

Empowering Communities and Countries to Conserve Biodiversity at the National and ASEAN Levels: Status, Challenges, and Ways Forward

Percy E. Sajise^{1,2}

Honorary Research Fellow, Bioversity International

Senior Fellow, Southeast Asia Regional Center for Graduate Study and Research in Agriculture (SEARCA)

Adjunct Professor, School of Environmental Science and Management, University of the Philippines at Los Baños

Introduction

The Convention on Biological Diversity (CBD) defines biodiversity as, ‘the variability amongst living organisms from all sources including, amongst other things, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part’. This includes diversity within species and of ecosystems found in both natural and human-modified ecosystems. Biodiversity provides the basic foundation for food security, human health, and ecological services. It also serves as a buffer against and as a coping mechanism for climate change. It is also linked to and underpins the resilience of ecosystems. A capacity for resilience and ecosystem stability is required to maintain essential ecosystem goods and services over time and space (Thompson et al., 2009). Resilience is the capacity of ecosystems to self-repair in response to perturbations caused by natural and human-induced factors. Hence, a loss of biodiversity could lead to lack of sustainability.

¹ p.sajise@cgiar.org

² This research was conducted as a part of the project of the Economic Research Institute for ASEAN and East Asia (ERIA) and the ASEAN Secretariat, ‘Framing the ASEAN Socio-Cultural Community (ASCC) Post 2015: Engendering Equity, Resiliency, Sustainability and Unity for One ASEAN Community’. The author is deeply indebted to the members of this project and to the ASEAN Centre for Biodiversity (ACB) for their support in providing the needed materials and documents. The opinions expressed in this paper are the sole responsibility of the author and do not reflect the views of ERIA or the ASEAN Secretariat.

Biodiversity is valued in terms of the ecosystem services it provides: cultural, provisioning, regulating, and supporting. In this context, the technical definition of biodiversity is complicated by the fact that various stakeholders choose to interpret this in many different ways and at various hierarchical levels. To fisherfolk, farmers, and other local resource users, biodiversity means food, clothing, and shelter, as well as the provider of other basic needs and human welfare. To some conservationists and policymakers, biodiversity means conservation of rare and endangered species and habitats. To others, biodiversity is the conservation of the natural heritage and the beauty of nature. Given this reality, all biodiversity decisions, including those based on science, are value-laden. The legitimacy of stakeholders' claims will always be debatable, with political and economic power dynamics providing the major influence in making decisions on access, use, and benefit-sharing of biodiversity (Vermeulen, 2004). This is the main reason why it took a long time before an access and benefit-sharing accord, referred to as The Nagoya Protocol under the CBD could be finalised and agreed in a manner similar to the legally binding International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) governing access to and benefit-sharing for the most important food crops and forage species that preceded the Protocol. Another complicating factor is that biodiversity, when thought of only in terms of the kinds and number of species – the usual way of quantitatively measuring it – is of little use if it is not related to the functions and services it provides. Therefore, biodiversity needs to be interpreted in terms of **functional biodiversity**, which is the kind of biodiversity that provides more available options for livelihoods in the social system, while at the same time maintaining ecosystem services. This functional dimension of biodiversity is the least studied and is mostly only implied.

Biodiversity and the ASEAN Vision of Sustainable Development

The ASEAN vision of sustainable development is described as 'an ASEAN Socio-Cultural Community that is inclusive, sustainable, resilient, dynamic, and engages and benefits the people'. An element of this vision includes, 'a balanced social development and sustainable environment that meet the current and future needs of the people'. Biodiversity will play a critical role in promoting resilience and the use of green technology, as expressed in the Nay Pyi Taw Declaration of 12 November 2014. This will be achieved through a people-oriented and people-centred process of empowerment and people-centred goals in biodiversity conservation and its sustainable use. This overall goal of biodiversity assumes even greater significance because ASEAN Member States (AMS), while occupying just 3% of the earth's surface,

contain over 20% of all known plant, animal, and marine species. Amongst these are a large number of endemic species found nowhere else in the world. This region has three of the 17 mega-biodiverse countries of the world – Malaysia, the Philippines, and Indonesia. These countries are also viewed as biodiversity ‘hotspots’ because of the rapid rate of loss of this valuable biodiversity. Southeast Asia is also home to many of the world’s most important crops, such as rice, mango, banana, and coconut, as well as a wealth of crop-wild relatives (CWR). It will be difficult to achieve the ASEAN Vision 2020 if biodiversity is not conserved and sustainably used at the community, country, and regional levels.

Status and Capacity of Achieving ASEAN Biodiversity Conservation and Sustainable Use Targets

The ASEAN Biodiversity Outlook 2010 summarises the dire biodiversity situation in the region as follows:

- Loss of 555,587 square km of forests in the period 1980–2007;
- Decline of mangroves by 26% in the period 1980–2005;
- Highest loss of coral reefs of 40% in the period 1994–2008;
- Significant loss of seagrass, especially in Indonesia, the Philippines, Singapore, and Thailand; and
- Increase in invasive and alien species that displace native biodiversity.

The major causes of biodiversity decline in the region include the following (Sajise, 2011):

- rapid modernisation of agriculture that strongly favours monoculture and high-yielding varieties vis-à-vis traditional varieties and landraces;
- changing consumer tastes that tend to lessen biodiversity in favour of just a few crops, breeds of animals, and other biological entities;
- rapid urban population increase partly as a result of migration from rural areas which results in the youth leaving farming, causing discontinuities in the practice of traditional agriculture that favours biodiversity;
- infrastructure development, pollution, and rapid land conversion resulting in the loss of agricultural land, natural forest, and aquatic areas; and
- poverty and lack of livelihood options resulting in human activities that destroy habitats.

Food and nutrition security in ASEAN will not be attained if the present rate of biodiversity loss continues. The demands placed on agriculture and other natural-resource base components in the region will increase significantly in the coming years

due to ever-increasing population pressure, unabated ecosystem degradation, and the frequent occurrence of disasters associated directly or indirectly with climate change. Meeting these demands will only be possible if we continue to have access to the genetic diversity of crops and animals, as well as their wild relatives that provide breeders and farmers with the raw materials required to sustain and improve their crops as well as adapt to climate change. Therefore, there is an urgency to fully implementing the updated National Biodiversity Strategy and Action Plan (NBSAP), given the Aichi Biodiversity Targets (2011–2020) by AMS to conserve remaining intact natural ecosystems, which serve not only as repositories of high biodiversity, but also provide ecosystem services needed by human societies. The ASEAN region remains slow in making progress, particularly in preventing invasive alien species, addressing the impact of biodiversity on species and ecosystems, abating pollution, and the exploitation of forests and wetlands. At the institutional level, the weak coordination between the Ministries of Environment, Agriculture, and Fisheries, as well as the lack of strong support by local government units and the private sector, enhances the problems of natural resource exploitation and slow restoration of degraded ecosystems. This is because natural biodiversity is the responsibility of the Ministry of Environment, while the Ministries of Agriculture and Fisheries cover the biodiversity materials for food and agriculture.

National Biodiversity Strategy and Action Plan (NBSAP) and the Aichi Biodiversity Targets in Support of CBD Goals in ASEAN

The overall status of biodiversity in AMS can be assessed through their NBSAP, which should be aligned along the five Aichi Biodiversity Strategic Goals: (i) address underlying causes of biodiversity loss; (ii) reduce the pressure on these causes; (iii) safeguard ecosystems; (iv) enhance the benefits of biodiversity; and (v) promote participatory processes in planning and implementation. The progress in achieving the biodiversity target in the ASEAN region is described in the ASEAN Biodiversity Outlook 2010. The following are highlights of the region's biodiversity:

- Targets under the Strategic Goal C of improving the status of biodiversity by safeguarding ecosystems, species, and genetic diversity in terms of the target for protected areas was fully met. Up to 12.6% of the ASEAN region's terrestrial land has been designated as Protected Areas (PAs). Six AMS have exceeded the 10% target, of which Brunei Darussalam, Cambodia, and Thailand have set aside more than one-fifth of their total land area for protection and conservation. However, efforts need to be directed towards improving management effectiveness of PAs and there should also be a focus on establishing more marine PAs given the region's vast marine and coastal-based resources. In a review conducted by the ASEAN Center

for Biodiversity (ACB) involving 30 ASEAN Heritage Parks (AHPs), 85% experience problems of poaching, illegal wildlife trade, illegal fishing, and illegal extraction of non-timber forest products. There were also problems with tenure conflicts and in securing boundaries. Eutrophication and pollution were also encountered as problems affecting water bodies. Ineffective management of PAs is commonly due to lack of funds and human resource capacity. Hence, there is a need for re-engineering and re-tooling to strengthen the common weaknesses identified to develop PAs that are effective *in situ* reservoirs of functional biodiversity for current and future generations.

- Most of the targets under the Strategic Goal B on reducing the direct pressures on biodiversity and promoting sustainable use were not met.
- There had been some initiatives and progress in AMS on most of the targets for Strategic Goals A, D, and E, but this has to be enhanced and good practices highlighted for possible adoption and wider dissemination.

Agro-biodiversity Status in ASEAN

Another means of assessing the status of biodiversity in the region is in terms of the conservation and sustainable use of agro-biodiversity in accordance with the **Global Plan of Action (GPA)**. The GPA provides a framework and spells out a guide for the conservation and sustainable use of plant genetic resources for food and agriculture. It has 20 interrelated priority activities organised into four groups: *in situ* development, *ex situ* conservation, utilisation of PGRFA, and institutions and capacity building. The GPA was adopted by the Member Countries of the Food and Agriculture Organization of the United Nations (FAO) and endorsed by the Conference of Parties (COP) of the CBD. The GPA is supported by the ITPGRFA. Legally binding, the ITPGRFA establishes the framework for access and benefit sharing within a multilateral system for most of the world's major food crops. It includes 35 genera of food crops and 29 forage species, including all major Consultative Group for International Agricultural Research (CGIAR) crops and a number of minor ones. The multilateral system provides uniform conditions for access and benefit-sharing and reduced transaction costs for users under streamlined conditions.

A National Information Sharing Mechanism (NISM) initiated and developed by FAO also exists in AMS. The NISM is designed to monitor the extent of implementation of the GPA for the conservation and sustainable use of PGRFA. In a survey conducted by FAO in 2000, the GPA priority activity for the Southeast Asian region was *ex situ* conservation and the top three activities were: Activity 5 (sustaining existing *ex situ* collection), Activity 7 (collecting Plant Genetic Resources [PGR]) and Activity 8 (expanding *ex situ*

collection) (Tao and Anishetty, 2001). Since then, there have been significant progress and efforts on *in situ* conservation and development not only in terms of protected areas but also on-farm conservation. Sajise (2011) conducted a regional assessment of the status of GPA implementation and came up with the following salient findings:

- Several AMS have expressed the need for better coordination at the national level of various agencies and stakeholders involved in PGRFA conservation and sustainable use. This improved coordination will enhance sharing of resources, good practices, and linkages with other institutions in the region with similar mandates.
- The *in situ* conservation gaps identified by countries in the ASEAN region are the following: (a) insufficient number of staff and weak technical capacity; (b) lack of or insufficient funding; (c) lack of incentives for farmers for on-farm conservation and participation in protected area protection; (d) lack of well-developed infrastructure and equipment in some countries; and (e) lack of, or weak, coordination.

Several AMS are prone to disaster exacerbated by climate change. To improve farmer resiliency the following are needed: (a) establish a network of community gene banks linked with national gene banks for disaster response; and (b) establish community seed banks as source of planting materials closer to where it is needed. Improved understanding of the local seed system was also identified as important to bolster the disaster response to restore agricultural systems. It is well recognised that *in situ* conservation of crop wild relatives (CWR) occurs in PAs, which is usually under the jurisdiction of the Ministry of Environment/Natural Resources. To bring about improved *in situ* conservation of CWR for PGRFA, there is a need for better coordination between these concerned sectors of government in partnership with local stakeholders.

■ Ex Situ Conservation

This conservation area broadly encompasses gene banks, botanic gardens, and *in vitro* and cryopreservation. The maintenance of *ex situ* collections requires a stable, sustainable, and perpetual funding stream, which is now partly provided by the Crop Diversity Trust. Furthermore, *ex situ* conservation has seen a considerable reduction in development-partner support in recent years, in favour of funding for *in situ* conservation. However, the complementarities between *in situ* and *ex situ* conservation are also more important than just an emphasis on one or the other, as both need to exist side by side to bring about sustainable conservation, evolution, and sustainable use of plant genetic resources.

Another common need indicated in AMS reports is a strengthened and focused collecting activity with particular attention given to CWR and under-utilised crop (UUC) species. Similarly, the need for better coordination at the national level for the

identification of duplicates and improved regeneration protocols, as well as increased efforts to regenerate accessions, were also identified. Identification of duplicates in and between collections, including safety duplication and processing of backlogs in collections, was also identified as existing needs in several country reports. Given that some AMS have no reliable electric power supply, this need was clearly identified and has to be alleviated to sustain existing *ex situ* collections in gene banks.

The need for expanding collection of targeted PGRFA is also recognised as a need. However, gaps reported by countries in the region for this activity are: (i) lack of focused approach, planning, and policies; (ii) inadequate funding; (iii) lack of clonal repositories; and (iv) lack of interdisciplinary teams to conduct targeted collecting. There is also a need for upgrading of facilities and equipment, improved technologies for *ex situ* conservation, and better institutional linkages both within and between countries to promote exchanges of germplasm materials.

■ Sustainable Use and Conservation of PGRFA

For all countries in the region, the common gap identified was in terms of evaluation and documentation of PGR, and the need to enhance linkages between users of PGRFA and the gene banks. The opportunity exists and should be encouraged for harnessing the strengths of some AMS for responding to the gaps in human resource capacity and the lack of facilities and equipment, especially in the use of molecular tools for characterisation and evaluation of conserved germplasms. There is also a need for more effort in characterisation and evaluation of germplasms collected in gene banks and to have them at a manageable level through the establishment of core and mini-core collections. A major concern expressed deals with increasing crop uniformity as a function of increasing industrialisation of agriculture and the influence of export markets. This trend is known to undermine agricultural sustainability and increase vulnerability to pests and diseases, as well as to environmental disturbances. Promoting and recognising the importance of UUCs, and enhancing crop diversification through market development and incentive systems were also identified by several countries in the region as much needed strategies to maintain and enhance agrobiodiversity.

Many countries in the region reported the need to develop improved seed systems through participatory selection, public sector seed systems, and growers' associations. The importance of responding to this need with an appropriate strategy has been demonstrated in connection with the success of participatory plant breeding in some AMS. However, the lack of institutional support to identify, recognise, and officially register farmers' varieties is working against providing economic incentives to commercially grow farmer's varieties. Country reports also indicated that lack of seeds is a major reason for the inability to promote cultivation of UUC species.

■ **Institutions and Capacity-Building**

A common need expressed by the majority of countries in AMS is that of staff training, database development, and educational training on PGR. The gaps identified were: (i) limited number of staff and a heavy workload; (ii) lack of financial resources and PGRFA that is often not seen as a national priority; (iii) PGR networks poorly managed; and (iv) limited international cooperation.

The establishment of the NISM in several AMS has greatly helped to assist the monitoring and evaluation of the GPA implementation in the region. At the country level, the NISM outputs can be used to develop a ‘national rolling plan/strategy’ for PGRFA conservation and sustainable use.

Opportunities in Biodiversity Conservation and Sustainable Use in the Region

The following were opportunities identified for biodiversity conservation and sustainable use in the region:

a. Presence of a Regional Biodiversity Institution

A significant positive factor in ASEAN is the existence of a formal regional institution, the ACB, which has the mandate to ‘facilitate cooperation and coordination amongst AMS and with relevant national government, regional and international organisation on the conservation and sustainable use of biological diversity and equitable sharing of benefits ensuing from the use of such biodiversity in the ASEAN region’ (<http://www.aseanbiodiversity.org>). It has had the important function of a clearing house of information related to biodiversity conservation and sustainable use for ASEAN. The ACB continues to support AMS to achieve international targets for biodiversity and management through various programmes and initiatives (Report of the ASEAN Socio-Cultural Council to the 25th ASEAN Summit, 2014). It is also involved in capacity building for developing regionally harmonised national processes for implementing CBD provisions on access and benefit-sharing for genetic resources. The ASEAN Socio-cultural Community blueprint calls for the ‘enhancement of the role and capacity of ACB to function as an effective regional center of excellence in promoting biodiversity conservation and management’. The target would be the full ratification of the establishment agreement of ACB by all AMS and the building up of the ASEAN Biodiversity Fund, which will ensure its sustainability and strengthened capacity for excellence, efficiency, and effectiveness in the service of AMS.

b. Existence of Networks for Plant Genetic Resources for Food and Agriculture

Most countries in the region are members of several commodity-based PGR networks (rice, banana, coconut, sweet potato) with linkages to international institutions, such as the various CGIAR centres. The PGRFA network in ASEAN is the Regional Cooperation for Plant Genetic Resources in Southeast Asia (RECSEA-PGR), mostly composed of heads of national gene banks as national focal points. This regional network, to be effective and sustainable, needs to be under the aegis of a formal regional inter-governmental organisation, such as ASEAN or any of its instrumentalities.

c. A Comprehensive Information System for Plant Genetic Resources for Food and Agriculture in the Region

Most AMS have established national PGR documentation systems. Standard descriptors for passport data were used by all the institutes involved in PGR activities for documenting accessions. Several countries in the region have set up and are maintaining a NISM, which is providing much needed inputs for assessing and updating the implementation of the GPA. There is also a need to develop an ASEAN NISM, which can serve a very important function of monitoring loss of genetic resources as a result of natural disasters as well as human activities.

d. Presence of Education and Training Institutions on PGRFA Conservation and Sustainable Use in some AMS

Many countries in the region reported the need for more and better trained human resources to carry out the various activities in PGRFA conservation and sustainable use. In addition to plant breeding and basic fields of taxonomy, there now exist higher levels of education in PGRFA through various academic institutions in Malaysia and the Philippines. These formal degree programmes are offered at the MSc level but some core courses are also offered at the undergraduate level, where they can either be an elective or part of a major course.

e. Enhanced Public Awareness of the Value of Biodiversity and PGRFA

There has been steady progress in enhancing public awareness of the value of biodiversity and PGRFA. Similarly, many countries in ASEAN are signatories to international platforms such as the ITPGRFA, CBD, International Union for the Protection of New Varieties of Plants (UPOV), and others. At the local level, biodiversity fairs, farmer cross-visits, and recognition of local biodiversity keepers, including women and their role, have been successfully employed to enhance public awareness.

f. Existing Research Consortia on Climate Change

There are existing National Research Consortia on Climate Change such as the one in Thailand comprising of six universities (Jintrawet et al., 2012) involved in joint research on different aspects of climate change. Other universities in the region, such as the University of the Philippines at Los Baños and others, have ongoing climate change research programmes. They can come together under an ASEAN umbrella to tackle an agreed national and regional research agenda on climate change and biodiversity.

g. Linking Biodiversity Conservation and Sustainable Use with New Approaches

At the landscape level, FAO has developed a network of Globally Important Agricultural Heritage Systems (GIAHS), which can be used as a vehicle for biodiversity conservation and its sustainable use, including its associated ecosystem services. GIAHS are defined as ‘remarkable land use systems and landscapes which are rich in globally significant biological diversity evolving from the co-adaptation of a community with its environment and its needs and aspirations for sustainable development’ (Koothakfan and Altieri, 2011). Currently, there is only one GIAHS in the region but there is a lot of potential for expanding this approach in AMS to promote biodiversity conservation and sustainable use at a landscape level.

Ways Forward

A practical strategy to move forward is to make use of the opportunities earlier identified vis-à-vis the needs for biodiversity conservation and sustainable use in the region. Specific suggestions are the following:

1. Enhancing the ASEAN Agenda on the Characterisation of Protected Areas as food and nutrition baskets and as a watershed of ecosystem services for the country and the region by linking this to the ITPGRFA implementation, as well as the GIAHS Program of FAO.

The aim is to highlight the value of PAs as providers of ecosystem services through better assessment of these ecosystem services and attempts at quantification to implement the scheme of Payment for Environmental Services (PES). Funds generated can be put into a national or regional **PA Environmental Fund** for use in the effective management of PAs. This agenda will strengthen and complement the increased efforts of AMS to designate PAs, while also recognising the need for better management and protection. These PAs can be piloted through a joint ASEAN regional effort carried out by the Ministries of Agriculture, Forestry, Natural Resources, and governments at local, national, and regional levels. At the global level, ASEAN can collaborate with

FAO to declare and manage GIAHS areas, which could include already declared PAs and ASEAN Heritage Parks (AHPs). While this effort is going on, there is also a need to set up an **ASEAN-wide management standard for PAs and AHPs**, which is needed to ensure an acceptable level of good management for different ecosystems. This can be initiated under the umbrella of ACB.

2. Supporting and monitoring the enhanced exchanges of biodiversity materials under the Nagoya Protocol and the ITPGRFA through existing ASEAN networks.

The development of a framework and guidelines for the implementation of the Protocol on access and benefit sharing under CBD must be implemented across all AMS. The development, degree of harmonisation, and putting in place of the national access and benefit-sharing framework following the Protocol must be a priority for AMS. **ACB can serve as a clearing house for this particular initiative in ASEAN.** Biodiversity materials and germplasm exchanges under the ITPGRFA can be monitored through existing commodity and regional networks under an ASEAN umbrella. The volume and rate of these exchanges can be used as an indicator of the economic usefulness of biodiversity materials in AMS.

3. Providing institutional mechanisms for enhanced coordination between the Ministries of Natural Resources, Agriculture, and Forestry, local government units, and academe in a fully integrated NBSAP and GPA.

The recommendation is to use existing mechanisms under ASEAN to bring this about at the national and regional levels. This can be achieved through a Coordinating Committee, a Task Force, or any other appropriate mechanism. In this way, the integration between programmes under the CBD and the ITPGRFA can take place at the local, national, and regional levels.

4. Strengthening capacities for biodiversity conservation and sustainable use in response to Climate Change.

This can be achieved by effectively linking community seed banks with national gene banks, national gene banks with CGIAR gene banks, and national gene banks with each other at the regional level to respond to the need for greater capacity (human resources, improvement of facilities) for climate change adaptation and mitigation in AMS. There is also a need to provide protection of Intellectual Property Rights at the community level, especially for farmers involved in participatory plant breeding and varietal selection.

5. Recognition of outstanding programmes for biodiversity conservation at the community, country, and regional level throughout ASEAN.

This involves recognising and providing incentives to outstanding farmers/fisherfolk; outstanding community seed-banks; outstanding community biodiversity managers; and biodiversity research and others. This is in line with the current ASEAN activity of recognising ASEAN Biodiversity Champions but encompassing specific areas that are highly relevant to biodiversity conservation and sustainable use for food and nutrition security (Status of Implementation of the ASCC Blueprint, 2009–15). The importance of gender can be highlighted in this strategy.

6. Creation of a Regional Biodiversity Field School (RBFS) for capacity-building of farmers, fisherfolk, and forest users patterned after the model of the farmer field school developed by FAO and development partner countries and non-government organisations in AMS.

This can be applied to promote participatory plant breeding and enhancing the enactment of legislation to promote farmers' rights, which should also consider the role of gender in biodiversity conservation and its sustainable use. Cross-visits to highlight lessons learned should be encouraged and promoted in ASEAN (Report of the ASEAN Socio-cultural Council to the 25th ASEAN Summit, 2014). ACB can coordinate this regional activity.

7. Markets and adding value to promote UUCs for enhancing the value of biodiversity

This can be linked to the assessment of forests and other natural ecosystems declared as PAs to enhance their values and to effectively link biodiversity conservation with sustainable use. It is recommended that ASEAN develop and promote a regional market to promote processing and adding value for UUC species for food, nutrition, energy, pharmaceuticals, nutraceuticals, and other basic uses.

8. Developing an ASEAN Consortium on Research for Biodiversity and Climate Change (AC-BCC)

This can be initiated by starting with the existing University Research Consortium in Thailand as a nucleus and expanding it to include a network of universities in ASEAN with ongoing programmes on climate change. The main agenda for the consortium's research should be climate change and biodiversity.

References

- Aichi Biodiversity Targets (2012). Available at: <http://biodiv.be/convention/strategiesplan.2011>
- ASCC Council (2014), Report of the ASEAN Socio-cultural Community Council to the 25th ASEAN Summit, 30 September, Bagan, Myanmar.
- ASEAN (2014), Nay Pyi Taw Declaration of the ASEAN Community's Post 2015 Vision. 12 November 2014, Nay Pyi Taw, Myanmar.
- ASEAN (2014), Status of Implementation of the ASCC Blueprint (2009–2015). Jakarta: ASEAN.
- ASEAN Center for Biodiversity (2010), *ASEAN Biodiversity Outlook*. Los Baños, Laguna, Philippines: ASEAN Center for Biodiversity.
- ASEAN Secretariat (2009), *Fourth ASEAN Environment Report*. Jakarta: ASEAN Secretariat. Available at: <http://www.aseanbiodiversity.org>
- Attachai, J. et al. (2012), 'Decision Support System Research and Development Network for Agricultural and Natural Resource Management in Thailand: A TRF–DSS Experience', *Southeast Asian Studies*, 1(1), pp. 141–62.
- Koohafkan, P. and M.A. Altieri (2011), *Globally Important Agricultural Heritage Systems: A Legacy for the Future*. Rome: FAO.
- Jintrawet, A. et al. (2012), 'Decision Support System Research and Development Network for Agricultural and Natural Resource Management in Thailand: A TRF–DSS Experience', *Southeast Asian Studies*, 1(1), pp. 141–62.
- Sajise, P.E. (2011), 'Regional Synthesis of Gaps and Needs for Updating the Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture: Asian Region', in *Plant Genetic Resources: Asian Perspectives*. Bangkok: FAO, Bangkok, pp. 65–87.
- Tao, K. and A. Murthy Anishetty (2001), 'The Implementation of the Global Plan of Action in the APO Region', *IPGRI Newsletter for APO*, Serdang, Malaysia.
- Thompson, I., B. Mackey, S. McNulty, and A. Mosseler (2009), 'Forest Resilience, Biodiversity and Climate Change. A Synthesis of the Biodiversity/Resilience/Stability Relationships in Forest Ecosystems', Secretariat of the Convention on Biological Diversity, Montreal, *Technical Series*, No. 43, p. 67.
- Vermeulen, S. (2004), 'Biodiversity Planning: Why and How Should Local Opinion Matter?' *Gatekeeper Series*, No. 115, p. 22.