TRANSFORMING FOREST EDUCATION TO MEET THE CHANGING DEMANDS FOR PROFESSIONALS

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The traditional forestry practice is under increasing pressure to transform, driven primarily by a shifting public perception of sustainability, and developments in science, communications, and global markets. In this context, the existing forestry education model is poorly equipped to cope with changes sweeping through the forestry sector that are linked to digitisation and rapid development in the information technology sectors. In preparing professionals for forestry practice today, notable discrepancies between what potential employers want and what the forestry institutions provide are apparent. In response, when hiring graduates of professional forestry programmes, forestry employers have changed the skill set and competencies sought. A similar scenario is also observed in South-East Asia, which despite its abundant forest resources and robust forest industries, is also experiencing dwindling interest among young people and falling enrollment rates in its forestry education institutes. Prevailing financial constraints and political pressures on higher education make it difficult for educators to close the gap between forestry education and forest practice. Nevertheless, a concerted effort from all stakeholders in revising the existing forestry education model to incorporate new courses and skills that will better prepare future foresters, appears to be the way forward.

Keywords: Forestry, training, curriculum, conservation, information technology

INTRODUCTION

The forests of the world are complex ecosystems. Their biodiversity is both a blessing and a curse as their bounty, which include timber, non-timber products and other services are indiscriminately exploited by man for economic returns (Ratnasingam & Ioras 2006). Despite considerable efforts by international agencies such as the Food and Agriculture Organization (FAO) of the United Nations and the International Tropical Timber Organization (ITTO) to ensure sustainable management of forest resources around the world, success on the ground has been mixed. In reality, the successful practice of sustainable forest management (SFM) depends on the availability of competent human capital to manage the forest and its resources (Ratnasingam & Ioras 2006), which is in turn the outcome of the forestry education system in place.

The radical changes in the forestry sector in past decades have been driven primarily by emerging global trends in social, economic and environmental issues. Globalisation, political changes, climate change, economic instability, the advent of new technologies including information technology (IT), fiber-based industry, energy industry, and geographic information systems (GIS), an increasing demand for vocational education, aging societies, and the increasing call for greener economies are among the emerging trends (Innes 2005).

The inevitable pressure for change in forestry and forest ecosystems are linked to all of these global trends, and require holistic and integrative approaches in response (Hetemäki & Mery 2010). However, the biggest anticipated changes in forestry education will be attributed to the increasing application of IT which will alter the ways people use forest services, and thereby alter the supply chains and the business logics of these forest services.

Perhaps the fate of professional forestry education throughout the world would be affected by: (1) an increasing global population that will exert greater pressure on forest resources, while increasing the demand for clean water, food, space and agricultural land, and (2) the risk

for higher biodiversity loss due to accelerating climate change and increasing waste production, both from households and industries (Vanclay 1996).

Generally, students are exposed to the forest very early in their schooling through geography and biology lessons, but the depth of coverage is often limited to main forest products and their contribution to the country's economic wealth (Attah et al. 2009, Ratnasingam et al. 2008, Ratnasingam & Ioras 2006). A focused approach to forestry as a professional study programme is usually available at college and university levels in many countries throughout the world. This paper examines the trends and challenges in forestry education worldwide in the context of changing demands on the profession, with emphasis on the South-East Asian region.

Traditional forestry education

The history of professional forestry education can be traced back more than two centuries, when the importance of the forest and its resources were realised. Since then, the forestry education system has been transformed to cope with the demands imposed by market needs. By the late 19th century, forestry emerged as a preferred choice of professional career education due to its important socio-economic status in many forest-rich countries around the world. Through the years, players in forestry education can be placed in four categories, with each category playing a particular role in ensuring the success of the overall forestry sector (Vanclay 1996):
(1) Providers: universities, technical training school, professional institutes
(2) Participants: forest managers, researchers, planners, policy makers, student
(3) Beneficiaries: potential employers, public and global biodiversity groups
(4) Intermediaries: media, schools

Generally, forestry education at the tertiary level is structured to produce professional foresters to meet prevailing market needs. However, Leslie et al. (2006) stated that school-leavers who selected forestry academic programmes at universities were usually driven by the opportunity to work outdoors (potentially with forest-based communities) and an interest in managing the biodiversity of natural environments, and creating and managing wood resources. Consequently, traditional forestry programmes first prepared students with a strong foundation in the core academic disciplines, of basic science, forestry science and botany, then trained them in the management, economics, research and communication skills needed as professionals in the forestry sector (Brown 2003).

It is of note that forestry education in Commonwealth countries has largely remained with this traditional model, as introduced by Britain, their former colonial ruler (Ratnasingam & Ioras 2006). The traditional forestry education model is unfortunately ill-equipped to produce the human capital needed to cope with the challenges arising from emerging global trends sweeping through the forestry sector. It is apparent that forestry education throughout the world is challenged and under growing pressure to restructure in order to remain relevant as a professional career option.

Forestry education in conundrum

Despite the socio-economic significance of the forest and forest industry sectors in many countries throughout the world, forestry education throughout the world is currently suffering from serious drawbacks. The future of forestry education in tertiary institutions has been the subject of numerous debates since the late 1990s (Arevalo et al. 2012). The core contention in these debates is whether forestry education is acceptable as university academic programme or is sufficient as a technical subject at a non-university diploma level (Innes & Ward 2010).

The problems faced by forestry education institutions have been primarily attributed to dwindling interest and enrollment in forestry academic programmes in many countries, including Great Britain (Burley et al. 2005), Canada (Innes 2005), Australia (Vanclay 2005), United States (Green 2006, Nyland 2008) and even Africa (Temu et al. 2006). School-leavers tend to choose careers with higher salaries than forestry, such as business, finance, engineering and information and communication technology (Nair 2004).

As a result of the falling enrollment in forestry programmes, some countries have resorted to hiring entry-level foresters from neighboring countries (Kanowski 2001). A 2009 survey of European Union (EU) countries evaluated the changing needs of professional foresters and ensuing reforms that university-level forestry programmes must undertake. The result pointed to a consensus between employers and

universities regarding important competencies, and identified gaps between the level of development achieved in those competencies and professional forester market needs (Arevalo et al. 2010).

The growing mismatch between existing forestry programmes and the necessary skills demanded by the market has been attributed to: (1) the apparent shift towards emphasising the social, cultural and ecological values of the forests, (2) globalisation and internationalisation processes that facilitate cross-border operations by multinational industries and environmental agencies/groups, (3) increasing competition from graduates of other nature, life and botany-related disciplines, and (4) the changing demands of employers with respect to the competencies and experience sought from forestry graduates (Arevalo et al. 2012).

Despite a growing discontent with the practical relevance of forestry programmes in many parts of the world, these programmes have not been restructured to meet current market demands. The syllabus of many forestry programmes still resemble that of the traditional Oxford syllabus, which is more than a century old (Vanclay 2007). Academics, teachers and trainers have not yet embraced the global paradigm shift in the forestry sector (Guariguata & Evans 2010). Rebranding existing curriculum without significant changes in the content of these forestry programmes is futile because graduates will be ill-equipped to cope with marketplace challenges (Temu et al. 2005).

Consequently, employment opportunities in the public forestry sector are dwindling. In the United Kingdom for instance, the private sector prefers to employ forestry degree holders but management positions within the Forestry Commission do not preferentially go to forestry graduates over graduates from other disciplines who are regarded as equally capable of doing the tasks of foresters (Leslie et al. 2006). Sadly, despite the significant change in attitude towards forests and increasing efforts to preserve their complex biodiversity, environment and wildlife sanctuaries, employment opportunities for forestry graduates have remained stagnant (Temu et al. 2006).

It has been argued that professional foresters with some business acumen, marketing knowledge and ability to work well with people were more employable (Miller 1992). The needs of the market for professional foresters are rapidly changing. In fact, more job opportunities for forestry graduates were in non-traditional sectors, such as non-governmental forestry, environmental-pressure groups, climate change advocacy groups and conservation-based organisations, especially in countries where the green economy has a strong foothold (Ratnasingam & Ioras 2006). Even in the South-East Asian region, which has a large forestry sector, there remains a perceived lack of job opportunities for forestry graduates that is contributing to the dwindling interest and enrolment in forestry programmes worldwide.

Forest resources and forest industries in South-East Asia

The forestry sector commands an important socio-economic status in countries in South-East Asia (SEA) region (Table 1). It is a well-known fact that the forestry sector is often associated with rural economy development in many developing countries in the region (Ratnasingam & Ioras 2006).

On this account, an analysis of the forestry education programmes in the SEA region may provide insights into the restructuring initiatives needed to ensure the relevance of forestry graduates in socio-economically important sectors.

Table 1   Forest cover and contribution of the forestry sector to national economies of ASEAN countries in 2015

Country	Forest cover as % of land area	Employment in forestry sector	Gross value-added in the forestry sector (USD million)
Indonesia	52	513,000	14,570
Malaysia	62	180,000	5720
Philippines	26	210,000	529
Thailand	37	117,000	3169
Vietnam	44	300,000	2356
Laos	68	109,000	164

Data from FAO (2016)

Evolution of forestry practices and forestry education in South-East Asia

The changing paradigm in forestry practices in the SEA region is increasingly apparent. Forestry practice has evolved since the 1970s, moving away from purely economic activities to focus on multiple use of forest resources and forest ecosystem conservation (Table 2).

Table 2   Trends in forestry practices in South-East Asia

Time period	Forestry practice focus
1976−1980	Timber production and agriculture expansion sentence case
1981−1990	Push for sustainable forest management
1991−2000	Strengthening forest conservation
2001−2010	Realising biodiversity conservation
2010 onwards	Exploring multiple-use of forest resources

Source: Ratnasingam & Ioras (2006)

Against this background, the survival of the forestry profession in many parts of the world will depend on its ability to adapt to the realities of the new market, and restructuring of the forestry education system as a whole.

According to a report by the South-East Asian Network for Agroforestry Education (SEANAFE) in 2015, 74 institutions in the region offered forestry-related programmes (including forest management, wood science and technology, forest recreation and park management, and wildlife management), at bachelor's, master's or doctoral degree levels. As of 2016, Indonesia had the highest number of institutions offering forestry-related programmes (29 institutions) followed by the Philippines with 23 institutions, while Laos, Vietnam, Malaysia and Thailand had 9, 6, 5 and 3 institutions respectively SEANAFE 2016). Between 2000 to 2015, total student enrollment in forestry-related programmes in Malaysia, the Philippines and Thailand was stagnant or declined slightly, but showed a marked increase in Indonesia, Vietnam and Laos. Increased student enrolment in those countries was attributed to populist views of forest conservation aided by external funding as well as the increasing number of employment opportunities in domestically large forest industries (Table 3). Nevertheless, it remains to be seen if this trend will continue in years to come as the global trends in forestry affect the domestic scenario.

The new reality for forestry education

One of the major drivers of change in forestry education has been the increasing number of multidisciplinary study programmes. Forest science content is frequently taught in programmes where forest ecosystems are only one among others, such as aquatic, wetland, range, mountain and agricultural systems (Sample et al. 2015). This could be why professional forestry education is losing its appeal worldwide with graduates from other multidisciplinary programmes filling forestry-related positions.

A 2016 survey of forestry programmes in SEA suggested that the major changes in forestry education in recent years have been due to: (1) the consolidation of traditional forestry programmes with other disciplines or termination of forestry programmes, (2) a multidisciplinary approach, (3) increasing demand for generic skills and social aspects of forestry, (4) e-learning and blended learning, and (5) internationalisation (Abdul Razak et al. 2005, Anon 2017).

In many instances, the restructured forestry education curriculum, can be categorised as: (1) forest science centered curricula based on and labeled 'forestry', 'forest sciences', 'forest management' or equivalent, and (2) natural resources study programmes based on and labeled 'natural resources management', 'environmental science' or equivalent. Nevertheless, it is fair to say that scientific research on forest education has not been extensively conducted in the past (Sample et al. 2015). A review of literature on forestry education studies found a focus on regionally-developing trends with little in-depth analysis of curricula needs to suit market requirements (Rekola et al. 2017). That review placed research undertaken into the following study categories: (1) pedagogical methods, such as problem-based learning, e-learning and life-long learning, (2) gap analysis, where competency needs in the forestry workplace were compared with competencies provided by formal education, and (3) student enrolment and graduate employability, where the flow of incoming students and fresh graduates entering the labor market were monitored.

Table 3　　Enrolment in forestry programmes in South-East Asia from 2000 to 2015

Year	Indonesia	Malaysia	Philippines	Thailand	Vietnam	Laos
2000	978	116	63	159	59	16
2005	1300	105	79	161	93	77
2010	1657	83	70	150	175	127
2015	2016	67	72	163	287	185

Data from FAO (2016) and Anon (2017)

Employment in the forestry sector in South-East Asia

The shrinking employment opportunities for forestry graduates have been attributed to: (1) changing social values, (2) diversification of degree offerings beyond traditional forestry, (3) inflexible, science-based curricula associated with accreditation and certification, (4) a perceived lack of forestry jobs and low wages, and (5) the limited appeal of forestry professions for women and minorities (Kanowski 2015).

In SEA, the public sector accounted for 48% of forestry jobs in 2016 while non-governmental organisations offered the most jobs (23%) among private sector employers (Anon 2017). Entrepreneurial or self-employed positions comprised 18% of forestry jobs while the forest industry and non-forestry segment offered 9 and 10% of forestry jobs. With the exception of forest departments and related agencies, public sector positions do not necessarily require forestry-related knowledge and skills. Increasing numbers of forestry graduates are embarking upon conservation-related careers. Very few supervisory and middle management positions exist for forestry graduates in forest industries, which favor employment of foreign contract workers.

Role of foresters in South-East Asia

The roles of foresters have also changed substantially in SEA over the last few decades (Burley et al. 2005). In almost all SEA countries there is a growing shift from traditional forestry towards social and community forestry, agro-forestry, plantation forestry, environmental conservation and a green economy. These changes call for foresters competent in dealing with human aspects of forestry and who use multidisciplinary and participatory approaches (Innes 2005). Most of the responses indicated that these changing roles will have to be taken into account in the curricula offered, both through new courses and programmes and a thorough revision of existing programmes. New directions in forestry education should emphasise the learning of 'hard skills', i.e., business, entrepreneurship, ICT, plant-optimisation, plantation management, multi-resource management, high conservation value forest management, eco-park management, green economy management, tourism, and 'soft skills', i.e. communication, presentation and critical thinking. Therefore, forestry education in the SEA region will have to cope with the changing trends in the marketplace and human capital needs.

Resources, facilities and funding

One of the biggest hindrances to change in existing forestry education systems in the SEA region is the lack of funding, which impedes improvements in teaching and learning facilities in many of its forestry institutions. Without funding to improve facilities, changes in the curricula will be meaningless as potential forestry graduates will lack the necessary hands-on skills required in the job marketplace. In fact, the poor facilities at forestry institutions can also have an adverse effect on the students' hands-on skills, specific technical knowledge, critical thinking, and global outlook (Anon 2017).

Solutions for human capital development for forestry in the future

Against the background of globalisation, democratisation of education, the rapid progress in science and technology and growing environmental concerns, the higher education sector, which includes forestry education, will have to be transformed, to remain relevant (Andersen et al. 2002).

Due to the importance of forestry, traditional forestry education will have to shift towards social

forestry, community forestry, and environmental conservation, with emphasis on those areas (Ratnasingam & Ioras 2006). Hence, the forestry education curriculum needs to be reviewed and restructured to develop relevant and quality programmes that will serve the public and private forestry sectors (Ratnasingam et al. 2013, Anon 2017). This curriculum development must be linked to natural resource development, potential business ventures and trade, the community environment, scientific research, and the country's need for forestry training, research and innovation (Nair 2004). Some experts argue that forestry education for the future must move away from industry-based forestry education models towards a more holistic forestry education that centers on the multiple-use of forest resources and environmental conservation (Ratnasingam et al. 2014). Others recommend that foresters be re-trained in the new approaches to forest management and that forestry education objectives be reviewed in the light of future developments brought about by the revolution in IT and digitisation (Guariguata & Evans 2010).

With the steady growth in community-based forestry and private-forest ownership throughout the world, on-line forestry education can be a viable and innovative alternative mode of education to serve a wider audience. Cornell University's Forest-Connect 'webinar series' is an example of a distance-learning forestry programme, to which participants responded positively and who were inspired to continue learning (Allred & Smallidge 2010). Other such distance-learning forestry programmes include those at Mississippi State University, which runs the programmes in collaboration with the Natural Resources Distance Learning Consortium (NRDLC). This is a clear testament of the power and influence of information technology in making available forestry education to the masses.

The forestry sector needs workers with a good command of basic concepts and essential skills to carry out required tasks in the forest and forest industries. In this context, forestry education curricula must continue to incorporate fundamental concepts and basic forestry skills, whilst-imparting other essential knowledge and skills to produce forestry graduates that are effective, competent and relevant to the changing job market (Ratnasingam & Ioras 2006). Many forestry institutions in the world are under the impression that changing the name of existing

forestry programmes without major content restructuring will be sufficient to increase student enrollment (Anon 2017). This perception is flawed because employers remain dissatisfied with the quality of forestry graduates due to their inability to perform effectively in the job environment (Anon 2017). Such marketing strategies may also account for the growing discontent among potential employers who end up looking for graduates from other disciplines to fill available positions (Nyland 2008, Attah et al. 2009).

Although the social, economic and environmental aspects of forestry practice throughout the world are comparable, countries differ in their (local) demands on forestry, forestry education and foresters. Therefore, forestry graduates must be flexible and resourceful in terms of knowledge and skills to remain relevant in the ever-changing job environment. The same is true for academics, teachers and trainers in forestry institutions, who must adopt an attitude of life-long-learning of knowledge and skills to impart to their students (Rekola et al. 2017). The promise of competent teachers and quality forestry programmes could attract more student enrollees and ultimately increase the number of professional foresters in the long-term.

Another concern is the lack of applied research in forestry institutions in the SEA region, where research outcomes have had minimal practical application and limited opportunities for commercialisation (Abdul Razak et al. 2005). Research priority areas should be determined in collaboration with the forestry industry rather than dictated 'top down' by policy makers or forestry institutions. The successful forestry education and research model practised in Germany is worth emulating (Ratnasingam 2011). In other words, there is an urgent need to address issues related to quality and relevance of the research rather than its quantity. In education, one should not equate accomplishment with activity. Similarly in forestry education, gaining relevant knowledge and skills is far more desirable to ensure employment in suitable positions relevant to the qualifications of forestry graduates.

CONCLUSIONS

Global forestry education is in transition, and efforts must be taken to renew students' interest and enrolment in forestry programmes worldwide. Traditional forestry curricula needs to be

restructured with a higher degree of flexibility that will allow graduates to adapt to the changing work-environment and market needs. The education curricula must equip forestry graduates with specialised skills and the ability to take on multiple roles managing forest resources. Such forestry education programmes will gain relevance, viability and wider acceptance in the forestry sector and society at large.

REFERENCES

Abdul Razak MA, Norini H & Krishnapillay B. 2005. Forestry Research and Education in Malaysia. *Forest Science and Technology* 1: 176–184.

Allred SB & Smallidge PJ. 2010. An educational evaluation of web-based forestry education. *Journal of Extension* 48: 1–14.

Andersen F, Konijnendijk CC & Randrup TB. 2002. Higher education on urban forestry in Europe: an overview. *Forestry* 75: 501–511.

Anon. 2017. Current Higher Forestry Education Trends. Pp 35–51 in *Growing Higher Forestry Education in a Changing World: Analysis of Higher Forestry Education in the Asia-Pacific Region*. University of British Columbia-APFNet, Vancouver.

Arevalo J, Mola-Yudego B, Pelkonen P & Qu M. 2012. Students' view on forestry education: a cross-national comparison across three universities in Brazil, China and Finland. *Forest Policy & Economics* 25: 123–131.

Arevalo J, Pitkänen S, Gritten D & Tahvanainen L. 2010. Market-relevant competencies for professional foresters in European graduate education. *International Forestry Review* 12: 200–208.

Attah A, Ioras F, Abrudan IV & Ratnasingam J. 2009. The Voluntary Partnership Agreement: the Ghanaian and Malaysian experiences. *International Forestry Review* 11: 311–318.

Brown N. 2003. A critical review of forestry education. *Bioscience Education E-Journal* 1: 1–4.

Burley J, Plenderleith K, Howe R & Freer-Smith P. 2005. Forest Education and Research in the United Kingdom. *Forest Science and Technology* 1: 67–76.

FAO. 2016. *State of the World's Forests 2016. Forests and Agriculture: Land-Use Challenges and Opportunities.* Rome.

Green CC. 2006. Forestry education in the United States. *Issues in Science and Technology Librarianship*, 46. doi:10.5062/F4FX77CX

Guariguata MR & Evans J. 2010. Advancing tropical forestry curricula through non-timber forest products. *International Forestry Review* 12: 418–426.

Hetemäki L, Mery G, Holopainen M, Hyyppä J, Vaario LM & Yrjälä K. 2010. Implications of technological development to forestry. Pp 157–179 in Gerardo M et al. (eds) *Forest and Society – Responding to Global Drivers of Change*. IUFRO World Series Volume 25. Vienna.

Innes JL. 2005. Multidisciplinarity, interdisciplinarity and training in forestry and forest research. *The Forestry Chronicle* 81: 324–329.

Innes JL & Ward D. 2010. Professional Education in Forestry. Pp 76–93 in *Commonwealth Forests 2010: An Overview of the Forest and Forestry Sectors of the Commonwealth*. Commonwealth Forestry Association, London.

Kanowski P. 2001. Forestry education in a changing landscape. *International Forestry Review* 3: 175–183.

Kanowski, PJ. 2015. Internationalizing forestry education. *Journal of Forestry* 113: 574–578.

Leslie AD, Wilson ER & Starr CB. 2006. Current state of professional forestry education in the United Kingdom. *International Forestry Review* 8: 339–349.

Miller H. 1992. Trends in forestry education in Great Britain and Germany. *Unasylva* 55: 29–32.

Nair CTS. 2004. What does the future hold for forestry education? *Unasylva* 55: 1–9.

Nyland RD. 2008. The decline in forestry education enrolment—some observations and opinions. *Bosque* 29: 105–108.

Ratnasingam J & Ioras F. 2006. *Colonial British Forestry and the Years Thereafter*. Tropical Resources Network Press, Kuala Lumpur.

Ratnasingam J, Macpherson TH, Ioras F & Abrudan IV. 2008. Chain of custody certification among Malaysian wooden furniture manufacturers: status and challenges. *International Forestry Review* 10: 23–28.

Ratnasingam J. 2011. Employability of forestry graduates in Malaysia—myths and realities. International Furniture Research Group Report No. 14. (Unpublished)

Ratnasingam J, Ioras F, Vacalie CC & Wenming L. 2013. The future of professional forestry education: trends and challenges from the Malaysian perspective. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca* 41: 12–20.

Ratnasingam J, Vacalie CC, Sestras AF & Ioras F. 2014. Public perception of forestry practices in Malaysia. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca* 42: 280–285.

Rekola M, Abbas D, Bal T, Burns J, Lackner M, Rodriguez S & Sharik T. 2017. *Global Outlook on Forest Education (GOFE)—A Pilot Study Report*. IUFRO & IFSA Task Force on Forest Education, Austria.

Sample VA, Bixler RP, McDonough MH, Bullard SH & Snieckus MM. 2015. The promise and performance of forestry education in the United States: results of a survey of forestry employers, graduates, and educators. *Journal of Forestry* 113: 528–537.

Temu AB, Rudebjer PG, Kiyiapi J & Lierop PV. 2005. *Forestry Education in Sub-Saharan and Southeast Asia: Trends, Myths and Realities*. Forestry Policy and Institutions Working Paper No. 14. Food and Agriculture Organization of the United Nations, Rome.

Temu AB, Okali D & Bishaw B. 2006. Forestry education, training and professional development in Africa. *International Forestry Review* 8: 118–125.

Vanclay J. 1996. The future of forestry education. *Institute of Foresters of Australia Newsletter* 37: 2–6.

Vanclay J. 2005. Achieving a quiet revolution in forestry education. *Australian Forest Grower* 28: 25–26.

Vanclay J. 2007. Educating Australian foresters for the 21st century. *International Forestry Review* 9: 884–891.

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