse systems, research is expected to identify the nature of conflicts that arise. A deeper understanding of existing conflicts could lead to options for resolving conflicts related forest landuse systems within the framework of sustainable forest management.

2.1.3 Competing interests between conservation and development

Different backgrounds and interests in managing forest resources often lead to dilemmatic choices between achieving economic growth, improving community welfare, and conserving biodiversity. There are many examples of these competing interests.



They include cinnamon (*Cinnamomum burmanii*) plantation in the Kerinci Seblat National Park (TNKS) and vegetable cultivation in private lands in the Dieng Plateau, Central Java. The situation is similar regarding land use conflicts between upland and lowland areas in relation to water resources conservation. Unsustainable management of these areas potentially increases the risk of natural disasters such as floods and landslides.

Lack of clarity and low incentives available for forest conservation are among the key issues requiring attention. Agroforestry research is being challenged to provide solutions to these problems. Although agroforestry systems may not always be the best option, research on these aspects is expected to lead to the development of agroforestry models that are best suited for reconciling such competing interests.



2.1.4 Slow progress of government programs on community participation in forest management

The MoF has initiated a number of programs to involve forest-dependent communities in forest management. Various schemes have been introduced such as Community Forestry (*Hutan Kemasyarakatan* - HKm), Village Forests (*Hutan Desa*-HD), and Community-Based Forest Plantations (*Hutan Tanaman Rakyat*-HTR). These schemes are expected to act as strategic entry points for the expansion of agroforestry practices. However, the slow implementation of these programs has emerged as the key challenge for developing agroforestry practices in Indonesia.

Government policies are sometimes counterproductive to efforts to develop agroforestry. For example, the implementation of legal certification of forest products (*Surat Keterangan Sahnya Hasil Hutan* - SKSHH) and certification of wood origin (*Surat Keterangan Asal Usul Kayu* - SKAU) for timber from smallholder plantations potentially creates market barriers for farmers and high transaction costs for traders. Nevertheless, these regulations are required to secure state forest resources. A better control mechanism is needed to ensure that such regulations do not burden farmers and discourage their investments in agroforestry businesses.

Policies and regulations that tend to neglect the rights of communities to forest resources could also lead to their negligence of forest conservation or the cultivation of particular commodities. A good example that illustrates this situation is that of sandalwood conservation in East Nusa Tenggara (NTT), where communities are hardly participating in a governmental campaign in support of sandalwood cultivation. Many of the policy recommendations, which were based on research findings were not quickly adopted by decision makers. This indicates that agroforestry research needs to be extended beyond the development of innovative technologies and recommendations. An effective method of approaching decision makers and communicating findings and results is also essential to convince them to adopt the recommendations.

2.1.5 Anticipating the impacts of global climate change

Global climate change is believed to affect various aspects of life. Experts have recommended two strategies for anticipating the negative impacts of climate change: adaptation and mitigation. In the case of mitigation, the response to climate change is to conserve carbon stocks across the globe through the Reducing Emissions from Deforestation and Degradation (REDD) program.

The program was further expanded into REDD+, which includes the enhancement of carbon stocks through forest rehabilitation and plantation development.

Many donor agencies have included the REDD+ program as a focus area of concern and support. Several international consultations have led to progress in the implementation of this support through the promotion of carbon fund distribution schemes. Thus, another challenge for agroforestry research is to contribute to developing the best schemes for implementing the carbon fund.

Regarding the adaptation approach, the challenges posed by global climate change require the readiness of producers, especially farmers, to adapt to consequences of climate change such as air temperature, precipitation and seasonal changes. The capacities of producers of crops, woods, and energy need to be strengthened so that they are able to adapt to various threats to their farm businesses. The concept of “sustainability” (Verchot *et al.* 2007), that is, the ability to make dynamic changes from an established business, is an optional strategy that should be developed to cope with threats. The potential of agroforestry to provide adoptable diversification strategies that increase adaptation capabilities is supported by various research findings.

2.1.6 Unsystematic research approach

There are some obstacles to the production of agroforestry research findings that are effectively adopted by users. Some of these impediments are a partial research approach, lack of coordination in research implementation, and an inappropriate outreach strategy. The Forestry Research Institute of Agroforestry Technology (Balai Penelitian Teknologi Agroforestri 2011) has described a number of agroforestry research activities that have been conducted in Indonesia (see Table 1). Yet, most of the research is still partial and focuses only on a particular aspect. A partial research approach is one of the main reasons for low adoption of the research findings.

A comprehensive understanding of an agroforestry system generally requires a multidisciplinary approach. Thus, a future strategy for agroforestry research planning is the application of a more integrative approach for investigating the different aspects of the system. Research on technical innovation should be followed by research on economic, social, and institutional aspects. A more integrative approach is expected to produce more comprehensive and convincing research findings that will be adopted by users.

As agroforestry is a multidisciplinary science, research in this field requires good coordination among various research institutions. Multidisciplinary science and multi-institutional cooperation, with clearly defined role-sharing

among collaborative partners are challenging objectives that should be anticipated in advance. In addition, appropriate planning of a strategy for disseminating research findings is required to increase their adoption by the users.

2.2 Opportunities

In conjunction with the challenges described above, many opportunities may also pave the way to developing agroforestry research and practices. The pool of knowledge acquired from previous studies provides a valuable foundation for further research activities. Government policies that relate to the empowerment of forest-dependent communities offer a favorable avenue for the development of agroforestry models. Furthermore, numerous research institutions are interested in agroforestry research and are potential partners in organizing collaborative and mutually benefiting research activities.

2.2.1 The availability of a pool of knowledge for agroforestry practices

Agroforestry is an ancient practice, worldwide, and research in this field has been ongoing since the late nineteenth century. The results are documented in various publication media, such as the Proceedings of the World Agroforestry Congress on Agroforestry (2004), which entailed the compilation of 800 research abstracts (IFAS 2004). Thus, a substantive body of agroforestry research findings is available and can be used as reference material for future research development.

2.2.2 Supportive policies for community-based forest management

Several government policies concerned with community-based forest development programs such as HKm, HD, HTR, and HR provide useful learning avenues for the application of research activities. The programs provide opportunities to apply various agroforestry models in the implementation of community-based forest management. These models are highly diverse in terms of their biophysical, social, economic, cultural, and institutional aspects. Therefore, opportunities exist for conducting research on various agroforestry models in line with the above-mentioned government programs, while at the same time providing opportunities for wider research adoption to improve those programs.

2.2.3 Potential partners for collaborative agroforestry research and development

There are currently a number of organizations that could be potential partners in conducting agroforestry research. These organizations are diverse in terms of their capacities, working scope, and expertise. They can provide opportunities for developing joint research collaborations to improve effectiveness and efficiency in implementing agroforestry research. Some of these potential organizations are presented in Table 2.



Table 2. Potential partner organizations for conducting agroforestry research in Indonesia

Working scope	Potential partner institutions
International	<ul style="list-style-type: none"> • <i>Agriculture and Agri-Food Canada (AAFC)</i> • <i>Agroforestry Net, Inc.</i> • <i>Association for Temperate Agroforestry (AFTA)</i> • <i>Canadian Forest Service (CFS)</i> • <i>Canadian International Development Agency (CIDA)</i> • <i>Center for Development Research (ZEF Bonn)</i> • <i>Center for International Forestry Research (CIFOR)</i> • <i>Center for Subtropical Agroforestry (SFRC)</i> • <i>Conservation International (CI)</i> • <i>FAO Forestry Department</i> • <i>Federal Ministry of Research and Education, Germany</i> • <i>Ford Foundation</i> • <i>Institute of Food and Agricultural Sciences (IFAS)</i> • <i>Inter-American Institute for Cooperation on Agriculture (IICA)</i> • <i>International Tropical Timber Organization (ITTO)</i> • <i>Japan International Corporation Agency (JICA)</i> • <i>MARS Incorporated</i> • <i>Prairie Farm Rehabilitation Administration (PFRA)</i> • <i>Rural Industries Research and Development Corporation (RIRDC)</i> • <i>Shelterbelt Centre</i> • <i>The Joint Venture Agroforestry Program (JVAP), Australia</i> • <i>United States Agency for International Development (USAID)</i> • <i>World Agroforestry Centre (ICRAF)</i>
National	<ul style="list-style-type: none"> • National Development Planning Agency (BAPPENAS) • State-Owned Companies (such as INHUTANI and PERHUTANI) • Professional Associations (such as Masyarakat Agroforestry Indonesia and Himpunan Ilmu Tanah Indonesia) • Ministry of Ocean and Fisheries • Ministry of Cooperatives and Small Scale Enterprises • Ministry of Environment, • Ministry of Tourism and Creative Economy • Ministry of Trade • Ministry of Industry • Ministry of Agriculture • Ministry of Research and Technology • National Science Institute • National NGOs such as HUMA, Qbar, WARSI, FKMM, WG Tenur, dan ICEL • Private companies
Local	<ul style="list-style-type: none"> • Regional governments • Local NGOs

3

Priority Research Topics





Considering its targeted vision, mission statement, as well as existing challenges and opportunities, the National Strategy focuses on four priority research topics as basic guidelines for conducting agroforestry research activities over the next two decades. The four priority research topics were identified through various consultation processes with related stakeholders. They are not intended to limit other research topics that could be considered as important due to specific circumstances. Rather, they are more directed toward providing guidance in agroforestry research planning; achieving synergy between the efforts being made; and ensuring the achievement of measurable results.

The four selected research topics are: 1) production and marketing systems in agroforestry business; 2) community empowerment in forest resources management; 3) anticipation of the problems caused by global climate change; and 4) enhancing agroforestry practices for environmental services and sustainability. These topics are clearly complex and require a multi-disciplinary research approach.

Detailed explanations of the four priority topics are expected to provide reasonably clear directions for future implementation of agroforestry research in Indonesia.

3.1 Smallholder Production Systems and Markets for Agroforestry Products

3.1.1 Rationale

Production and marketing systems are integral components of smallholder agroforestry businesses. Therefore, research on these aspects requires an integrated approach. Previous research activities, which applied a partial approach, often failed to provide comprehensive recommendations to foster agroforestry business development. For example, a study that focuses only on the technical aspects of innovation in production systems often ignores the implications of applying these new innovations to the overall business system. The implications of increased production costs and potential benefits to be gained from the new innovation are highly sensitive factors for farmers that need to be clarified before adoption of the innovation can occur. Therefore, research on production and marketing systems needs to involve multiple scientific disciplines, in order to obtain more comprehensive information and to increase adoption of recommendations arising out of the research findings by users.

Markets and marketing aspects often determine the success of agroforestry businesses. Demand for agroforestry products, attractive farm gate prices, and good market access play a vital role as driving factors for agroforestry business development (Zhang and Owiredo 2007; Midgley *et al.* 2007; Nair 2007; Bertomeu 2006). In contrast, market uncertainty, low profit margins, and low bargaining power of farmers are among the factors that limit community investment in agroforestry businesses (Rohadi 2012; Race *et al.* 2009; van Bodegom *et al.* 2008; Hardjanto 2003).

In the marketing context, the establishment of a linkage between the farming business (producers of agroforestry products) and processing industries is very important. Information gaps between the producers and processing industries are often an obstacle to the development of an agroforestry business. For example, farmers often have limited access to timber markets, while at the same time a number of wood processing industries are experiencing difficulties in finding a supply of wood as raw material (Rohadi 2012). Another example is that of the many herbs that have high potential for cultivation. However, only a few of these species have an existing potential market (Budiadi¹ *personal communication*). Research on this aspect should focus on improving farmers' access to markets for their agroforestry products, and also facilitating access of the processing industries to more regular supplies of raw materials that meet quality and regulatory requirements. Developing partnership models between producer groups and downstream industries is one of the main agendas regarding this research aspect.

There is often a lack of innovative technologies available to improve the productivity of some of the potential commodities, either for subsistence or for commercial purposes. Therefore, research on technical aspects that include species selection, nurseries, and other cultivation techniques should also be considered.

Various institutional aspects such as regulations, rules, culture, perceptions and types of interaction among the various actors involved in the system will determine the system's performance (Ostrom 2006). Likewise, in agroforestry business systems, these institutional aspects require proportional attention. For example, government policies and regulations can lead to market constraints or high transaction costs in agroforestry business. Research on institutional aspects needs to focus on creating conducive institutions to support production and marketing of agroforestry businesses.

The research status review indicated that current research intensity in agroforestry is dominated by agrisilviculture models. Less attention has been

¹ Mr. Budiadi is a lecturer at the University of Gajah Mada. His statement was made during a meeting of experts held in Bogor on March 27, 2012 to discuss the draft of this National Strategy for Agroforestry Research in Indonesia.

given to other agroforestry models, such as honeybee cultivation, silkworm cultivation, silvopasture, and mangrove cultivation. Given the diversity of agroforestry businesses, one option is to address research needs based on priorities set by the main actors within agroforestry systems. Through this subject approach, problem formulation will become more closely connected to the real conditions faced by the targeted people, regardless of their types of agroforestry business.

Some key questions that need to be addressed within this research topic include:

1. What is required to be done to enable the application of sustainable business management (best practices) by actors involved in the agroforestry business?
2. What interventions are required to improve the market access and bargaining power of farmers in the value chains of agroforestry businesses?
3. What interventions are required to encourage and foster business partnerships between producers and processors/downstream industries to achieve sustainable and mutual benefits for both parties?

3.1.2 Research goal

This research topic is aiming at developing agroforestry as an attractive and competitive business for farmers compared with other types of business.



3.1.3 Research objectives

This research topic has three objectives:

1. To strengthen the market access and bargaining power of farmers through collective action, and to develop partnership models between farmer groups and industries.
2. To improve and sustain productivity through the application of best practices in business management and cultivation techniques.
3. To refine policies and regulations to strengthen farmers' access to markets and to reduce marketing transaction costs.

3.1.4 Expected outputs

The expected outputs of these research activities include:

1. Guidelines for farmers on collective marketing.
2. Guidelines on business management for different models of agroforestry.
3. Manuals of cultivation techniques for different models of agroforestry, which include species selection, propagation, seed management, and other silvicultural aspects.
4. Partnership models established between farmer groups and industries engaged in agroforestry businesses.
5. Policy recommendations to strengthen market access, and to eliminate or simplify regulations that potentially create market barriers or cause high transaction costs.

3.1.5 Target beneficiaries

The parties that will potentially be affected by and benefit from the research findings include:

1. Farmers, farmer groups, and extension officers, who will benefit through the availability of practical guidelines to strengthen farmers' collective actions.
2. Farmers, farmer groups, and processing industries, who will benefit through the provision of effective and mutually beneficial business models.
3. Decision makers and policy makers, who will benefit through the availability of policy recommendations.

3.2 Community-Based Forest Management in State Forest Areas

3.2.1 Rationale

Many of state forest areas are threatened by encroachment. On the other hand, the existence of forest areas and resources are often the only available option for people, who live in areas surrounding forests to produce food crops or other commercial crops for their livelihoods. MoF data (Permenhut No. 66/2011) indicates that the total population living in villages within and around forest areas and depending on forest resources numbers about 48.8 million people, of whom 10.2 million are classified as poor. This figure amounts to about 31% of the total number of poor people at the national level.

A high dependency on forests has influenced the culture of forest communities and their utilization of forest products. In general, these communities follow their customary laws on forest management practices (Faculty of Agriculture, University of Kapuas 2007). However, there are many cases of customary laws and traditional rules not being legally recognized, which often creates conflict between communities and the government. If such conflicts are not resolved, they can escalate into an open access situation regarding forest resources and lead to forest degradation. Strengthening land tenure rights is thus a key issue and needs to be addressed at the national level to achieve sustainable forest management in Indonesia (Contreras-Hermosilla and Fay 2005).

Agroforestry practices can serve as a means of effecting reconciliation over land conflicts. If they are well designed, they can provide livelihoods and can also be directed toward forest conservation efforts. Multiple forest management goals are not a new concept and should be developed to fulfil multistakeholder interests.

Various community-based forest management programs have been developed by the MoF such as Community Forestry or *Hutan Kemasyarakatan* (HKm), Village Forests or *Hutan Desa* (HD), and Community Forest Plantations or *Hutan Tanaman Rakyat* (HTR). In 2011, MoF launched a new program, *Pengembangan Perhutanan Masyarakat Pedesaan Berbasis Konservasi* (PPMPBK) or Conservation-Based Rural Community Forestry Development (Permenhut No P. 66/Menhut-II/2011). The program is aiming at supporting economic growth (pro growth), reducing poverty (pro poor), providing employment (pro jobs), and at the same time preserving the environment (pro-environment). It is being implemented by distributing direct

cash assistance or *Bantuan Langsung Tunai* (BLM) to community groups, with up to Rp 50 million allocated for each group. The MoF has set a target of implementing this program in 32 provinces with a total of 2,000 groups by the end of 2014. The PPMPBK will cover a variety of agroforestry businesses, including agrisilviculture, silvopasture, silvofishery, and forest medicinal plants.

In general, however, the programs described above have not run as well as expected. As an example, the HTR program is hampered by various technical and institutional barriers due to a lack of coordination between central and local governments and low institutional capacity to implement the program. The policies that are directed toward supporting forestry development in Indonesia are often too centralized and driven by the common sense of decision-makers, making them difficult to implement in the field. (Herawati 2011). Some previous studies have indicated that policy interventions could do better if decision makers have a better understanding of the people who become the targets of their decisions. For example, in the context of developing smallholder timber plantations, policy makers need to view farmers, not as mere objects, but rather as subjects who avail of various options and strategies in running their farm businesses (Rohadi 2012).

Community-based forest management can also be coordinated with the food security program in accordance with the national program as stated in the National Forestry Plan (Permenhut No. 49/ 2011). In fact, agroforestry and food crop farming activities are merged in shifting cultivation, which is practiced by indigenous people living in areas surrounding forests. Such techniques can be modified so as not to cause degradation of forest quality and function.

Research activities in this area are aimed at supporting the implementation of the programs mentioned above to achieve two main objectives. These are: 1) conservation of forest resources; and 2) improvement of people's livelihoods, for example, through improved access to forest resources, mutual partnerships in forest resources management, and community collective action. Research activities under this topic need to be implemented comprehensively, covering various institutional, social, economic, and technical aspects. The research will be directed toward strengthening land tenure security and developing forest management models to achieve both conservation and development objectives.

3.2.2 Research goal

This research topic is aimed at the harmonious development of agroforestry systems in state forest areas to achieve various objectives such as enhancing

people's livelihoods and production of food crops and commercial commodities, while maintaining the sustainability of forest functions.

3.2.3 Research objectives

This research has three objectives:

1. To strengthen/clarify community rights over forests, including both land and forest products through the implementation of agroforestry systems.
2. To refine policies and rules regarding the Community-Based Forest Management program at various forest functions.
3. To increase productivity and environmental services through the implementation of proper land use management.

3.2.4 Expected outputs

The expected results from these research activities include:

1. Guidelines for the development of participatory principal agent- based concepts in community-based forest management.
2. Policy recommendations to encourage the implementation of community-based forest management.
3. Guidelines for appropriate land use management of various forest functions.
4. Demonstration plots to showcase community-based forest management that can be used as learning tools for integrated conservation and development approaches to forest management.

3.2.5 Target beneficiaries

The target beneficiaries of research findings from these research activities include:

1. People living in and around forest areas, who will benefit through the availability of proper policies and rules on forest land use.
2. Decision makers at central and local levels, who will benefit through a better understanding of multi-stakeholder interests in forest management, particularly the needs and concerns of the communities living within and around the forest areas.

3.3 Harmonization of Agroforestry Practices with Global Climate Change

3.3.1 Rationale

Global climate change will affect various levels of ecosystems (species, farming systems, and natural resources) and community groups. The rural poor are expected to suffer the greatest impact from global climate change because of their low adaptive capacity regarding changes in natural conditions. Poor people in rural areas generally rely more on natural factors and lack supportive economic and institutional capacities to deal with the changes (Verchot *et al.* 2007).

On the other hand, the climate change issue also opens up new opportunities for agroforestry development. Mega programs such as the Clean Development Mechanism (CDM), Reducing Emissions from Deforestation and Forest Degradation (REDD), and REDD+ provide incentives through carbon funds to conserve and increase carbon stocks on earth. However, mechanisms for distributing these carbon funds are still the subject of lengthy discussions at both international and national levels. Agroforestry research can contribute to the development of appropriate mechanisms for ensuring that farmers who participate in the conservation and enhancement of carbon stocks have access to these incentives to develop their agroforestry practices. The concept of agroforestry can also contribute to developing an adaptation process for farming systems to anticipate global climate change, thereby enhancing the resilience of farmers in the adjustment of their farming systems.

The research themes in this area include studies to develop appropriate protocols to monitor, report, and assess agroforestry practices, as well as appropriate incentive schemes for participating farmers. In the case of adaptation, the research themes include studies to develop an understanding of farmers' behavior and strategies for anticipating extreme weather conditions, as well as options for improving these strategies for wider application elsewhere.

3.3.2 Research goal

The goal of this research topic is to make agroforestry practices an effective tool for synergizing adaptation and mitigation efforts in anticipating global climate change.

3.3.3 Research objectives

This research topic has three objectives:

1. To improve farmers' capacities to withstand potential risks caused by climate change,
2. To develop attractive incentive schemes for agroforestry activities that preserve and enhance carbon stocks, though not at the expense of other livelihoods or ecosystem benefits,
3. To improve policies to mainstream agroforestry within climate change adaptation and mitigation efforts.

3.3.4 Expected outputs

The expected results of these research activities include:

1. Science based knowledge to understand risks and consequences of climate change for agroforestry practices.
2. Practical guidelines for decision makers, extension officers, as well as farmers to increase the resilience of agroforestry practices to climate change.
3. Incentive models of agroforestry activities that promote carbon sequestration.

3.3.5 Target beneficiaries

The target beneficiaries of research findings from these research activities include:

1. Farmers, who benefit through the availability of guidelines for improving agroforestry businesses.
2. Donor agencies, which benefit through the availability of incentive schemes for activities that promote carbon sequestration.
3. Decision makers, who benefit through the availability of information to better understand the impacts of climate change on agroforestry businesses, as well as of options in adaptation and mitigation efforts.

3.4 Enhancing Agroforestry Practices for Environmental Services

3.4.1 Rationale

High demand for certain wood species, food crops, or other commercial commodities are influencing people's behavior relating to land management, resulting in an overriding focus on production goals and the neglect of environmental sustainability. In some areas such as the Dieng Mountain Range, market opportunities have driven farmers' cultivation patterns to emphasize production of commercial crops (food crops and horticulture) and neglect the importance of trees for environmental preservation. A market driven approach may also change farmers' behavior regarding their cultivation patterns, for example, from a previously mixed farm pattern to monoculture crops. This occurred in the case of sengon (*Paraserianthes falcataria*) plantations in certain areas. A similar case also occurred in coastal areas, which are dominated by mangroves. Silvofishery and fish pond cultivation often involve the destruction of mangrove ecosystems, thereby eliminating the mangrove's protection function in coastal areas.

These cultivation behaviors are highly risky, particularly when they are applied to critical land areas such as mountainous regions. In mountainous areas, forests and tree vegetation play critical roles in maintaining ecological functions, preventing flooding and landslides and supporting hydrological systems. Land use patterns that neglect environmental aspects threaten downstream areas as well as their own business sustainability. Such behaviors also potentially reduce biodiversity and other environmental functions that are linked with forest vegetation types.

Various factors are contributing to these unsustainable land management systems. The private property status of land in the case of the Dieng Mountains led to land use decisions that were made exclusively by the land owners. Farmers chose a business approach in producing cash crops and were less concerned with environmental aspects because of the lack of incentives for tree planting efforts. In principle, these conditions represent a conflict of interest between conservation and development in the land use system.

The challenge for research is to find alternative solutions for these conflicts of interest. Agroforestry systems can become a reconciliation tool to mediate such conflicts. To address these challenges, agroforestry research requires a multi-disciplinary approach that includes technical, social, economic, and institutional dimensions in land use management systems. For example,

regarding the technical and economic dimensions, agroforestry research could focus on the identification of suitable tree species and their site conditions, which have high market potential. Regarding the social and institutional dimensions, the research could focus on developing incentive mechanisms to promote land rehabilitation, for example, through the introduction of micro hydro power plants. Research on this dimension needs to be carried out at the site as well as landscape levels.

3.4.2 Research goal

This research topic is aimed at producing incentive systems and technologies in agroforestry practices to promote environmental improvement.

3.4.3 Research objectives

This research topic has three objectives:

1. Development of agroforestry business models that can improve people's livelihoods and provide incentives for efforts to protect the environment and increase biodiversity.
2. Availability of agroforestry technologies that support improvement of people's livelihoods and conservation of natural resources at the scales of land sites and landscapes.
3. Strengthening of local institutions to sustain agroforestry business models that support improvement of people's livelihoods and conservation of natural resources.

3.4.4 Expected outputs

The expected results from this research topic include:

1. Micro hydro business models for rural energy development that integrate conservation of water catchment areas with electricity supply for rural areas.
2. Silvofishery business models to improve household incomes and conserve mangrove areas.
3. Agroforestry business models which are suitable for critical land in mountainous and former mining areas.
4. Policy recommendations and institutional arrangement models to strengthen rewards for environmental services.

3.4.5 Target beneficiaries

The target beneficiaries of research findings from these research activities include:

1. Rural communities living around forest areas, who benefit through the availability of agroforestry business models that are environmentally sound.
2. Decision makers, working on conservation areas,, through the availability of better options for integrating efforts to achieve improvement of people's livelihoods and enhancement of environmental conservation.

The private sector,through the availability of models and activities for implementing corporate social responsibility (CSR) and corporate environmental responsibility (CER) programs.





4

Research Implementation Strategy



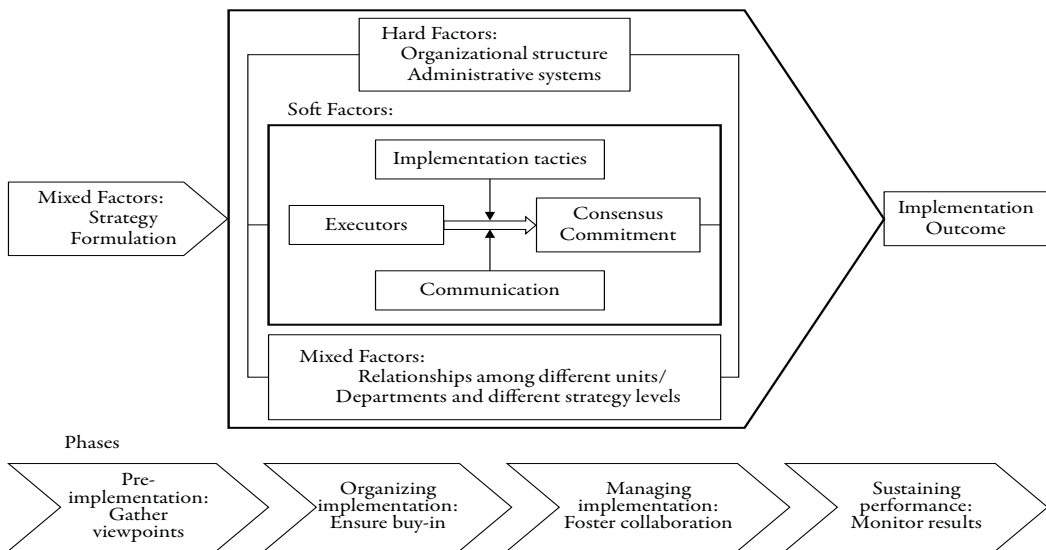
The strategy adopted for implementing research activities will determine the achievement and adoption rate of research findings by users. An implementation strategy is a dynamic, iterative, and complex process, which consists of a series of decisions and activities undertaken by managers and staff to achieve the objectives of a strategic plan (Li *et al.* 2008). Two key perspectives that need to be clear in the implementation strategy are: process and behavior. From the process perspective, the implementation strategy needs to provide clear directions regarding processes of implementing research programs. The processes should ensure that research activities are related to the identified problems and that the research findings can provide answers to the research questions. From the behavior perspective, the strategy needs to clearly describe the decisions and actions to be taken in allocating resources to achieve the intended goals.

Li *et al.* (2008) further state that the success of an implementation strategy is determined by several factors that can be grouped into hard factors, soft factors, and mixed factors (see Figure 6). The structure and system of organization are included among the hard factors, while soft factors include, for example, individuals who execute the strategy and tactics, and facilitate consensus building, commitment, and communication among the parties involved in the strategy. Between these two groups, there are combined factors that also affect the process of the implementation strategy. Besides these factors, there are four stages in the implementation strategy that should be followed. These are the stages of: pre-implementation, organizing implementation, managing implementation, and sustaining performance.

O'Corrbui (undated) states that an implementation strategy should avoid seven things. These are: (1) an unrealistic or unfeasible strategy to be implemented; (2) lack of clarity on how to run the strategy; (3) incomprehension of the strategy by staff or users; (4) lack of clear individual responsibilities in the implementation of the strategy; (5) non-involvement of senior managers in the strategy implementation; (6) ignoring potential constraints; and (7) preparation of the strategy only as a temporary job and not as part of daily work.

There are five aspects that need to be addressed in more detail in the implementation strategy. These aspects relate to the research approach, dissemination of research results, research capacity building, the research funding system, and the impact pathway. Research activities need to be carried out using the right approach to be able to solve problems or provide answers to the research questions. Dissemination of research results requires the right strategy so that research findings can be easily and quickly adopted

by the users. The quality of research is determined by the capacities of the implementing agencies. This means that strengthening the research capacities of both individual researchers and institutional organizations is a main agenda that need to be addressed in the strategy. A good financing system will help to ensure that research activities run smoothly. The strategy should also discuss how research funding will be obtained to support research activities, as well as how to effectively allocate a limited budget and efficiently finance research activities. Finally, the implementation strategy needs to provide a clear impact pathway to ensure that research recommendations will be taken on board by decision makers to achieve the expected changes.



Source: Li *et al.*

Figure 6. The framework of research implementation strategy (Li *et al.* 2008)

4.1 Research Approach

Research will only be effective if it answers the right research questions. Therefore, the formulation of problems or research questions is an important step that needs to be done carefully to avoid conducting research which answers wrong questions. Formulation of problems or research questions can be pursued through an appropriate process and assessment of research proposal development.

The research management system needs to have a good mechanism for developing a proposal that involves related parties, such as the research team, partners, and target beneficiaries. In multiple year research that involves many research partners, arranging a proposal development workshop is a useful option.

Formulation of a research methodology is also very important in research planning and implementation processes. Selecting the right methodology will determine the validity of research findings and widen opportunities for the adoption and application of the results. Based on its scope, the type of research can be classified based on three levels: ideas, institutions, and management practices (Ujjwal Pradhan² *personal communication*). The research methodology needs to be adjusted in scope according to these three levels of research. In addition, it needs to consider the subjects or objects of the research. For example, a research approach that is applied in a study on state forests will be different to that applied in a study on private lands. Research on state forests will more frequently focus on regulation and administrative approaches, whereas market mechanisms will be a preferred approach for research on private lands. Essentially, research methods need to be appropriately designed, to be relevant to the research objectives and to the objects or subjects of the research. An assessment mechanism for the research methodology also needs to be included in the research management system.

Future research activities should be carried out with greater involvement of institutions as research partners, not only from government and non-government institutions, but also from the targets of the research activities, for example, farmers' groups or other project beneficiaries. Collaborative research is very useful for avoiding partial activities, increasing efficiency by preventing unnecessary research duplication, and enhancing capacities through the accumulation of limited resources. Collaborative research activities can be done at all stages of the research, from research proposal development, through implementing research activities, to the reporting of research findings. Thus, in the future, more collaborative research, involving multiple partner institutions, should be promoted.

Collaboration with target beneficiaries increases participation, adoption of research recommendations by user groups, and ownership of research results. However, clear roles, rights, and responsibilities between institutional partners are required, and should be documented in a legal contract. This should include an agreement on intellectual property rights over the results generated by the research activities.

² Dr. Ujjwal Pradhan is the South East Asia Regional Coordinator of the World Agroforestry Center (ICRAF). His statement was made during the expert meeting to discuss the draft of this National Strategy of Agroforestry Research in Indonesia, held in Bogor on 27 March 2012.

Comprehensive and multi-partner research activities usually have long term time frames (multiple years). Multiple year research requires a good funding strategy to ensure the continuity of research activities, particularly during the transition period of the fiscal year.

Future agroforestry research activities can no longer be done by simply collecting data, analyzing it, and delivering results to the users. This traditional method is less effective in increasing the adoption rate of research recommendations as it tends to create a gap between research recommendations and the needs of the users. Action-oriented research should be promoted to reduce this gap and improve the rate of adoption of research results. In action-oriented research, beneficiaries are also subjects in research activities, who work with the research team in problem identification, methodology design, and development of solution options.

Due to the nature of research, which is comprehensive, multi-party, carried out over multiple years, and implemented using an action-oriented research approach, site selection is very strategic. Research activities need to be conducted at sentinel sites to ensure continuity and comprehensiveness of baseline data. Baseline data is necessary to gain an in depth understanding of causal relationships among factors existing at the research site, and their contexts, with research impacts.

Research sites should be carefully selected and potential benefits from the scaling up of the research results should be considered. There are several criteria that can be used in the research site selection process. The first criterion relates to regionalization. Due to the diversity of geographical conditions in Indonesia, representation of this diversity needs to be considered in the selection of research sites. For example, research on silvopastoral topics should be done at sites that represent most of the suitable areas for developing silvopastures in Indonesia such as the Nusa Tenggara region. Social and cultural criteria can also be used in site selection according to the research topic. Highly populated areas, for example, will have different problems when compared with remote areas with relatively large forest cover. Other criteria for site selection can be based on forest transition conditions, as adopted by the CGIAR Research Program (CRP) No.6 (CGIAR 2011). Based on conditions of forest transition, research sites can be selected to represent regions of old growth forests, logged over forests, secondary forests, annual crop areas, grassland, and mosaic landscapes.

4.2 Dissemination Strategy for Research Results

Dissemination entails an effort to distribute research results to users. Dissemination of research findings can be done in various ways depending

on the purpose. Harmsworth *et al.* (2001) state that dissemination can be done to achieve one or more of three objectives: to raise awareness, improve understanding, or influence actions. Therefore, a dissemination strategy should be tailored to the targeted objectives.

The Community Alliance for Research and Engagement (CARE, undated) has raised four points that need to be considered in developing a dissemination strategy for research results. Those four points are: (1) objectives, which question the purpose and expected impacts of dissemination; (2) target audiences, which question the target of dissemination; (3) media, which questions the most effective way of delivering messages to audiences; and (4) execution, which questions who will do the dissemination and when.

Dissemination of research results needs to consider knowledge gaps that exist on the user side. A dissemination strategy needs to be more responsive to emerging issues in various media. It also needs to consider the locus of intervention. For example, a dissemination strategy applied to policy makers at the national level will differ from a strategy used at regional or village levels.

A variety of media can be used in the dissemination of research results. They include print and audiovisual media, meetings, and demonstration plots. Print media covers various forms of scientific or popular publications such as journals, books, policy briefs, newspapers, magazines, manuals, brochures, and posters. Dissemination of audiovisual media focuses on the use of electronic information technology such as online journals, video clips, and websites. Dissemination can also be done through various kinds of meetings such as seminars, workshops, or focus group discussions with more limited numbers of participants. Demonstration plots can also be used as show cases of examples of best practices in crop management. These varieties of dissemination media should be used in accordance with the objectives and targeted audience, as shown in Table 3.

There are several areas that require special attention in formulating a dissemination strategy for research results. 1) the future strategy should promote popular science publications for practitioners in the field, particularly for farmers and extension officers. These publications should be formulated in a practical and easy to understand language style for the target groups. They may include handbooks, brochures, posters, and visual media. 2) the strategy should encourage publication of policy briefs for policy-makers, especially targeting government institutions, donors, and private companies. Policy recommendations should be communicated through the use of appropriate approaches (further described in subsection 4.5) to effectively reach the target users. They can be communicated through various means such as working groups or focus group meetings.

Publication of research findings in various international journals is one way of acknowledging and appreciating the work of Indonesian researchers so that they can be widely recognized within the international scientific community. The number of publications of national scientists in international journals is relatively low. Efforts to increase their exposure through publication in international journals are also, therefore, necessary. Such efforts include encouraging joint publications between national scientists and foreign researchers, who are already familiar with publishing their research findings in international research journals.

Table 3. Variety of media for disseminating research findings

No.	Media	Goals	Audiences
1	Print media: • Research journals	Improving understanding and increasing awareness	Researchers, academicians, policy-makers, industrial managers, and donors
	• books	Improving understanding and increasing awareness	Wider user communities
	• policy brief	Influencing actions	Policy-makers
	• Newspapers, magazines, brochures, posters	Increasing awareness	Wider user communities
	• Guideline books	Influencing actions and increasing awareness	Practitioners (farmers and extension officers),
2	Audio visual media: • Online journals	Improving understanding and increasing awareness	Researchers, academicians, policy-makers, donors, and industrial managers
	• Video clips, websites	Increasing awareness and improving understanding	Wider user communities
3	Meetings: • Seminars, workshops	Increasing awareness and improving understanding	Researchers, academicians, policy-makers, donors, industrial managers.
	• Closed meetings	Influencing actions	Policy-makers
4	Demonstration plots	Increasing awareness, improving understanding, and influencing actions	Wider user communities

Scientific meetings, such as workshops and seminars should be carried out periodically. International seminars, which include agroforestry topics should be organized at least once in every two years in Indonesia, while national level seminars should be held at least once a year. These scientific meetings are useful for providing updates on the progress of agroforestry science.

Electronic media can effectively and efficiently facilitate dissemination of research findings. Development of websites with useful information about agroforestry will easily facilitate public access to research findings in agroforestry. Adequate attention should be given to the electronic information system units to maintain and display updated information.

4.3 Capacity-Building

Capacity-building has two goals: internal and external capacity building. Internal capacity building means building internal capacities to be able to carry out tasks or missions to achieve stated goals. External capacity-building means building the capacities of targeted individuals or groups to enable them to overcome their own problems.

In the context of internal capacity building, especially within research institutions, the definition of capacity building developed by the Department for International Development, United Kingdom (DFID 2010) can be adopted. According to this definition, capacity building means to strengthen the capacities of individuals, organizations, and institutional systems to conduct research and development activities, and to disseminate high quality research results to various target groups in effective and efficient ways. In this context, capacity building entails three levels:

1. An individual level, which involves the capacities and teamwork of individual researchers through training and education assistance, in planning and implementing research; writing and publishing research results; and delivering recommendations to influence decision makers.
2. An organizational level, which involves sustainably developing the organizational capacities of research institutions in conducting research activities, developing a think tank and other research facilities, as well as self-financing and management of research activities.
3. An institutional level, which involves developing the “rules of the game” within the organization and incentive structures in political, regulatory and resource allocation contexts where research activities are implemented and utilized by policy makers.

The key components of capacities, in terms of the above definition are illustrated in Figure 7. These consist of a combination of learning and adaptation abilities of groups, organizations or networks, and the performances of these groups, organizations or networks in providing high quality research results that impact on policy changes and management practices. There are five basic skills that need attention as they determine the performance and sustainability of an organization. These are:

1. Commitment, connection and involvement: empowering, motivating, and developing self-confidence and managing relationships.
2. Carrying out technical tasks, services, and logistics: these are the basic functions that are directed at achieving organization's mandate.
3. Attracting resources and support: resource mobilization, networking and developing legitimacy.
4. Adapting and change: learning, strategy development, adapting to and managing change.
5. Maintaining a balance between coherence and diversity: fostering innovation and stability, managing complexity, and balancing various capabilities.

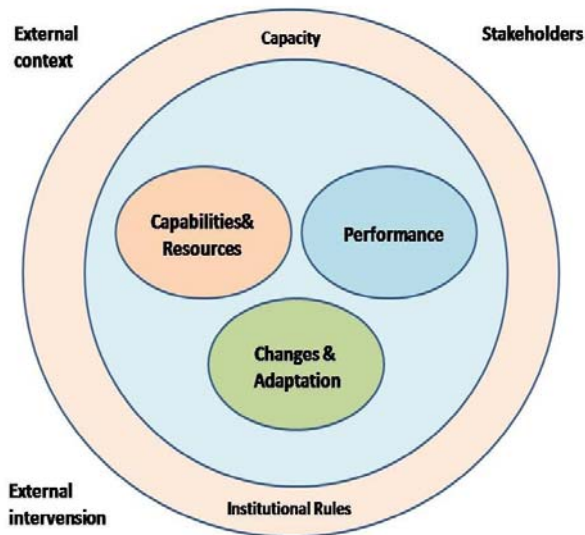


Figure 7. Key elements of capacity building (DFID 2010)

Referring to the concept of capacity building, as described above, Table 4 provides various examples of forms and types of capacity building activities that are required at agroforestry research institutions in Indonesia.

External capacity building of various key stakeholders occurs in the implementation of an agroforestry business. The main actors include farmers or farmer groups, extension officers, NGO staff, and government agencies at local levels. Extension officers play very important roles in farmers' capacity building as they liaise between research institutions and users, and especially with farmers at the village level.

Crowder and Anderson (1996) state that synergistic efforts among elements of research, extension, and education are essential if technological innovations are expected to have significant impacts for fostering change. These efforts need to be directed toward clear targets, that is, the subjects who will receive these innovations. In the context of agroforestry development at the village level, farmers' capacities in implementing agroforestry businesses should be the central focus, as illustrated in Figure 8.

Table 4. The series of strategies for building agroforestry research capacities in Indonesia

No.	Targets of capacity building	Forms and types of activities
1	Individual capacity building	<ul style="list-style-type: none"> a. Training (writing technical papers, proposals and reports, research methodology). b. Comparative studies (facilitation of researchers' attendance at international and national scientific meetings and events). c. Apprenticeship (Assignment of researchers to work at international research institutions such as CIFOR, ICRAF, and WWF). d. Postgraduate education (master's and doctoral degrees)
2	Organizational capacity building	<ul style="list-style-type: none"> a. Designing a research and development program (with revisions over a five-year period). b. Development of research infrastructure (laboratory maintenance, certification of laboratories). c. Development of a research and development think tank in the field of agroforestry.
3	Institutional capacity building	<ul style="list-style-type: none"> a. Development of "the rules of the game": This entails formulating various Standard Operating Procedures (SOPs), for example, for collaborative research and research administration. b. Network development: Renewal of membership in research associations at international and national levels (for example, at IUFRO and the Indonesian Community of Agroforestry or MAFI), and revitalization of the Forum Communications on Agroforestry (INAFE). c. Development of incentive systems (staff development and performance appraisal systems)

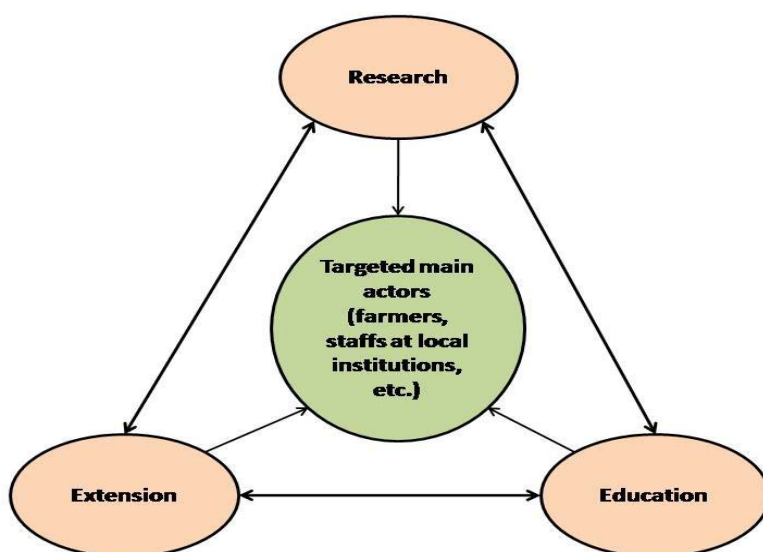


Figure 8. Illustration of the synergy between research, extension, and education components for improving capacities of the targeted actors

Figure 8 shows that the three capacity building components, that is, research, extension, and education, need to be designed and their strategies adjusted to increase the capacities of targeted actors. The internal capacities of each actor in these institutions should also be improved so that the agencies can perform their roles and functions optimally. Therefore, human resource development programs in those institutions should continually be revised in accordance with changing needs and agroforestry science and technology development.

FORDA will focus on producing materials on research findings that can be used by related agencies within MoF and other ministerial sectors in their capacity building programs. These will be useful for scaling up lessons learnt and disseminating research recommendations to improve the capacities of farmers as well as decision makers at local, regional, and national levels. At the MoF level, coordination and communication between FORDA and the extension and training agency, Badan Penyuluhan dan Pengembangan (SDM), will be intensified through both formal and informal networks.



4.4 Research Funding

Financing is very important for supporting research activities. A financing mechanism for research activities needs to be flexible while also maintaining its accountability. The current financing system adopted by government research institutions is too rigid and often limits the operational implementation of research activities. Rigidity is mainly found within the administrative system of financial accountability and in the budgeting time frame. Simplification of this mechanism needs to be carried out at various levels. At the operational level, which includes the scope of organization units (research centers or research institutes); simplification entails improving staff understanding of financial administration under the current regulation system. At a broader level (national), an evaluation needs to be undertaken to improve the country's financial administration system for research activities, which would involve relevant authorities such as the Ministry of Finance.

Other than improvements in the financial administration system, budget allocation for research activities and efficiency in the use of research funds need to increase. Efforts should be made to utilize potential alternative sources of research funds and to improve coordination in the research planning and implementation process. Alternative funding sources are available from:

1. International donor agencies;
2. Competitive research grants, for example, those offered by the Directorate General of Higher Education, the Ministry of National Education, and the Ministry of Research and Technology;
3. Contributions by private companies through their Corporate Social Responsibility (CSR) and Corporate Environmental Responsibility (CER funds); and
4. Research funds allocated through the regional government budget.

Developing collaborative research proposals for submission to international donors is an example of a strategy for increasing research funding. Systematic efforts need to be made to improve the quality of research proposals by combining national and donor interests in investment in agroforestry research. Improving the quality of research proposals can be achieved by training staff in writing research proposals, developing networks with donors, and facilitating research teams in the process of proposal development.

Some agroforestry research topics have great scope for attracting funds from CSR programs. CSR programs are mandatory for companies that benefit from managing natural resources. They are required to participate in sustainable development efforts in compliance with Article 74 of Law No. 40/2007 pertaining to limited liability companies. One way of implementing the CSR program is through the Partnership and Environment Development Program. For example, forest plantation programs can be developed through partnership schemes in areas bordering industrial plantations.

CSR programs are also likely to be developed in conjunction with the payment for environmental (PES) scheme by companies that obtain benefits from environmental services. Some strategic industries or companies such as hydroelectric power plants and mining industries depend on the availability of water resources. These industries may be invited to participate in environmental improvement efforts to ensure sustainability of water resources. Some types of community business such as micro hydro power plants are also potential entry points for inviting public participation in water resource maintenance efforts.

Many agroforestry activities can be integrated into forest and land rehabilitation programs. Such activities can take advantage of carbon funds. Although carbon payment schemes, for example, through REDD+ are still at the negotiation and development stage, financing models or schemes for associating agroforestry activities with carbon sequestration efforts should be anticipated as early as possible.

Along with decentralization, regional governments have greater roles to play in natural resources management, including in the conduct of research activities. Some local governments have sufficient finances, but do not have human resources to conduct research activities. Research institutions can develop research partnerships in collaboration with local governments to improve the effectiveness and efficiency of regional development. These partnerships require identification of research problems that are strongly associated with particular areas of regional interest. Relevance of the selected research topics will determine the interest level of the local government to contribute to research funding through their regional budget or *Anggaran Pendapatan dan Belanja Daerah* (APBD).

Agroforestry topics are more likely to attract funding because of their strong relevance to various regional problems.

4.5 Impact Pathways

The overall implementation of research activities in agroforestry in Indonesia is aimed at achieving the vision and mission described in this National Strategy. The whole range of activities from the planning stages of research, through implementation of research activities, dissemination of research findings, and evaluation of research implementation need to be continuously monitored to ensure that these achievements are accomplished. Continuous monitoring should be done since there is always room for changes, even in good plans. However, although modifications and improvements to this strategic plan are possible in the course of time, such modifications should be done in a controlled manner to maintain consistency in achieving the vision and mission of this strategy.

Figure 9 below presents the impact pathway of the National Strategy. The impact pathway presents a summary of research themes that will be pursued, research implementation strategies, expected achievements (outcomes), and how the sequence of activities and results will be directed toward achieving the desired impacts to realize the vision and mission of this National Strategy.



Figure 9. The impact pathway of the agroforestry research strategy

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Tuti Herawati. Born in Ciamis, December 15, 1973. Tuti was graduated from the Department of Forest Management, Faculty of Forestry, IPB in 1997. She then directly continued to get her Master of Science at the same university. In 2011, Tuti completed her Doctoral degree in Forestry Sciences at the Faculty of Forestry, IPB. Tuti started her career as staff at the Directorate General of Land Rehabilitation and Social Forestry, the Ministry of Forestry in 1998, focusing on non-timber forest products and social forestry development programs. In 2004 Tuti moved as scientist at the Center for Research and Development on Forests and Nature Conservation, Forestry Research and Development Agency. Since 2011 Tuti moved to the Center for Research and Development on Forest Productivity Improvement and up to now is leading scientific group on Biometrics. Tuti is active in various research activities within the internal office and with various FORDA's partners. Tuti's expertise include community forestry (HKM), community plantation forest (HTR), management of non-timber forest products, and currently is more focus on policy and institutional research.



Nugraha Firdaus. Born in Tasikmalaya on 8 October 1978. Nugraha completed his Bachelor education at the Faculty of Forestry, University of Gadjah Mada in 2004. Soon after his undergraduate, he joined the Indonesian Conservation Community - WARSI (KKI - WARSI) as Project Coordinator on Forest Management Rationalization at Bukit Tiga Puluh National Park until 2007. Nugraha then joined the Ministry of Forestry and was based in Forestry Research Institute of Ciamis. Nugraha completed his master degree on Environment at the University of Melbourne, Victoria, Australia. After completing his master, Nugraha was back to the Forestry Research Institute of Ciamis and worked as staff in Research Evaluation and Cooperation Section. Nugraha is one among the authors of Research Master Plan on Agroforestry, which is now transferred into this national strategy.



Retno Maryani. Works as scientist at the Center for Research and Development on Climate Change and Policy, Ministry of Forestry. Her areas of expertise focusing on 'human dimension in forest management', which includes the relationship between dynamics of forest management and institutions and forest sustainability. Retno started her career as scientist at collaborative project between FORDA and TROPENBOS in Samboja, East Kalimantan (1988 -1990). Since her first career, Retno had started to realize that institution is a critical factor in conserving and developing Dipterocarp forests. Her interest in the field of institution deepened through her involvement in various research cooperation projects, which include SFD Community Forest Project in West Kalimantan (funded by GTZ Germany in 1996); studies on institution and policies of sandalwood in East Nusa Tenggara (CIFOR project in 1996 and ITTO project in 2010); the Development of Criteria and Indicator of Community Based Forest Management (CIFOR project in 1996); and Policy Review on Sustainable Management of Ramin (*Gonystilus* sp.) and its Conservation (ITTO project in 2008-2009). More recently Retno was involved in climate change studies and among the team members of REDD Readiness Plan Indonesia. Retno also actively involved in the World Bank's Forest Carbon Partnership Facility (FCPF) project. Retno had been working as ICRAF's Liaison Officer in 2010-2012, and currently serves as FORDA's Research Coordinator on forest landscape management.



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