objective, nature of crops grown, and structure and composition of whole gardens rather than a listing of individual crop species or combinations observed in the survey area.

Fruit cropping has been widely accepted in the study area, where the majority of upland farm plots are now some type of garden. Fruit is grown for both home consumption as well as for commercial reasons, both of which were project objectives of the Sam Mun Highland Development Project. Home gardens and home garden-like agroforests are very abundant and crop diversity is generally high. Economic objectives clearly also have an important role in Home Garden-Like Agroforestry as well as more conventional Commercial Orchard subsystems. Few of the commercial orchards have exclusively cash crops. The majority have some small home-use function as well. Most of the subsystems appear to incorporate dual home and commercial functions.

These systems are very dynamic, as indicated by the age structures and age ranges of the gardens. Composition and abundance of species are changed frequently through death and additional planting. Few gardens are established within a year. Many of the gardens are not yet 'mature' but are still in development. It can be concluded that many gardens' classifications would likely be different five years before and again five years after the current classification. The composition of young orchards does not necessarily indicate what the nature of the garden will be in the future. Although each subsystem represents a coherent group, there are no sharp lines of division between the different fruit cropping subsystems but rather a gradient of differences. These groups could be rearranged or further subdivided if the list of classifying variables was altered. Also, the survey is not exhaustive, but limited in area and not all possible patterns are encountered. However, a framework now exists to which other subsystems can be added.

This classification can be useful in two important ways. First, it can be used as a tool for further analysis in the study area. Second, it can be used as a survey tool to help develop a better picture of the nature of fruit cropping activities over a wider area of the Highlands in northern Thailand, mainland Southeast Asia, and perhaps elsewhere. Both uses are relevant to ongoing development and resource management activities in northern Thailand. In the next phase of this study, we will examine the economic, social and ecological costs and benefits of these systems.

Acknowledgements

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Chapter 8 provides an excellent summary on hedgerow intercropping for soil management. It reviews the effects of climate and soil fertility on crop yields with hedgerow intercropping. It presents current thinking on the environmental and socioeconomic conditions under which farmers might adopt hedgerow intercropping, thereby highlighting that no single agroforestry system will be universally adopted. The book concludes that some trials indicate sustained crop yield advantages with hedgerow intercropping in the longer term of more than five years. I have, however, some reservations with this conclusion because it could be biased by the use of control treatments with monocropping rather than realistic cropping patterns of farmers. Greater yield declines with monocropping than realistic cropping patterns – which is a very likely possibility over the long term – could lead to an overestimation of the sustainable crop production with hedgerow intercropping when monocropping is used as the control.

Chapter 10 on research offers several essential, but often not considered, guidelines for researchers. It calls for conducting researcher-managed trials at sites with a soil fertility level representative of the target farming area, even though this may necessitate working outside existing experiment stations (p. 240). It recommends delaying a major sampling and analysis for monitoring changes in soil properties until after an initial analysis of a few properties in a few selected samples indicates a high likelihood of significant differences (p. 248). I hope agroforestry researchers carefully consider these recommendations. In this chapter, however, I would have liked to see more emphasis placed on initial characterization of research sites for the main soil constraint, particularly for the nutrient(s) limiting plant growth. This can be vital for assessing the conditions under which an agroforestry system influences crop yields. For example, an improved fallow with a fast growing, N_2-fixing tree might effectively increase crop yield when nitrogen is the nutrient limiting crop yield. On the other hand, it would likely not effectively increase crop yield when phosphorus limits crop yield.

There is the risk that a simplified presentation, which makes a potentially complex topic more understandable, can lead to an overly optimistic or biased assessment of agroforestry. I believe this is particularly possible for the presentation of improved fallows in the book. The assessment of the relative length of cultivation in an entire fallow–cultivation cycle (p. 157) is based on experiment station results. It does not consider that the optimum lengths of fallow and subsequent cultivation depend upon biomass production of the fallow, nutrient cycling by the fallow biomass, and economic factors. The statement on p. 206 that 'even on the basis of the limited research to date, one could establish a demonstration site for tree fallows or biomass transfer and be confident of large positive effects' fails to consider that the effect on crop production is strongly dependent upon the biomass production and the nutrient release from biomass for the selected tree species. In addition, the simplified presentation on the maintenance of soil organic matter in Chapter 5 does not thoroughly consider the trade-offs associated with wood produc-

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Book review

Agroforestry for Soil Management, 2nd edition. Anthony Young. CAB International, Wallingford, UK (in association with ICRAF, Nairobi, Kenya). 1997, 320 pp. ISBN 0 85199 189 0. Paperback, US$45.00.

Agroforestry is considered to provide a number of benefits to soil management that can contribute to sustainable land use. In the 1980s and early 1990s, a number of hypotheses were formulated on the potential of well-designed and well-managed agroforestry systems to control soil erosion, maintain soil organic matter, maintain soil physical properties, promote nutrient cycling and promote efficient nutrient use. Anthony Young presented these hypotheses in 1989 in the book entitled *Agroforestry for Soil Conservation*. At that time, however, research data to test the hypotheses were very limited. Within the 1990s the science of agroforestry has rapidly advanced, and considerable research data examining the earlier hypotheses have been recently published.

Anthony Young has now completely rewritten his earlier book into a new edition with a new title. The objectives of the new edition are to summarize the present state of knowledge on soil-related aspects of agroforestry and to indicate needs for research. The book contains twelve chapters with Chapters 2 to 8 presenting the state of knowledge for twelve key soil-agroforestry hypotheses. Chapter 9 addresses modelling, Chapter 10 deals with research approaches and needs and Chapter 11 presents agroforestry in the context of land use and the environment. Chapter 12 summarizes the current status of knowledge for the soil-agroforestry hypotheses and the extent to which the hypotheses have been verified. The book contains an extensive list of references largely dating from the 1990s.

I am particularly pleased that the book (i) distinguishes nutrient inputs from nutrient recycling, (ii) recognizes that agroforestry does not eliminate the need for nutrient inputs, and (iii) highlights that agroforestry for soil management is not synonymous with solely alley cropping. Some earlier literature refers to nutrients in *in situ* produced biomass as 'inputs', but this book separately lists processes that increase additions or reduce losses and processes that simply affect soil physical, chemical and biological processes (pp. 34–39). The book clearly states that nutrients in *in situ* produced biomass – apart from inputs via biological N_2 fixation, retrieval from subsoil below crop rooting and atmospheric deposition – are simply recycled rather than net inputs. Despite the benefits of agroforestry in nutrient cycling, the need for nutrient inputs is not eliminated (p. 134). The detailed review of hedgerow intercropping (alley cropping) in Chapter 8 is presented in the context that hedgerow intercropping is only one of a number of agroforestry systems for soil management.

tion and litter quality. High export of wood from trees in fallows, for example, can lead to more economic products but less inputs of carbon to soil. Low quality, slow-decomposing litter – that is effective in building soil carbon – could be ineffective as a nutrient source. We should learn from the lessons of hedgerow intercropping and ensure a realistic identification of the environmental and socioeconomic conditions under which farmers might adopt various improved fallow systems.

The general listing of properties of woody perennials suitable for soil fertility (p. 47) is a good starting point in the selection of tree species for agroforestry systems. The subsequent challenge for researchers is to identify the properties of trees for specific conditions of soil, climate, cropping intensity, and tree–crop configurations. Modelling may play a role in meeting this challenge, and Chapter 9 deals with the potential role and availability of agroforestry models. While models undoubtedly can serve as a learning tool as explained in Chapter 9, I believe the potential of models to solve real needs of identifying biophysically and socioeconomically appropriate agroforestry systems for site-specific conditions remains to be demonstrated. Simplicity and utility must be stressed in modelling to ensure that agroforestry models do not become unwieldy.

One of the two objectives of the book is to identify needs for research. The listed key areas for research (pp. 243–244) are many and more detailed than in the first edition of the book. Indeed, much research remains to be conducted in agroforestry. The book, however, does not provide insights on how to prioritize such a large number of key research areas. This challenge remains for others or perhaps for a future third edition of this book.

Chapter 12 on Conclusions is concise and up-to-date. The summary on state of knowledge for each hypothesis, however, would have benefited from more citation of literature to support specific points in order for readers to locate the primary sources of information. Some conclusions also risk sounding overly optimistic without reference to the specific research findings. In reality, the answer to a hypothesis on the potential of an agroforestry system to control erosion, maintain soil organic matter and soil physical properties, or promote nutrient cycling and efficient nutrient use will frequently not be a simple true or false. Rather, the answer will be conditional depending upon many factors such as the tree species, tree biomass production and quality, soil and climate.

It is important to recognize that a true hypothesis on the potential of an agroforestry system to control erosion, maintain soil organic matter and soil physical properties, or promote nutrient cycling and efficient nutrient use does not guarantee increases in crop yields or an economical system. For example, the book indicates that despite frequently reported benefits of hedgerow intercropping on soil properties and nutrient cycling, there has been limited cases of increased crop yields with hedgerow intercropping and virtually no farmer adoption of hedgerow intercropping. The benefits of mulches on reduced soil and water loss and increased soil water content are well documented (Chapter 3), but the use of mulches in production of relatively low-valued staple food crops – as compared to systems with higher valued perennials or vegetables – is limited. The following quote on pp. 202–204 best summarizes the challenge: 'However technically efficient a land-use system may be in conserving soil fertility, this benefit will not be achieved if the system is not practised by farmers'.

I particularly found the summary boxes within chapters and at the end of each chapter to be valuable. They enhance the value of the book as a rapid-to-use, introductory reference. The book's production is high quality with very few errors, except for numbering of footnotes in Chapter 8.

Anthony Young has effectively simplified a potentially complex topic into an easy-to-read and thoroughly updated book. The book is without doubt essential reading for students, researchers and development workers in agroforestry. At US$45, it is reasonably affordable.

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Erratum

Tree windbreaks and shelter benefits to pasture in temperate grazing systems

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On page 36 of the above article, the correct figure should be as follows

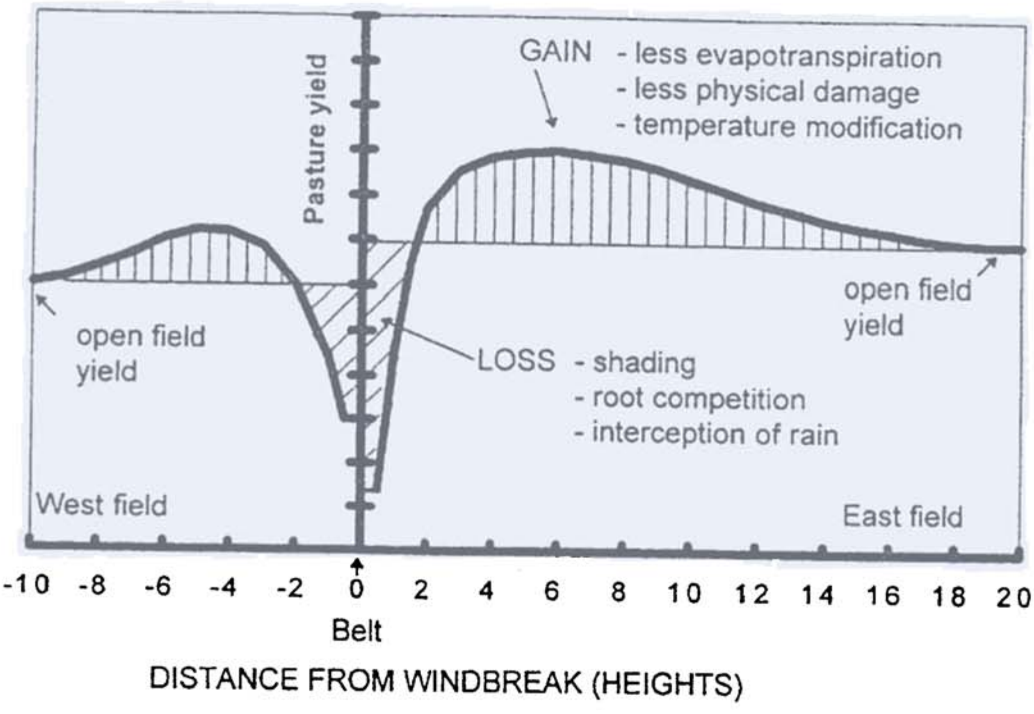

Figure 1. Generalised representation of possible shelter effects on pasture yield, indicating factors that may influence losses in the competitive zone and gains in the shelter zone on both sides of the windbreak.
Source: after Bates, 1911.