sustainability

MDPI

Review

Soil and Water Conservation Techniques in Tropical and Subtropical Asia: A Review

Bin Huang [1,2,3], Zaijian Yuan [1,2,3], Mingguo Zheng [1,2,3], Yishan Liao [1,2,3], Kim Loi Nguyen [4], Thi Hong Nguyen [5], Samran Sombatpanit [6] and Dingqiang Li [1,2,3,*]

[1] Guangdong Key Laboratory of Integrated Agro-Environmental Pollution Control and Management, Institute of Eco-Environment and Soil Sciences, Guangdong Academy of Sciences, Guangzhou 510650, China; bhuang@soil.gd.cn (B.H.); zjyuan@soil.gd.cn (Z.Y.); mgzheng@soil.gd.cn (M.Z.); ysliao@soil.gd.cn (Y.L.)
[2] National-Regional Joint Engineering Research Center for Soil Pollution Control and Remediation in South China, Guangzhou 510650, China
[3] International Academy of Soil and Water Conservation, Meizhou 514000, China
[4] Research Center for Climate Change, Nong Lam University, Ho Chi Minh City 70000, Vietnam; ngkloi@hcmuaf.edu.vn
[5] Faculty of Geology, VNU University of Science, Vietnam National University, Hanoi 100000, Vietnam; nguyenthihong.hus@gmail.com
[6] Land Development Department, Bangkok 10900, Thailand; sombatpanit@gmail.com
* Correspondence: lidq@gzb.ac.cn

Abstract: Soil and water loss is a severe environmental problem in tropical and subtropical Asia (TSA). This review systematically summarizes the techniques that have been widely applied in the TSA region and compares the conservation efficiency of these techniques based on the runoff and sediment reduction ratios (η_r and η_s). The results show that the current techniques can be divided into biological, engineering and agricultural practice measures, and in most cases, their efficiencies in reducing sediment loss (η_s = 14.0–99.5%, 61.3–100.0% and 0.6–95.4%, respectively) were higher than in reducing runoff loss (η_r = 2.8–9.38%, 0.28–83.3% and 1.62–70.2%, respectively). Monocultures of single tree species (e.g., *Pinus massoniana*) sometimes showed very limited conservation effects. Vetiver and alfalfa were more effective at reducing soil loss than other hedgerow species. Contour tillage, ridge farming, and reduced tillage generally showed high efficiencies in reducing soil loss compared with other agricultural practice measures. The combination of engineering and biological techniques could more effectively reduce soil and water loss compared with the application of these techniques along. Future works should be conducted to build unified technical standards and reasonable comprehensive evaluation systems, to combine these techniques with environmental engineering technologies, and to develop new amendment materials.

Keywords: tropical and subtropical Asia; soil erosion; soil and water conservation; ecological engineering techniques; runoff reduction ratio; sediment reduction ratio

Citation: Huang, B.; Yuan, Z.; Zheng, M.; Liao, Y.; Nguyen, K.L.; Nguyen, T.H.; Sombatpanit, S.; Li, D. Soil and Water Conservation Techniques in Tropical and Subtropical Asia: A Review. *Sustainability* **2022**, *14*, 5035. https://doi.org/10.3390/su14095035

Academic Editors: Nektarios N. Kourgialas, Ioannis Anastopoulos and Alexandros Stefanakis

Received: 4 March 2022
Accepted: 20 April 2022
Published: 22 April 2022

1. Introduction

Soil erosion is a worldwide environmental problem. It can lead to soil structure destruction and nutrient loss, causing the degradation of soil functions and reductions in crop yield [1]. Soil erosion also plays an important role in affecting hydrological process and cycling of crucial elements, such as carbon and nitrogen [2,3]. A report released by the Food and Agriculture Organization (FAO) of the United Nations showed that approximately 75 Pg of soil is eroded annually from arable lands worldwide [4]. Soil erosion is a complex dynamic process intimately influenced by climatic, vegetational and edaphic factors [5–7]. Serious soil erosion is usually associated with intensive human activities including unreasonable cultivation, deforestation, and imprudent land construction [8–11]. In some ecologically vulnerable areas, for example, the loss plateau of China, severe soil erosion has caused great damage to local social and economic development [12,13]. To restrain excessive soil erosion, various soil and water conservation techniques have been adopted in many places worldwide. The effects of these techniques have been well evaluated, and the related mechanisms have been deeply analyzed and discussed at different research scales in the last few decades [14–18].

Tropical and subtropical Asia (TSA) mainly includes South China and Southeast and South Asia. In this region, precipitation, rainfall intensity and temperature are relatively higher than those in other regions of the world. Soils in this area are heavily weathered and desilicified, with extremely high enrichment of aluminum and iron oxides [19]. Despite the favorable hydrothermal and vegetation conditions, the soils are easily eroded, especially under poor land management conditions [20,21]. Moreover, TSA is one of the most densely populated areas in the world, with a total population of more than 3 billion [22]. Most TSA countries are currently undergoing rapid development and extensive changes in social and economic structure, which has resulted in overexploitation of soil resources [23–25]. Water and soil loss has been a great threat to local ecological security and economic development, especially agricultural production. One statistic shows that water erosion covers 21% of the total land area in TSA, with the predominant areas in large parts of South China, the Indian subcontinent and Indonesia [26]. In South China, the total area of the soil erosion was estimated at approximately 600,000 km^2, among which 20% belonged to seriously eroded areas [27]. In Southeast Asia, a certain part of the cultivation area is affected by soil erosion due to the transformation of forest to new farmland [28,29].

Soil and water conservation techniques are widely used to reduce water and soil loss through engineering, tillage and biological measures in TSA. The conservation objects of the techniques include sloping farmland, barren land and eroded gullies [30–32]. Applying reasonable water and soil conservation techniques must consider various factors including erosion degree and natural conditions, in addition, economic and social benefits should also be taken into account [17,25,33]. During the past few decades, various water and soil conservation techniques have been applied in TSA. For example, due to the implementation of the project of returning farmland to forestland or grassland and comprehensive control of soil erosion, water and soil loss area in South China have decreased by 30–40% since the 1980s [34]. In tropical countries such as Thailand, India and Pakistan, conservation techniques including terraces, mulching and soil management have been widely practiced [35–38].

Although many soil and water conservation techniques have been applied and studied in TSA, the objects, mechanisms, and effects are quite diverse. To date, only a few studies have systematically summarized the existing techniques applied in TSA and the efficiency of these techniques on soil and water conservation has not been well compared. In this paper, we critically review the existing literature regarding water and soil conservation techniques applied in TSA and systematically summarize these techniques and the related mechanisms, as well as compare the efficiency of techniques on soil and water loss control.

2. Materials and Methods

To compare the soil and water conservation efficiency of different techniques applied in TSA, the results of runoff plot experiments recorded in as much relevant literature (published between 1980 and 2018) as possibly were collected and collated with the help of the China National Knowledge Infrastructure, ISI web of science, and Google scholar databases. The collected literature mainly includes journal articles, books and dissertations. The databases were searched within the period of 1 November 2019 to 30 May 2020. Papers with terms including "soil and water conservation", "runoff/sediment reduction", "plot experiment", "runoff plot" and the TSA country names in the title, keywords, or abstract were preliminarily screened. Each term or the combination of the terms was screened by an individual reviewer, and the data were collected and collated. The techniques in the selected literature were then divided into different categories, such as biological measures, engineering measures and agricultural practice techniques. Within a category, the data of a specific technique (e.g., measure with the same vegetation type) was statistically processed, and the results of different subgroup categories were compared.

The runoff reduction ratio (η_w) and sediment reduction ratio (η_s) of the plot observation experiments were used as the comparative indicators [38]:

$$\eta_w = \frac{W_0 - W_s}{W_0} \times 100\% \quad (1)$$

$$\eta_s = \frac{G_0 - G_s}{G_0} \times 100\% \quad (2)$$

where W_s and W_0 are the total runoff amounts generated from the plots treated with different techniques and the control group, respectively, and G_s and G_0 are the total sediment amounts generated from the plots treated with different techniques and the control group, respectively.

In parts of the literature, the η_w and η_s values are directly given, while in other literature, they need further calculation based on the existing data. The calculated η_w and η_s values represent the accumulated values throughout the entire experimental duration. The duration time of the referred runoff plot experiments ranged from a few months to several years, and neither simulated rainfall experiments nor runoff plots with too small sizes (length < 1.0 m) were included in the analysis. The experiments should include control groups that were set up with the forms of barren land or conventionally planted land with crops. For some techniques, it was impossible to obtain the η_w and η_s values by using runoff plots, their conservation efficiencies can be evaluated through watershed-scale runoff and sediment data. Statistical analyses were conducted using SPSS 10.0 (SPSS Inc., Chicago, IL, USA) and SigmaPlot 12.5 software (Systat Software Inc., San Jose, CA, USA).

3. Environmental and Soil and Water Erosion Conditions in TSA

TSA mainly includes South China, Southeast Asia and South Asia. Over 3 billion people live in this region, making it one of the areas with the highest population densities in the world. Mountains, hills, and plains are the main landforms of which the proportions in local areas are quite different. The predominant agrotypes are ultisols, alfsols and vertisols (Figure 1a). The main climate types are subtropical monsoons, tropical monsoons and tropical rainforest. This region is rich in water and heat resources; the mean annual temperature ranges from 18 to 28 °C, except for individual countries located at high altitudes, such as Nepal and Bhutan. Except for Pakistan, the mean annual precipitation of all the countries is more than 1000 mm (Figure 1b). For some Southeast Asian countries, the mean annual precipitation reaches approximately 3000 mm. In general, with the decrease in latitude, the annual average temperature and precipitation of the countries in this region gradually increase.

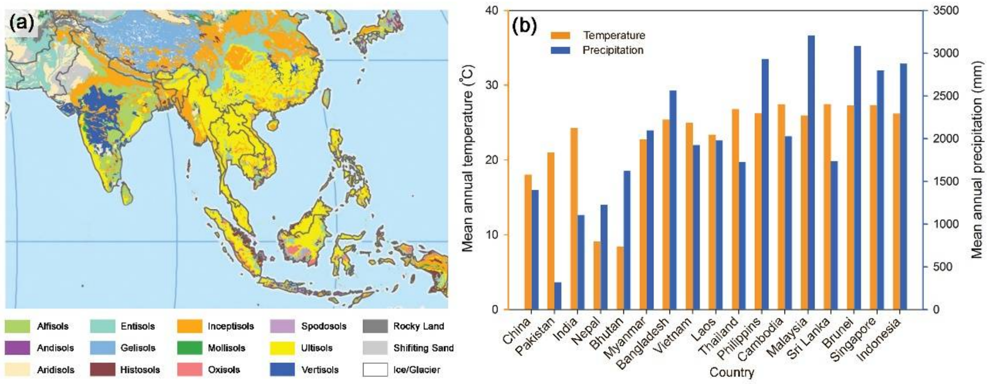

Figure 1. Soil type distribution (**a**) [39], and mean annual temperature and precipitation (2006–2016) of countries in tropical and subtropical Asia (**b**) [40].

Influenced by humid and rainy climate conditions, ultisols and alfsols in the region are highly weathered and slightly acidic. The soils are easily eroded under the condition of frequently occurring rainstorm events. In addition, due to the intensification of human activities such as deforestation and agricultural production, soil erosion has become a serious environmental issue in this region [26]. In some serious soil erosion areas of South China, the eroded soil modulus even reached 8000–15,000 t km^{-2} $year^{-1}$. The main erosion types in this region include sloping farmland and, underforest soil erosion, Benggang and rocky desertification [41–44]. A remarkable feature of land use change in this area in the last 50 years was the rapid increase in cultivated land and plantations [45], while the decreased cultivated area caused by soil and water loss has been estimated to be more than 3 million hm^2. In recent years, due to the implementation of environmental policy proposed by the Chinese government, the deterioration trend of soil and water erosion in South China has been preliminarily controlled [27]. In South and Southeast Asia, soil erosion mainly occurs in mountainous and hilly areas where local residents extensively cut forest and plant crops in hillside sloping fields. Research showed that the area of cultivated land and the area bearing grass and shrub vegetation increased by 86% and 20%, respectively, while the total forest cover decreased by 29% during 1880–1980 [46]. Zeng et al. [47] estimated that an area of 82 billion m^2 has been developed into croplands in the Southeast Asian highlands. Furthermore, rainfall mainly occurs during the rainy season (from May to October) which is exactly the planting period of cropping, as a result, agricultural land in mountainous and hilly areas often experiences severe water erosion. Investigation showed that the sediment yield of reservoir catchments that had been impacted by land use change in Southeast Asia varied in the range of 500–15,000 t km^{-2} $year^{-1}$ [48]. Soil erosion in South Asia primarily originates from inappropriate agricultural parties such as excessive tillage, poor soil management and soil pollution [49–51]. In particular, in the Himalayas hill region, due to strong dissected high land topography and extremely abundant rainfall (intensity ranges from 2000 to 10,000 mm), the potential soil erosion rate exceeds 4×105 t km^{-2} $year^{-1}$, which is much higher than the specific soil loss tolerance limit [52].

Figure 2 lists the relative distribution of water erosion areas (1990s) [53] and the estimated variation in soil erosion (2001–2013) [54] in the countries of TSA. In the 1990s, moderate to extreme water erosion is particularly important in countries such as Philippines, Thailand, and Pakistan (Figure 2a). It should be noted that, though the relative value of China was not very high (less than 20%), its total land area suffered water erosion exceeded 180 Mha, equaling nearly half of the total eroded area of South and Southeast Asia. During 2001–2013, obviously aggravated soil loss mainly occurred in partial areas of South China, Vietnam, Laos, Maymmer and Nepal (Figure 2b). In conclusion, soil erosion in TSA is closely linked to anthropogenic factors. Due to constantly increasing demand for natural resources, considerable land use changes have occurred during the last few decades; in addition, special soil, topography, and climate conditions also play important roles.

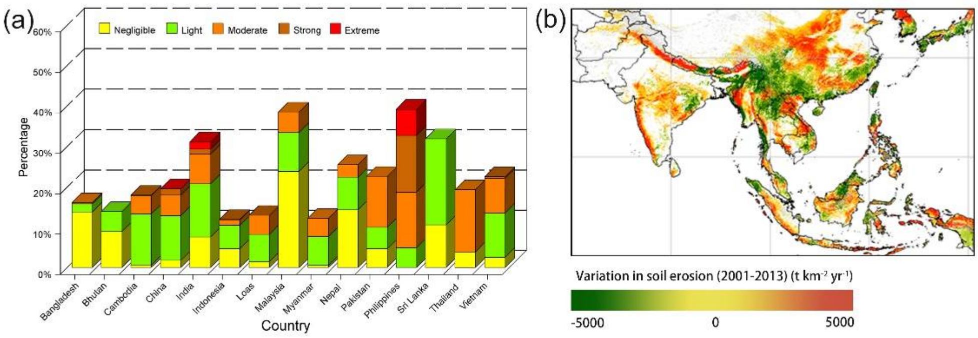

Figure 2. Relative distribution of water erosion (as % of total area per country) (**a**) [53] and estimated difference in soil erosion between 2001 and 2013 (**b**) [54] in TSA countries.

4. Soil and Water Conservation Techniques

4.1. Biological Measures

4.1.1. Water and Soil Conservation Forests

The mechanisms involved in controlling soil erosion through biological measures include canopy interception, retention of trunk and litter layers, and increasing soil infiltration [55]. Due to the rich hydrothermal conditions, vegetation grows very fast and can rapidly increase surface coverage in TSA; therefore, biological measures are considered an effective way of preventing and treating soil and water loss. The effects of soil and water conservation forests on conserving soil and water are reflected mainly in alleviating surface runoff scour and maintaining or recovering soil fertility [25]. Tree species and stand structure are the most important factors determining the conservation efficiency. Native tree species and multilayer vegetation structures (e.g., tree + shrub + herb and tree + herb) are usually the priority afforestation patterns. Forest cover in Southeast Asia has continuously decreased in recent years. High forest loss rates have been reported in countries including Indonesia, Myanmar and Cambodia [56–58]. In contrast to the decrease in natural forest cover, plantations have significantly increased. Artificial soil and water conservation forests are widely constructed in South China. The commonly selected tree species include *Pinus massoniana*, *Pinus elliottii*, *Schima superba*, *Acacia mangium*, *Ecucalyptus urophylla*, *Liquidambar formosanan*, *Cunninghamia lanceolato*, *Robinia pseudoacacia* and *Cinnamomum camphora* [59–67].

Although afforestation can obviously increase vegetation coverage, monocultures of single tree species have been found to have very limited conservation effects, sometimes even aggravated soil and water loss. *Pinus massoniana* is the most representative pioneer species for ecological restoration in South China. However, monoculture of *Pinus massoniana* usually leads to acidification of soil, making the understory vegetation very hard to grow. The soil may also have poor structural stability, as the soil microorganism activity is very low due to the low input of litter biomass. In the hilly area of South China, the average soil erosion rate of monocultured *Pinus massoniana* forest is estimated to be 3200 t km^{-2} $year^{-1}$, which is 11 times higher than that of other tree species [68]. As a result of long-term erosion, the nutrients in the topsoil of the *Pinus massoniana* forest dramatically decreased, further obstructing the formation of understory ecological systems. Culturing *Pinus massoniana* together with shrubs, herbs and/or other macrophanerophytes has been shown to be more effective in controlling water and soil loss in most cases. The co-planted vegetation species include *Pennisetum purpureum*, *Vetiveria zizanioides*, *Paspalum notatum*, *Lespedeza bilaeor* and *Schima superba*. Figure 3 shows the runoff and sediment reduction ratios of *Pinus massoniana* forests implemented with different conservation measures [69–73]. Except for the monoculture treatment, the η_s values were higher than that of η_w values in all the treatments. The lowest values (η_w = 44.4 $\pm$ 23.1%; η_s = 39.7 $\pm$ 27.6%) appeared in the *Pinus massoniana* monoculture treatment, while the values of planting *Pinus massoniana* together with herbs (η_w = 51.7.4 $\pm$ 7.1%; η_s = 70.5 $\pm$ 9.4%) and other macrophanerophytes (η_w = 47.6 $\pm$ 20.7%; η_s = 74.0 $\pm$ 10.1%) were clealy higher than those of the *Pinus massoniana* monoculture treatment. The conservation efficiency of afforestation might also be influenced by other factors such as gradient, canopy density, fertilization and auxiliary engineering measures [74–76]. In addition, understory shrubs and herbs can also effectively decrease soil nutrient loss. Research found that nitrogen and phosphate loss decreased by 20.40% and 38.93%, and 34.59% and 24.24%, respectively, after interplanting peanut and soybean in *Pinus massoniana* forest [71]. Similar results were also observed for *Pinus elliottii*, *Schima superba* [77,78] and other species of ecological trees such as *Eucalyptus urophylla* [75] and *Citrus reticulata Blanco* [79].

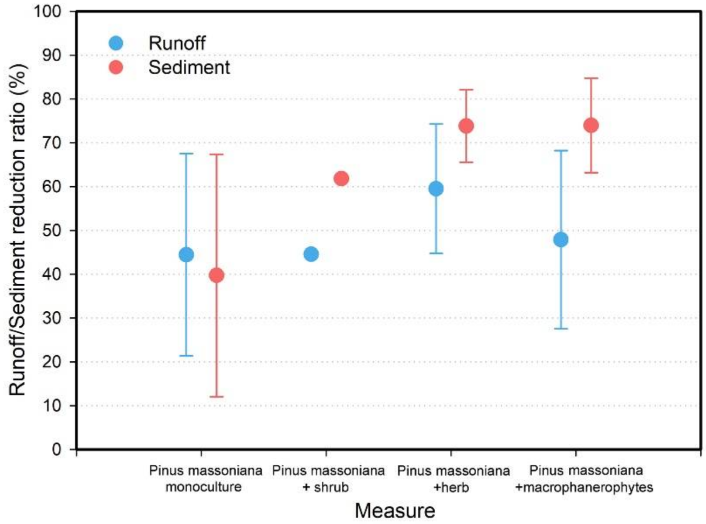

Figure 3. Runoff and sediment reduction ratios of different *Pinus massoniana* forests.

4.1.2. Hedgerows

Hedgerows are narrow bands of woody vegetation and associated organisms that separate fields [80]. Agricultural and cash crops are usually planted in the spaces between contour hedgerows [81]. Hedgerows can effectively control slope soil erosion, trap runoff, and improve soil fertility, and they can also be applied to farmland as biomass mulching and green manure. The cost of hedgerows is relatively low; thus, hedgerows are considered a cost-effective measure for soil and water conservation in agricultural practices. The commonly selected species of shrub and herb used for hedgerow and co-planted crops in TSA are listed in Table 1. *Vetiveria zizanioides*, *Leucaena leucocephala*, *Amorpha fruticosa* and *Hemerocallis citrine* are the most commonly used and studied species in Southern China, while in South and Southeast Asia, *Vetiveria zizanioides* and *Leucaena leucocephala* receive more attention.

Table 1. Commonly used vegetation species for hedgerow in TSA.

Region	Co-Planted Crop	Vegetation Used for Hedgerow	References
South China	Maize, Glycine max, Soybean, Nectarine	*Vetiveria zizanioides*, *Leucaena leucocephala*, *Amorpha fruticosa*, *Arundo donax*, *Medicago sativa*, *Am orpha fruticosa*, *Eulaliopsis binata*, *Paspalum notatum Flugge*, *Hemerocallis citrina Baroni*, *Lonicera japonica*, etc.	[82–88]
Southeast Asia	Maize, Cassava, Peanut, Cowpa, Pigeopea	*Vetiveria zizanioides*, *Ruzi grass*, *Leucaena leucocephala*, *Tephrosia* sp., *Cajanus* sp., *Guinea grass*, *Rottboellia grass*, *Cymbopogon ccitratus*, *Gliricidia speium*, *Flemingia macrophylla*, *Callandra calothyrsus*, *Pennisetum purpureum*, *kakawate*, etc.	[89–93]
South Asia	Finger millet, Pigeopea, Sorghum, Tea	*Vetiveria zizanioides*, *Saccharum* spp., *Thysanolaena maxima*, *bamboo*, *Calliandra calothyrsus*, *Senna spectabilis*, *Gliricidia sepium*, etc.	[94–98]

Figure 4 shows the summary of η_w and η_s values for soil conservation measures using the five most-used species (vetiver, Leucaena, Amorpha, Citrina, and alfalfa) of hedgerow techniques in TSA [83–86,99–116]. For all the measures, the values of η_s are generally higher than those of η_w, which is in line with the results obtained for *Pinus massoniana* forests (Figure 4). The average η_s values of the vetiver (79.4%) and alfalfa (80.0%) treatments were obviously higher than those of other treatments (54.6–58.0%), while the average η_s values of all the hedgerow treatments seemed to be relatively close

(39.7–50.4%). Both η_w and η_s varied in very wide ranges (η_w: 2.8–93.8%; η_s: 15.0–99.5%), which can be partly attributed to the difference in experimental conditions, such as plot size, monitoring duration, soil type, slope and crop species [117]. The research of Tuan et al. [94] showed that hedgerow measures had no effect on controlling soil loss in the first year of trial establishment, while greatly decreased soil loss from the second year after the hedgerow ecosystem was already stable. The width and density of hedgerow are important factors influencing the conservation effect. Cai et al. [101] found that 4 and 6 rows/bands of *Vetiveria zizanioides* or *Tephrosia purpurea* treatments showed significantly higher efficiencies than two row/band treatments; however, six row/band treatments occupied more crop area, which directly decreased the cropping area. Although hedgerows have a considerable effect on controlling soil and water loss, their promotion was sometimes limited due to several disadvantages, including the extra labor required for pruning and hedgerows and maintenance, a lack of the skills to design and build strictures for farmers and limited early returns on investment [100,118,119]. Another problem of the hedgerow technique that should be mentioned is its influence on crop production. Apart from occupying cropping areas, hedgerow may compete with crops for light, water, and nutrients, leading to decline in crop yield. Guo et al. [120] found that the growth of soybean was greatly suppressed in the false indigo (*Amorpha fruticosa*) and vetiver hedgerow systems. A survey in northern Vietnam showed that less than 1/3 of the local farmers adopted the hedgerow technique which reduced available areas for the production and demanded more labor at times of labor peaks [91]. Therefore, both ecological and economic benefits must be considered when applying hedgerow techniques for soil and water conservation. Hedgerows are also used for soil conservation of road and river slopes [121], but the related research is rather limited.

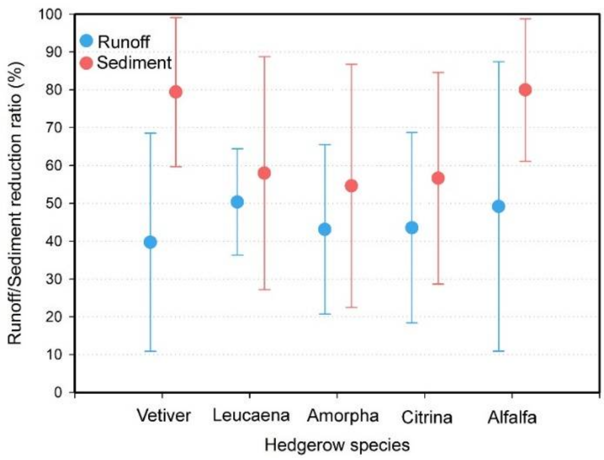

Figure 4. Runoff and sediment reduction ratios for soil conservation measures using different hedgerow techniques.

4.1.3. Area Enclosures

Enclosures are constructed to fence in protected areas and areas of human activities, such as reclamation and grazing; logging is prohibited in these areas. Under this condition, with the self-regenerative capability of forests and suitable environmental conditions, the vegetation in the eroded area recovers very fast. Based on the protection intensity, enclosure measures can be divided into [122]: (i) total enclosures, mainly for moderately and lightly eroded areas located in high mountains and in the stream and surrounding regions of reservoirs; (ii) half-enclosures, in which the enclosure measure is only implemented in certain seasons; (iii) rotating enclosures, mainly for lightly eroded areas which are divided into several subareas for rotating enclosures; (iv): enclosures combined with planting, for moderately eroded areas with very low vegetation coverage, where appropriate trees and grass are artificially planted as necessary compensation. After enclosure for a certain period, the structure and fertility of the soil, and the biodiversity can be significantly enhanced. Huang [122] found that the soil moisture and organic matter content increased by 3.7~8.8% and 59.0~75.0%, respectively, in hilly woodlands planted with *Pinus massoniana*, *Schima superba*, and *Cunninghamia lanceolato*, etc. In the research of Yang et al. [123], the erosion modulus of purple soil decreased to one-tenth of the original value, and the erosion level varied from 'severe' to 'light' after 10 years of enclosure. Liu et al. [124] compared different conservation techniques and also pointed out that enclosures are the best measure for water and soil conservation in China's purple soil hilly region. Planting economic tree species can obtain a high return in the case of low early investigation cost; thus, the measure is quite suitable for remote areas with a sparse population and vast available land. Auxiliary measures such as tending management, replanting and reseeding, and ecological migration can further promote the effect of enclosure [125]. In Southeast Asian countries, the destructed forest is often too degraded to be recovered to sustainable forest ecosystems. Accelerating natural regeneration techniques including several steps are applied to restore tropical forestland. The most important step of these techniques is to protect forests from disturbances such as fire destruction and the influence of animals or human activities [126–131].

4.2. Engineering Measures

Engineering measures refer to the conservation of soil and water through changing the topography, regulating surface runoff or rising the basis level of erosion, including transforming slopes to terraces, slope drainage, and gully erosion control projects (e.g., check dams).

4.2.1. Terracing

Terracing is a land consolidation project that can simultaneously control water and soil loss and develop new farmland for agricultural activities. After transforming from the slope, terracing changes the continuity of the topography and reduces the slope length. The surface soil is consolidated to flat or anti-inclined slopes, thus cutting off runoff and increasing the infiltration time [132]. In the hilly and mountainous areas of TSA, such as southwestern China and northern Thailand, Vietnam, and Laos, terracing is one of the most important measures implemented for reclaiming sloped land [133–136]. The Department of Land Development (DLD) of Thailand recommends farmers living on slope grades between 12% and 35% construct terraces or hillside ditches combined with buffer strips to control soil erosion [137]. Terrace types include level terraces, interval terraces and slope terraces. Level terraces can provide effective areas for growing water-intensive crops (e.g., rice). Combining terraces with vegetation measures has also been adopted in many places. Factors influencing the conservation efficiency of terracing include the shape and composition material of the terrace and their combination with biological measures. Sun et al. [138] showed that the soil and water conservation efficiency of terracing increased with the slope gradient in the Rocky Mountains of Southwest China (Figure 5a). Yuan et al. [139] found that the "terrace + hedgerow" and the "terrace + shrub + herb" measures could greatly decrease water and soil loss in red soil hilly areas (Figure 5b). Terracing may also show certain deficiencies. The compaction and removal of surface soil across terraces cause negative effects on soil physical properties, leading to reductions in hydraulic conductivity, aggregate stability and water retention capacity [140]. Another potential problem that should be noted is that, once a terrace is destroyed, soil erosion could become more serious.

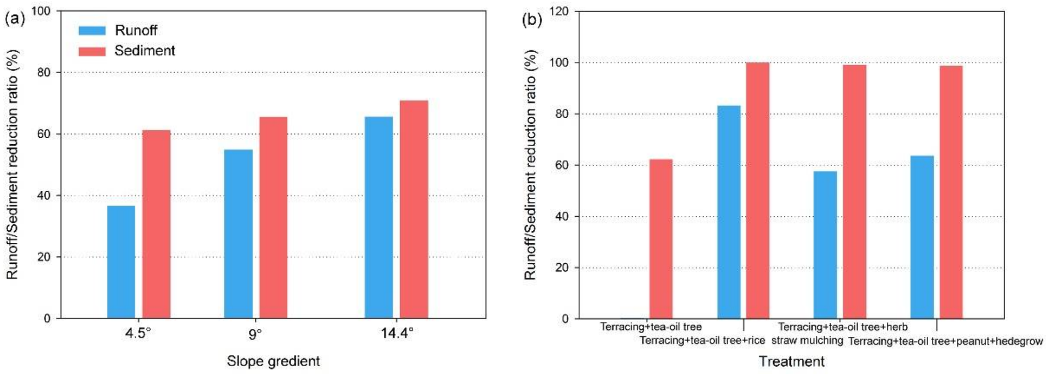

Figure 5. Runoff and sediment reduction ratios of different terracing treatments influence of slope gradient (**a**) [138] and combination with biological measures (**b**) [139].

4.2.2. Slope Hydraulics Projects

Slope hydraulics projects include drainage ditches and reservoirs of different forms on the slopes and flats. These projects are usually constructed as the support parts of the terrace systems. Slope hydraulics projects are suitable for gently sloping (<25°) land areas with precipitation higher than 800 mm [141]. In the uplands of Thailand with a 5–20% inclination, the Department of Land Development recommends hillside ditches with 10–12 m contour intervals and hedges of legume crops in alternative strips to alleviate soil erosion [137]. Measures including farm ponds, silt traps and diversion bunds are usually constructed for catching surface runoff and irrigation [142,143]. Drainage and farm pond technologies are also widely used in the central and coastal regions of India [144]. The effects of slope hydraulics projects on water and soil conservation are generally evaluated at the watershed scale. A study conducted in Sichuan Province (Southwestern China) showed that runoff and sediment decreased by 76.4% and 87.4%, respectively, in a small watershed after slope hydraulics projects (e.g., drainage ditches, reservoirs and sediment basins) were constructed. Apart from reducing the scouring energy of slope runoff and capturing sediment, slope hydraulics projects can efficiently collect runoff for irrigation and control non-point pollution. Wang et al. [145] found that the establishment of bio-ditches and reservoirs in red soil slope could significantly reduce nitrogen and phosphate loss.

4.2.3. Gully Erosion Control Techniques

Measures adopted for controlling gully erosion are mainly represented by check dams of different forms. In gullies that suffer strong down-cutting erosion or receive sediment originated gravity erosion, construction of check dams can raise the base level of erosion. According to the construction material, check dams can be divided into earthen, masonry and biological dams. Typical examples of the application of check dam in South China include controlling debris flows in the mountain area and Benggang in the red granite soil hilly region. Check dams are als1o constructed to protect farmlands from landslides and flood-related damage. Combined with vegetation planting, check dams can effectively retain sediment from Benggang and improve soil quality. In agricultural areas of India, check dams are constructed to increase the groundwater level, thus providing available water resources to farmers. The cost of check dams is the key factor restricting their implementation, and large dams are susceptible to damage. Low-cost gabions and sandbags are sometimes used for small-scale gully control [144]. In Nepal, gabion retaining walls and spurs with launching aprons were constructed to control land cutting by streams [146]. At the watershed scale, check dams will be more beneficial when combined with vegetation measures, including grass strips, increasing tree numbers, and fertilizer application [147–150].

4.3. Agricultural Practice Techniques

Agricultural practice techniques are important measures for the water and soil conservation of sloping cropland in TSA countries, and mainly include changing the surface topography, such as by performing contour tillage, ridge tillage, and ridge farming; improving soil properties, such as implementing no-tillage and reduced tillage; and increasing coverage, such as by enacting contour strip intercropping and mulching.

4.3.1. Tillage Practices

Tillage practice can increase infiltration by impeding runoff and modifying soil roughness and thereby reducing slope runoff loss. Contour tillage reduces erosion by dividing slopes into short sections. Research conducted by Bhatia and Choudhary [151] found that, compared with up-down cultivation, contour cultivation on alluvial soils in India reduced soil loss by 28% and runoff by 61%. Barton et al. [20] also found that the erosion rates of contour cultivation were 31% less than those of downslope planting, and the achieved benefits were little affected by slope angle in Southwest China. In some Southeast Asian countries, contour tillage is widely applied to plant crops including cassava, maize and peanut to efficiently utilize soil resources and reduce soil and water loss [93,107,142]. Ridge tillage is a conservation tillage practice in which plants are grown on soil formed into raised beds or ridges [152]. This technique has been proven to significantly increase crop yields compared to moldboard plow tillage systems. Ridge farming is similar to contour tillage except that the crop is planted on the ridge instead of in the furrow, which is suitable for planting of soybeans, corn, peas, and other large-seed crops. No-tillage has long been studied and practiced in developed countries [153]. In recent years, it has also attracted increasing attention in TSA. A distinct advantage of this technique is improving soil quality by increasing organic matter content and thereby enhancing soil structure stability and erosion resistance. Similar to no-tillage, reducing tillage exerts a moderate disturbance on soil. The application of reduced tillage for soil and water conservation has been recommended as a potential researchable option in countries including China, Nepal, and Thailand [154–156]. For example, reduced tillage significantly lowered annual and pre-monsoon soil and nutrient losses compared to conventional tillage in the upland of Nepal. However, the disadvantages of no-tillage and reduced tillage measures are the possible competition for nutrients from weeds and soil structure degradation [157–159].

4.3.2. Increasing Coverage

Tillage practices are usually combined with vegetation measures to obtain better soil and water conservation efficiencies. The aforementioned contour hedgerows represent such a typical measure. In addition, intercropping fruit trees, herbs and crops are commonly implemented to increase land coverage in the agricultural areas of TSA. The intercropping combinations that have been proven to be effective in conserving soil and water include maize and potato, citrus and potato, and maize and legumes (e.g., soybean, black bean and cowpea). Table 2 lists the commonly used intercropping measures in South China, Southeast Asia, and South Asia [20,118,159–174]. Another method for increasing land coverage is mulching, which consists of using dead leaves, compost, and manure to cover surface soil. The objectives of mulching are to prevent the loss of soil moisture by evaporation, preventing soil erosion and control weeds. The most commonly used materials in TSA for mulching include the straw of rice and maize, residues of legumes and vetiver grass, and plastic film [107,142,175–177]. Mulching can also improve the soil structure, increase the organic matter content, and provide nutrients for crops [178]. Nitrogen-fixing species (e.g., legumes) are sometimes used for hedgerows, and their practice is applied to crops as green manure to enhance nutrient recycling, which greatly reduces the need for commercial fertilizers [36,179,180].

Table 2. Commonly used intercropping measures for soil and water conservation in TSA.

Area	Intercropping Measure	References
South China	*maize + potato/sweet potato/legumes/cabbage*	[20,159–161]
	citrus + potato/legumes/cabbage/vigna sinensis/herbage	[162,163]
	Camellia Oleifera + L.pernne/V.myuros/peanut herbage	[164,165]
	Rubbe + pineapple	[166]
Southeast Asia	*Maize + cassava/legumes/coffee/herbage*	[142,167]
	Cassava + legumes/herbage	[118]
	Fruit tree + cassava/maize/peanut/upland rice	[168]
	Tobacco + legumes	[169]
South Asia	*Maize + legumes/weed/wheat/millet*	[170–172]
	Cotton + citrus/legumes	[173]
	Pepper + coffee/legumes	[97]
	Coconut + coffee/pineapple/cacao	[174]

In recent years, some amendments, such as biochar and polyacrylamide (PAM), have become research hotspots and have been adopted to reduce soil and water loss [104,181–185]. However, these materials should be carefully used due to their negative effect under certain conditions. For example, the application of biochar to soil may lead to increase in surface runoff and nutrient loss in the sediment [186]. Figure 6 shows the runoff and sediment reduction ratios of different agricultural practice techniques adopted in TSA [20,83,106,124,187–199]. As with the afforestation (*Pinus massoniana* forest) and hedge row techniques, the sediment reduction ratios of sediment (η_s = 0–78.2%) were also generally higher than that of runoff (η_r = 3.4–69.3%), and the average η_s values of contour tillage (63.8%), ridge farming (78.2%) and reduced tillage (60.0%) were obviously higher than those of other techniques. In some cases, contour tillage, ridge tillage and intercropping measures did not obtain very effective results regarding reductions in runoff loss, probably because of the influence of topography (e.g., steep slope) [20]. Measures for increasing coverage are usually combined with tillage practices to obtain optimized effects (e.g., contour/ridge tillage + hedgerow + mulching and no/reduced tlillage + intercropping).

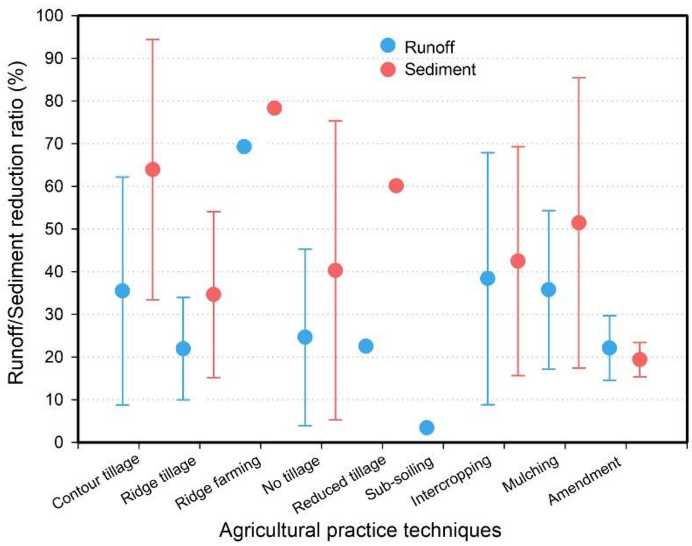

Figure 6. Runoff and sediment reduction ratios of different agricultural practice techniques.

5. Conclusions and Prospects

Various soil and water conservation techniques have been adopted and implemented in tropical and subtropical Asia regions to control soil and water loss. These techniques can be divided into biological (afforestation, hedgerow, and enclosure), engineering (terracing, slope hydraulics project, and gully control techniques) and agricultural technical measures (topographic reform (e.g., contour tillage), increasing coverage (intercropping and mulching), and soil quality improvement (no-tillage and conservation tillage)). The analysis results of the soil and water conservation efficiencies of these techniques showed that, for most of the measures, the runoff and sediment reduction (η_s and η_w) values varied within wide ranges, and their implementation was more effective at reducing sediment loss than runoff. The efficiencies of the combined measures were generally higher than those of individual measure. The erosion degree, topography and vegetation type are important factors influencing the efficiency of soil and water conservation techniques. High costs and potential impacts on crop production might limit the application of these measures in agricultural areas. In the authors' view, future work regarding soil and water conservation techniques research in tropical and subtropical Asia could be pursued in the following aspects: (1) Unified technical standards are needed. To date, the implemented techniques in this region with special environmental conditions have not been well monitored or summarized. More information regarding the technical parameters is needed, and the conservation efficiency is suggested to be assessed by a standardized monitoring method. (2) A reasonable comprehensive evaluation system also needs to be built that includes an evaluation of the economic benefit which is seldom considered. Apart from the efficiencies of these measures in reducing water and soil loss, economic factors are crucial in determining whether these techniques will be adopted by people such as farmers. (3) Water and soil conservation techniques should be combined with environmental engineering technologies to effectively resolve environmental issues such as non-point source pollution. Research and practices on this aspect are relatively limited at present. (4) The development and application of new materials used as amendments should be strengthened, and these new materials should have few negative effects as possible and ensure reasonable costs.

Author Contributions: Conceptualization, D.L.; methodology, B.H.; software, B.H.; validation, Z.Y., M.Z. and Y.L.; formal analysis, B.H.; investigation, B.H., Y.L. and Z.Y.; data curation, B.H.; writing—original draft preparation, B.H.; writing—review and editing, D.L., K.L.N., T.H.N. and S.S.; funding acquisition, B.H., D.L. and Z.Y. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the National Natural Science Foundation of China (No. 42177343), the GDAS' Project of Science and Technology Development (2019GDASYL-0104015, 2019GDASYL-0502004, 2019GDASYL-0503003), the Guangdong Provincial Science and Technology Project (2018B030324001, 2019B121202006, 2021B1212050019), Guangzhou Science and Technology Plan Project (202002020026), Meizhou Science and Technology Plan Project (2020B0204001), and Guangdong Basic and Applied Basic Research Foundation (2021A1515011552).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

References

1. Morgan, R.P.C. *Soil Erosion and Conservation*, 2nd ed.; Longman Group Ltd.: Harlow, UK, 1995.
2. Quinton, J.N.; Govers, G.; Van Oost, K.; Bardgett, R.D. The impact of agricultural soil erosion on biogeochemical cycling. *Nat. Geosci.* **2010**, *3*, 311–314. [CrossRef]
3. Lal, R. *Soil Quality and Soil Erosion*; Soil and Water Conservation Society: Ankeny, IA, USA, 1999.
4. Berhe, A.A.; Harte, J.; Harden, J.W.; Torn, M. The Significance of the Erosion-induced Terrestrial Carbon Sink. *Bioscience* **2007**, *57*, 337–346. [CrossRef]
5. Li, Z.; Fang, H. Impacts of climate change on water erosion: A review. *Earth-Sci. Rev.* **2016**, *163*, 94–117. [CrossRef]
6. Prosdocimi, M.; Cerdà, A.; Tarolli, P. Soil water erosion on Mediterranean vineyards: A review. *Catena* **2016**, *141*, 1–21. [CrossRef]

7. Zhou, J.; Fu, B.; Gao, G.; Lü, Y.; Liu, Y.; Lü, N.; Wang, S. Effects of precipitation and restoration vegetation on soil erosion in a semi-arid environment in the Loess Plateau, China. *Catena* **2016**, *137*, 1–11. [CrossRef]
8. Cerdà, A. Soil water erosion on road embankments in eastern Spain. *Sci. Total Environ.* **2007**, *378*, 151–155. [CrossRef]
9. Jain, S.K.; Kumar, S.; Varghese, J. Estimation of Soil Erosion for a Himalayan Watershed Using GIS Technique. *Water Resour. Manag.* **2001**, *15*, 41–54. [CrossRef]
10. Mohammad, A.G.; Adam, M.A. The impact of vegetative cover type on runoff and soil erosion under different land uses. *Catena* **2010**, *81*, 97–103. [CrossRef]
11. Vásquez-Méndez, R.; Ventura-Ramos, E.; Oleschko, K.; Hernández-Sandoval, L.; Parrot, J.-F.; Nearing, M.A. Soil erosion and runoff in different vegetation patches from semiarid Central Mexico. *Catena* **2010**, *80*, 162–169. [CrossRef]
12. Chen, L.; Wei, W.; Fu, B.; Lü, Y. Soil and water conservation on the Loess Plateau in China: Review and perspective. *Prog. Phys. Geogr. Earth Environ.* **2017**, *31*, 389–403. [CrossRef]
13. Shi, H.; Shao, M. Soil and water loss from the Loess Plateau in China. *J. Arid Environ.* **2000**, *45*, 9–20. [CrossRef]
14. Bekele, W.; Drake, L. Soil and water conservation decision behavior of subsistence farmers in the Eastern Highlands of Ethiopia: A case study of the Hunde-Lafto area. *Ecol. Econ.* **2003**, *46*, 437–451. [CrossRef]
15. Freebairn, D.M.; Loch, R.J.; Cogle, A.L. Tillage methods and soil and water conservation in Australia. *Soil Tillage Res.* **1993**, *27*, 303–325. [CrossRef]
16. Nie, X.; Li, Z.; Huang, J.; Liu, L.; Xiao, H.; Liu, C.; Zeng, G. Thermal stability of organic carbon in soil aggregates as affected by soil erosion and deposition. *Soil Tillage Res.* **2018**, *175*, 82–90. [CrossRef]
17. Nyssen, J.; Poesen, J.; Deckers, J. Land degradation and soil and water conservation in tropical highlands. *Soil Tillage Res.* **2009**, *103*, 197–202. [CrossRef]
18. Tefera, B.; Sterk, G. Land management, erosion problems and soil and water conservation in Fincha'a watershed, western Ethiopia. *Land Use Policy* **2010**, *27*, 1027–1037. [CrossRef]
19. Qafoku, N.P.; Van Ranst, E.; Noble, A.; Baert, G. Variable Charge Soils: Their Mineralogy, Chemistry and Management. *Adv. Agron.* **2004**, *84*, 159–215. [CrossRef]
20. Barton, A.; Fullen, M.; Mitchell, D.; Hocking, T.; Liu, L.; Bo, Z.W.; Zheng, Y.; Xia, Z.Y. Effects of soil conservation measures on erosion rates and crop productivity on subtropical Ultisols in Yunnan Province, China. *Agric. Ecosyst. Environ.* **2004**, *104*, 343–357. [CrossRef]
21. Yang, D.; Kanae, S.; Oki, T.; Koike, T.; Musiake, K. Global potential soil erosion with reference to land use and climate changes. *Hydrol. Process.* **2003**, *17*, 2913–2928. [CrossRef]
22. Livi-Bacci, M. *A Concise History of World Population*; John Wiley & Sons: Hoboken, NJ, USA, 2012.
23. Fox, J.; Vogler, J.B. Land-Use and Land-Cover Change in Montane Mainland Southeast Asia. *Environ. Manag.* **2005**, *36*, 394–403. [CrossRef]
24. Niroula, G.S.; Thapa, G.B. Impacts and causes of land fragmentation, and lessons learned from land consolidation in South Asia. *Land Use Policy* **2005**, *22*, 358–372. [CrossRef]
25. Wang, C.; Yang, Y.; Zhang, Y. Cost-Effective Targeting Soil and Water Conservation: A Case Study of Changting County in Southeast China. *Land Degrad. Dev.* **2016**, *27*, 387–394. [CrossRef]
26. Grierson, I.T. The assessment of the status of human induced soil degradation in South and Southeast Asia. *Geogr. J.* **2000**, *166*, 91–92.
27. Ministry of Water Resources of the People's Republic of China, Communique on Soil and Water Conservation of the First National Hydraulic Census of China. Available online: http://www.mwr.gov.cn/sj/tjgb/zgstbcgb/201612/t20161222_776093.html (accessed on 1 May 2020).
28. Pansak, W.; Hilger, T.; Lusiana, B.; Kongkaew, T.; Marohn, C.; Cadisch, G. Assessing soil conservation strategies for upland cropping in Northeast Thailand with the WaNuLCAS model. *Agrofor. Syst.* **2010**, *79*, 123–144. [CrossRef]
29. Wong, M.K.; Selliah, P.; Ng, T.F.; Amir Hassan, M.H.; Van Ranst, E.; Inubushi, K. Impact of agricultural land use on physicchemical properties of soils derived from sedimentary rocks in Malaysia. *Soil Sci. Plant Nutr.* **2020**, *66*, 214–224. [CrossRef]
30. Shi, X.; Liang, Y.; Gong, Z. Biological Practices and Soil Conservation in Southern China. *J. Crop Prod.* **2001**, *3*, 41–48. [CrossRef]
31. Valentin, C.; Poesen, J.; Li, Y. Gully erosion: Impacts, factors and control. *Catena* **2005**, *63*, 132–153. [CrossRef]
32. Wang, L.; Dalabay, N.; Lu, P.; Wu, F. Effects of tillage practices and slope on runoff and erosion of soil from the Loess Plateau, China, subjected to simulated rainfall. *Soil Tillage Res.* **2017**, *166*, 147–156. [CrossRef]
33. Amsalu, A.; de Graaff, J. Determinants of adoption and continued use of stone terraces for soil and water conservation in an Ethiopian highland watershed. *Ecol. Econ.* **2007**, *61*, 294–302. [CrossRef]
34. Zheng, H.; Chen, F.; Ouyang, Z.; Tu, N.; Xu, W.; Wang, X.; Miao, H.; Li, X.; Tian, Y. Impacts of reforestation approaches on runoff control in the hilly red soil region of Southern China. *J. Hydrol.* **2008**, *356*, 174–184. [CrossRef]
35. Ali, M.; Khan, F.; Khan, I.; Ali, W.; Sara, S.; Kamal, A. Soil and Water Conservation Practices in District Swabi, KP, Pakistan. *Adv. Crop Sci. Technol.* **2018**, *6*, 1–9. [CrossRef]
36. Donjadee, S.; Tingsanchali, T. Reduction of runoff and soil loss over steep slopes by using vetiver hedgerow systems. *Paddy Water Environ.* **2012**, *11*, 573–581. [CrossRef]

37. Ghosh, B.; Meena, V.; Alam, N.; Dogra, P.; Bhattacharyya, R.; Sharma, N.; Mishra, P. Impact of conservation practices on soil aggregation and the carbon management index after seven years of maize–wheat cropping system in the Indian Himalayas. *Agric. Ecosyst. Environ.* **2016**, *216*, 247–257. [CrossRef]
38. Xiong, M.; Sun, R.; Chen, L. Effects of soil conservation techniques on water erosion control: A global analysis. *Sci. Total Environ.* **2018**, *645*, 753–760. [CrossRef]
39. U.S. Department of Agriculture. Global Soil Regions. Available online: https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/use/worldsoils/?cid=nrcs142p2_054013 (accessed on 7 May 2020).
40. University of East Anglia. Available online: https://crudata.uea.ac.uk/cru/data/hrg/cru_ts_3.23/crucy.1506241137.v3.-23/countries (accessed on 7 May 2020).
41. Chen, J.; Xiao, H.; Li, Z.; Liu, C.; Wang, D.; Wang, L.; Tang, C. Threshold effects of vegetation coverage on soil erosion control in small watersheds of the red soil hilly region in China. *Ecol. Eng.* **2019**, *132*, 109–114. [CrossRef]
42. Liao, Y.S.; Yuan, Z.J.; Zheng, M.G.; Li, D.Q.; Nie, X.D.; Wu, X.L.; Huang, B.; Xie, Z.Y. The spatial distribution of Benngang and the factors that influence it. *Land Degrad. Dev.* **2019**, *30*, 2323–2335. [CrossRef]
43. Tang, X.; Liu, S.; Liu, J.; Zhou, G. Effects of vegetation restoration and slope positions on soil aggregation and soil carbon accumulation on heavily eroded tropical land of Southern China. *J. Soils Sediments* **2009**, *10*, 505–513. [CrossRef]
44. Zhang, J.Y.; Dai, M.H.; Wang, L.C.; Zeng, C.F.; Su, W.C. The challenge and future of rocky desertification control in karst areas in southwest China. *Solid Earth* **2016**, *7*, 83–91. [CrossRef]
45. Lin, G.C.; Ho, S.P. China's land resources and land-use change: Insights from the 1996 land survey. *Land Use Policy* **2003**, *20*, 87–107. [CrossRef]
46. Flint, E. Changes in land use in South and Southeast Asia from 1880 to 1980: A data base prepared as part of a coordinated research program on carbon fluxes in the tropics. *Chemosphere* **1994**, *29*, 1015–1062. [CrossRef]
47. Zeng, Z.; Estes, L.; Ziegler, A.D.; Chen, A.; Searchinger, T.; Hua, F.; Guan, K.; Jintrawet, A.; Wood, E.F. Highland cropland expansion and forest loss in Southeast Asia in the twenty-first century. *Nat. Geosci.* **2018**, *11*, 556–562. [CrossRef]
48. Walling, D.E.; Webb, B.W. Erosion and Sediment Yield: A Global Overview. In *Series of Proceedings and Reports-Intern Assoc Hydrological Sciences*; IAHS Publications: Exeter, UK, 1996; Volume 36, pp. 3–20.
49. Bhattacharyya, R.; Ghosh, B.N.; Mishra, P.K.; Mandal, B.; Rao, C.S.; Sarkar, D.; Das, K.; Anil, K.S.; Lalitha, M.; Hati, K.M.; et al. Soil Degradation in India: Challenges and Potential Solutions. *Sustainability* **2015**, *7*, 3528–3570. [CrossRef]
50. Dissanayake, D.M.S.L.B.; Takehiro, M.; Manjula, R. Accessing the soil erosion rate based on RUSLE model for sustainable land use management: A case study of the Kotmale watershed, Sri Lanka. *Model Earth Syst. Environ.* **2019**, *5*, 291–306. [CrossRef]
51. Mandal, D.; Sharda, V.N. Appraisal of soil erosion risk in the eastern himalayan region of india for soil conservation planning. *Land Degrad. Dev.* **2011**, *24*, 430–437. [CrossRef]
52. Dabral, P.P.; Baithuri, N.; Pandey, A. Soil Erosion Assessment in a Hilly Catchment of North Eastern India Using USLE, GIS and Remote Sensing. *Water Resour. Manag.* **2008**, *22*, 1783–1798. [CrossRef]
53. Van Lynden, G.W.; Oldeman, L.R. The Assessment of the Status of Human-Induced Soil Degradation in South and Southeast Asia. ISRIC: Wageningen, The Netherlands, 1997.
54. Carlos, A.G.; Rosa, I.M.; Valentini, E.; Wolf, F.; Filipponi, F.; Karger, D.N.; Xuan, A.N.; Mathieu, J.; Lavelle, P.; Eisenhauer, N. Global vulnerability of soil ecosystems to erosion. *Landsc. Ecol.* **2020**, *35*, 823–842. [CrossRef]
55. Zhou, P.; Luukkanen, O.; Tokola, T.; Nieminen, J. Effect of vegetation cover on soil erosion in a mountainous watershed. *Catena* **2008**, *75*, 319–325. [CrossRef]
56. Scheidel, A.; Work, C. Forest plantations and climate change discourses: New powers of 'green' grabbing in Cambodia. *Land Use Policy* **2018**, *77*, 9–18. [CrossRef]
57. Sukvibool, C. Change of forest vegetation and management of soil erosion in Southeast Asia. Bull. *Soil Water Conserv.* **2019**, *39*, 307–312.
58. Van Noordwijk, M.; Ekadinata, A.; Leimona, B.; Catacutan, D.; Martini, E.; Tata, H.L.; Öborn, I.; Hairiah, K.; Wangpakapattanawong, P.; Mulia, R.; et al. *Agroforestry Options for Degraded Landscapes in Southeast Asia*; Dagar, J.C., Gupta, S.R., Teketay, D., Eds.; Springer: Singapore, 2020; pp. 307–347. [CrossRef]
59. Castella, J.-C.; Lestrelin, G.; Hett, C.; Bourgoin, J.; Fitriana, Y.R.; Heinimann, A.; Pfund, J.-L. Effects of Landscape Segregation on Livelihood Vulnerability: Moving from Extensive Shifting Cultivation to Rotational Agriculture and Natural Forests in Northern Laos. *Hum. Ecol.* **2013**, *41*, 63–76. [CrossRef]
60. Li, D.; Yang, X.; Deng, Y.; Li, Y. Soil physical properties under effects of Eucalyptus understory vegetation and litter. *Chin. J. Ecol.* **2006**, *6*, 607–611.
61. Nguyen, D.; Ancev, T.; Randall, A. Forest governance and economic values of forest ecosystem services in Vietnam. *Land Use Policy* **2020**, *97*, 103297. [CrossRef]
62. Prescott, G.W.; Sutherland, W.J.; Aguirre, D.; Baird, M.; Bowman, V.; Brunner, J.; Connette, G.M.; Cosier, M.; Dapice, D.; De Alban, J.D.T.; et al. Political transition and emergent forest-conservation issues in Myanmar. *Conserv. Biol.* **2017**, *31*, 1257–1270. [CrossRef] [PubMed]
63. Quang, D.V.; Schreinemachers, P.; Berger, T. Ex-ante assessment of soil conservation methods in the uplands of Vietnam: An agent-based modeling approach. *Agric. Syst.* **2014**, *123*, 108–119. [CrossRef]

64. Uddin, K.; Matin, M.A.; Maharjan, S. Assessment of Land Cover Change and Its Impact on Changes in Soil Erosion Risk in Nepal. *Sustainability* **2018**, *10*, 4715. [CrossRef]
65. Wang, R.; Guo, Z.H. Responses of seedling leaf anatomical structure of Liquidambar formosana, a deciduous broadleaf tree, to different light regimes. *Chin. J. Ecol.* **2007**, *26*, 1719–1724.
66. Xue, L.; Liang, L.L.; Ren, X.R.; Cao, H.; Wang, X.E.; Xie, T.F. Soil physical properties and water conservation function of model plantations in South China. *Chin. J. Soil Sci.* **2008**, *39*, 986–989.
67. Zeng, S.Q.; She, J.Y.; Xiao, Y.T.; Lu, Y.; Tang, D.S.; Deng, X.W. Metrological studies of hydrological functions of *Pinus massoniana* forest for water and soil conservation-I. crown interception and water-holding capacity of the soil. *J. Cent. South For. Univ.* **1996**, *16*, 1–8.
68. He, S.J.; Xie, J.S.; Yang, Z.J.; Yin, Y.F.; Li, D.C.; Yang, Y.S. Status, cause and prevention of soil and water loss in *Pinus massoniana* woodland in hilly red soil region of southern China. *Sci. Soil Water Conserv.* **2011**, *9*, 65–70.
69. Chen, Z.B. Rehabilitation of Eroded Granite Mountainous Region and Its Eco-Environmental Effects. Ph.D. Thesis, Fujian Normal University, Fuzhou, China, 2005.
70. Li, G.J.; Cui, M.; Zhou, J.X.; Peng, S.Y.; Xie, Y.M. Research of soil and water conservation benefits from forest soil erosion control measures in red soil region of Southern China. *J. Soil Water Conserv.* **2014**, *28*, 1–5.
71. Huang, S.D. Runoff and sediment characteristics and nutrition loss under forest canopy of pinus massoniana with different inter-planting modes. *Chin. Agric. Sci. Bull.* **2015**, *31*, 1–5.
72. Huang, Z.G. Characteristics of Soil and Water Loss under Different Forest Types in Hilly Red Soil Region of Southern China. Master's Thesis, Hunan Agricultural University, Changsha, China, 2006.
73. Song, Y.J.; Huang, Y.H.; Yang, J.; Xiao, L. The characteristics of soil and water lss in Pinus massoniana forest in red soil region of Jiangxi Province and the effect of soil and water conservation. *J. Arid Land Resour. Environ.* **2018**, *32*, 119–125.
74. Cao, L.; Liang, Y.; Wang, Y.; Lu, H. Runoff and soil loss from Pinus massoniana forest in southern China after simulated rainfall. *Catena* **2015**, *129*, 1–8. [CrossRef]
75. Li, Z.X.; Li, Q.Y.; Hou, X.L.; Huang, Z.J.; Liu, Q.; Chen, S.Y.; Zhao, Y.M. Characteristics of soil and water loss under different natural rainfall grades of Pinus Massoniana forest with different canopy density. *J. Soil Water Conserv.* **2020**, *34*, 27–33.
76. Xu, C.; Yang, Z.; Qian, W.; Chen, S.; Liu, X.; Lin, W.; Xiong, D.; Jiang, M.; Chang, C.; Huang, J.; et al. Runoff and soil erosion responses to rainfall and vegetation cover under various afforestation management regimes in subtropical montane forest. *Land Degrad. Dev.* **2019**, *30*, 1711–1724. [CrossRef]
77. Li, D.; Mo, J.; Fang, Y.; Cai, X.; Xue, J.; Xu, G. Effects of simulated nitrogen deposition on growth and photosynthesis of Schima superba, Castanopsis chinensis and Cryptocarya concinna seedlings. *Acta Ecol. Sin.* **2004**, *24*, 876–882.
78. Permar, T.; Fisher, R. Nitrogen fixation and accretion by wax myrtle (*Myrica cerifera*) in slash pine (*Pinus elliottii*) plantations. *For. Ecol. Manag.* **1983**, *5*, 39–46. [CrossRef]
79. Tchichelle, S.V.; Mareschal, L.; Koutika, L.-S.; Epron, D. Biomass production, nitrogen accumulation and symbiotic nitrogen fixation in a mixed-species plantation of eucalypt and acacia on a nutrient-poor tropical soil. *For. Ecol. Manag.* **2017**, *403*, 103–111. [CrossRef]
80. Forman, R.T.T.; Baudry, J. Hedgerows and hedgerow networks in landscape ecology. *Environ. Manag.* **1984**, *8*, 495–510. [CrossRef]
81. Kang, B.T.; Wilson, G.F.; Sipkens, L. Alley cropping maize (*Zea mays* L.) and leucaena (*Leucaena leucocephala* Lam) in southern Nigeria. *Plant Soil* **1981**, *63*, 165–179. [CrossRef]
82. Dong, Y.P. Studies on the Water and Soil Erosion of Mountain Areas with Different Hedgerow in the South of China. Master's Thesis, Anhui University, Hefei, China, 2009.
83. Lin, C.W.; Tu, S.H.; Huang, J.J.; Chen, Y.B. Effects of plant hedgerows on soil erosion and soil fertility on slopping farmland in the purple soil area. *Acta Ecol. Sin.* **2007**, *27*, 2191–2198.
84. Meng, C.F.; Wang, J.; Guo, X.S.; Lv, G.S. Effects of different soil conservation measures on soil and water conservation of sloping cultuvated land in Chaohu area. *J. Anhui Agric. Sci.* **2018**, *46*, 133–136+140.
85. Ren, Y.Z.; Zheng, J.K.; Fu, Y.; Wang, W.W.; Zeng, Q.T.; Zheng, X.H. Characteristics of runoff and sediment yield in purple soil sloping farmland under different tillage patterns in Suining formation. *J. Soil Water Conserv.* **2019**, *33*, 30–38.
86. Xie, T.S.; Luo, L.R. Research on natural vegetation recovery and erosion characteristics in the condition of building plant-fencing in corroded ditch of purple soil hills. *Res. Soil Water Conserv.* **2005**, *12*, 62–65.
87. Xu, F.; Cai, Q.G.; Wu, S.A.; Zhang, G.Y. A study on the effect of the vetiver zizanioides contour hedgerow on the soil and nutrient loss control. *J. Mt. Agric. Biol.* **2000**, *19*, 75–78.
88. Chan, S.; Tan, S.L.; Mohammed, H.G.; Howeler, R.H. Soil erosion control in cassava cultivation using tillage and cropping techniques. *Mardi Res. J.* **1994**, *22*, 55–66.
89. Daño, A.M.; Siapno, F.E. The effectiveness of soil conservation structures in steep cultivated mountain regions of the Philippines. In *Debris Flows and Environment in Mountain Regions*; Walling, D.E., Davies, T.R.H., Hasholt, B., Eds.; IAHS Publication: Wallingford, CT, USA, 1992; pp. 399–405.
90. Donjadee, S.; Clemente, R.S.; Tingsanchali, T.; Chinnarasri, C. Effects of vertical hedge interval of vetiver grass on erosion on steep agricultural lands. *Land Degrad. Dev.* **2009**, *21*, 219–227. [CrossRef]
91. Friederichsen, J.R. Assessment of erosion control in farming systems in Northwestern Vietnam. In Proceedings of the International Conference, Tropentag, Deutscher, 14 October 1999.

92. Suyamto, H.; Howeler, R.H. *Cultural Practices for Soil Erosion Control in Cassava-Based Cropping Systems in Indonesia*; Science Pulisher: Enfield, UK, 2004.
93. Thapa, B.; Cassel, D.; Garrity, D. Ridge tillage and contour natural grass barrier strips reduce tillage erosion. *Soil Tillage Res.* **1999**, *51*, 341–356. [CrossRef]
94. Tuan, V.D.; Hilger, T.; MacDonald, L.; Clemens, G.; Shiraishi, E.; Vien, T.D.; Stahr, K.; Cadisch, G. Mitigation potential of soil conservation in maize cropping on steep slopes. *Field Crops Res.* **2014**, *156*, 91–102. [CrossRef]
95. De Costa, W.A.J.M.; Atapattu, A.M.L.K. Decomposition and nutrient loss from prunings of different contour hedgerow species in tea plantations in the sloping highlands of Sri Lanka. *Agrofor. Syst.* **2001**, *51*, 201–211. [CrossRef]
96. Divakara, B.N.; Kumar, B.M.; Balachandran, P.V.; Kamalam, N.V. Bamboo hedgerow systems in Kerala, India: Root distribution and competition with trees for phosphorus. *Agrofor. Syst.* **2001**, *51*, 189–200. [CrossRef]
97. Diyabalanage, S.; Samarakoon, K.K.; Adikari, S.B.; Hewawasam, T. Impact of soil and water conservation measures on soil erosion rate and sediment yields in a tropical watershed in the Central Highlands of Sri Lanka. *Appl. Geogr.* **2017**, *79*, 103–114. [CrossRef]
98. Rao, M.R.; Sharma, M.M.; Ong, C.K. A study of the potential of hedgerow intercropping in semi-arid India using a two-way systematic design. *Agrofor. Syst.* **1990**, *11*, 243–258. [CrossRef]
99. Sudhishri, S.; Dass, A.; Lenka, N. Efficacy of vegetative barriers for rehabilitation of degraded hill slopes in eastern India. *Soil Tillage Res.* **2008**, *99*, 98–107. [CrossRef]
100. Adhikary, P.P.; Hombegowda, H.C.; Barman, D.; Jakhar, P.; Madhu, M. Soil erosion control and carbon sequestration in shifting cultivated degraded highlands of eastern India: Performance of two contour hedgerow systems. *Agrofor. Syst.* **2017**, *91*, 757–771. [CrossRef]
101. Cai, X.; Zhou, Y.; Liu, X.; Ma, L.; Tian, X. Nutrient blocking effects of plant hedge with various row on slope farmland nearby Hongfeng Lake. *Sci. Soil Water. Conserv.* **2012**, *10*, 36–42.
102. Chen, Z.G.; Zhu, Q.; Wang, W.H.; Li, J. Effect of soil and water conservation with balance fertilization combined with economic plant hedge in southern red-yellow soil area. *Res. Soil Water. Conserv.* **2006**, *13*, 248–251.
103. Fan, J.; Yan, L.; Zhang, P.; Zhang, G. Effects of grass contour hedgerow systems on controlling soil erosion in red soil hilly areas, Southeast China. *Int. J. Sediment Res.* **2015**, *30*, 107–116. [CrossRef]
104. Guo, T.L. Effect of Conservation Tillage Measures on Soil Physicochemical Property and Nutrient Loss on Slope Farmland in Purple Soil Area. Master's Thesis, Southwest University, Chongqing, China, 2016.
105. Li., T.; Chen, Y.; He, B.H.; Xiang, M.; Tang, H.; Liu, X.H.; Wang, R.Z. Study on soil and water conservation effects of *Veteria zizanioides* and *Leucaenba leucocephala* hedgerows with different planting years in central hill region of Sichuan basin. *J. Soil Water. Conserv.* **2019**, *33*, 27–35.
106. Xing, M.A.; Wang, W.; Zheng, J.; Qin, W.; Shan, Z.; Chen, X.; Xiang, M. Effects of hedgerow on runoff and sediment yield and microtopography on purple soil sloping farmland. *J. Soil Water. Conserv.* **2017**, *31*, 85–89, 188.
107. Peng, X.; Li, A.D.; Li, W.J.; Lu, W. Alley cropping for managing soil erosion of hilly lands in the Philippines. *Soil Technol.* **1995**, *8*, 193–204.
108. Zheng, H.; Nie, X.; Liu, Z.; Mo, M.; Song, Y. Identifying optimal ridge practices under different rainfall types on runoff and soil loss from sloping farmland in a humid subtropical region of Southern China. *Agric. Water Manag.* **2021**, *255*, 107043. [CrossRef]
109. Presbitero, A.; Escalante, M.; Rose, C.; Coughlan, K.; Ciesiolka, C. Erodibility evaluation and the effect of land management practices on soil erosion from steep slopes in Leyte, the Philippines. *Soil Technol.* **1995**, *8*, 205–213. [CrossRef]
110. Sun, H.; Tang, Y.; Chen, K.; Zhang, Y. Effects of contour hedgerow intercropping on surface flow control of sloping cropland. *Bull. Soil Water. Conserv.* **2001**, *21*, 48–51.
111. Truong, P.; Loch, R. Vetiver system for erosion and sediment control. In Proceedings of the 13th International Soil Conservation Organization Conference, Brisbane, Australia, 4–8 July 2004.
112. Wang, T.; Zhu, B.; Xia, L. Effects of contour hedgerow intercropping on nutrient losses from the sloping farmland in the Three Gorges Area, China. *J. Mt. Sci.* **2012**, *9*, 105–114. [CrossRef]
113. Xia, L.Z.; Ma, L.; Yang, L.Z.; Liu, G.H.; Li, Y.D. Effects of hedgerows and ridge cultivation on losses of nitrogen and phosphorus of slope land in Three Gorges Reservoir area. *Trans. Chin. Soc. Agric. Eng.* **2012**, *28*, 104–111.
114. Yao, G.Z.; Liu, Z.Y. Preliminary study on the effects of different hedgerow on the runoff and nutrient loss on slope farmland in Danjiangko Reservoir. *J. Anhui Agric. Sci.* **2010**, *38*, 3015–3016.
115. Zhang, L.; Liu, L.H.; Cheng, D.S.; Zhao, J.W.; Ji, Z.H.; He, M.Y.; Zhou, H.D. Impact of different agronomic measures on control of nitrogen, phosphorus, soil and water loss on sloping land. *J. Soil Water. Conserv.* **2009**, *23*, 21–25.
116. Zhang, Y.; Rong, X.M.; Wang, X.X.; Zhou, L.; Zhang, Y.P.; Liu, Q.; Xie, G.X.; Song, H.X. Effects of ecology interception and film mulching on surface runoff and nitrogen loss in upland soil. *J. Soil Water. Conserv.* **2014**, *28*, 15–19.
117. Yadav, L.P.; Smith, D.; Aziz, A.A.; Le Thuy, C.T.; Thao, H.X.; Le, H.H.; Nicetic, O.; Quyen, L.N.; Vagneron, I. Can traders help farmers transition towards more sustainable maize based farming systems? Evidence from the Lao-Vietnamese border. *Int. J. Agric. Sustain.* **2021**, *19*, 234–254. [CrossRef]
118. Pansak, W. *Soil Conservation, Erosion and Nitrogen Dynamics in Hillside Maize Cropping in Northeast Thailand*; Cuvillier: Göt-tingen, Germany, 9 April 2009.

119. Sidle, R.C.; Ziegler, A.D.; Negishi, J.N.; Nik, A.R.; Siew, R.; Turkelboom, F. Erosion processes in steep terrain—Truths, myths, and uncertainties related to forest management in Southeast Asia. *For. Ecol. Manag.* **2006**, *224*, 199–225. [CrossRef]
120. Guo, Z.L.; Zhong, C.; Cai, C.F.; Ding, S.W.; Wang, Z.M. Nitrogen competition in contour hedgerow systems in subtropical China. *Nutr. Cycl. Agroecosyst.* **2008**, *81*, 71–83. [CrossRef]
121. Cheng, H.; Chen, F.; Chen, S. A way of the vetiver grass technology for stabilizing slope of highway. *Res. Soil Water. Conserv.* **2000**, *3*, 67–68.
122. Huang, X.M. Research on the benefits of controlling methods to water and soil erosion in north Fujian. Master's Thesis, Fujian Agricultural University, Fuzhou, China, 2008.
123. Yang, Y.X.; Zhu, X.M.; Shao, J.R.; Lin, L.J.; Yong, W.U.; Jiang, X.J. Analysis of soil erosion on suining group parent material after closing management. Bull. *Soil Water. Conserv.* **2007**, *27*, 24–28.
124. Liu, G.; Xiang, Y.; Zhang, J.; Zhou, Z.; Shuhan, D.U. The primitive study on the adaptability of soil and water conservation measures on barren land in hilly area of sichuan basin. *J. Mt. Sci.-Engl.* **2008**, *6*, 714–720.
125. Bao, Y.; Cong, P.; Feng, W.; Wang, H.; He, X.B.; Tian, F. Comprehensive management system of soil and water loss in purple soil area of southwestern China. Bull. *Soil Water. Conserv.* **2018**, *38*, 143–150.
126. Friess, D.A.; Thompson, B.; Brown, B.; Amir, A.A.; Cameron, C.; Koldewey, H.J.; Sasmito, S.D.; Sidik, F. Policy challenges and approaches for the conservation of mangrove forests in Southeast Asia. *Conserv. Biol.* **2016**, *30*, 933–949. [CrossRef]
127. Hardwick, K.; Healey, J.R.; Elliott, S.; Blakesley, D. Research needs for restoring seasonal tropical forests in Thailand: Accelerated natural regeneration. *New For.* **2004**, *27*, 285–302. [CrossRef]
128. Konopik, O.; Steffan-Dewenter, I.; Grafe, T.U. Effects of Logging and Oil Palm Expansion on Stream Frog Communities on Borneo, Southeast Asia. *Biotropica* **2015**, *47*, 636–643. [CrossRef]
129. Lestrelin, G.; Vigiak, O.; Pelletreau, A.; Keohavong, B.; Valentin, C. Challenging established narratives on soil erosion and shifting cultivation in Laos. *Nat. Resour. Forum* **2012**, *36*, 63–75. [CrossRef]
130. Shono, K.; Cadaweng, E.A.; Durst, P.B. Application of Assisted Natural Regeneration to Restore Degraded Tropical Forestlands. *Restor. Ecol.* **2007**, *15*, 620–626. [CrossRef]
131. Thapa, G.B. Changing Approaches to Mountain Watersheds Management in Mainland South and Southeast Asia. *Environ. Manag.* **2001**, *27*, 667–679. [CrossRef] [PubMed]
132. Li, X.H.; Yang, J.; Zhao, C.Y.; Wang, B. Runoff and sediment from orchard terraces in southeastern china. *Land Degrad. Dev.* **2014**, *25*, 184–192. [CrossRef]
133. Arunyawat, S.; Shrestha, R.P. Assessing Land Use Change and Its Impact on Ecosystem Services in Northern Thailand. *Sustainablity* **2016**, *8*, 768. [CrossRef]
134. Chen, D.; Wei, W.; Chen, L. Effects of terracing practices on water erosion control in China: A meta-analysis. *Earth-Sci. Rev.* **2017**, *173*, 109–121. [CrossRef]
135. Castella, J.-C.; Boissau, S.; Thanh, N.H.; Novosad, P. Impact of forestland allocation on land use in a mountainous province of Vietnam. *Land Use Policy* **2006**, *23*, 147–160. [CrossRef]
136. Ribolzi, O.; Patin, J.; Bresson, L.; Latsachack, K.; Mouche, E.; Sengtaheuanghoung, O.; Silvera, N.; Thiébaux, J.; Valentin, C. Impact of slope gradient on soil surface features and infiltration on steep slopes in northern Laos. *Geomorphology* **2011**, *127*, 53–63. [CrossRef]
137. Sang-Arun, J.; Mihara, M.; Horaguchi, Y.; Yamaji, E. Soil erosion and participatory remediation strategy for bench terraces in northern Thailand. *Catena* **2006**, *65*, 258–264. [CrossRef]
138. Sun, Y.; Li, S.G.; Zhang, N. Effect of different tillage measures on soil and water loss characteristics of sloping cropland in rocky mountain area of Southwest China. *J. Anhui Agric.* **2017**, *45*, 118–120.
139. Yuan, M.; Wen, S.L.; Lin, Q.; Dong, C.H. Characteristics of soil and water loss under different ecological planting patterns in red soil hilly region of Southern human province. *J. Soil Water. Conserv.* **2012**, *26*, 21–26.
140. Mohsen, B.; Christopher, T.B.S.; Husni, M.H.A.; Zaharah, A.R. Soil, Nutrients and Water Conservation Practices in Oil Palm Plantations on Sloping and Steep Lands in Malaysia. In Proceedings of the International Agriculture Congress 2014, Putrajaya, Malaysia, 25–27 November 2014; Volume 45, pp. 118–120. [CrossRef]
141. Zhang, C.; Chen, F. Study on technical application of water system engineering works built on slopes. *Soil Water Concerv. Chin.* **2004**, *10*, 15–17.
142. Kobayashi, H. Current approach to soil and water conservation for upland agriculture in Thailand. *Jpn. Agric. Res. Quar.* **1996**, *30*, 43–48.
143. Dommain, R.; Couwenberg, J.; Joosten, H. Hydrological self-regulation of domed peatlands in south-east Asia and consequences for conservation and restoration. *Mires Peat.* **2010**, *6*, 1–17.
144. Bhattacharyya, R.; Ghosh, B.N.; Dogra, P.; Mishra, P.K.; Santra, P.; Kumar, S.; Fullen, M.A.; Mandal, U.K.; Anil, K.S.; Lalitha, M.; et al. Soil Conservation Issues in India. *Sustainabilty* **2016**, *8*, 565. [CrossRef]
145. Wang, B.; Fang, S.; Yang, J. Analysis on effects of sediment retention and pollution control by slope water works in red soil area in north Jiangxi Province. *Yangtze River* **2013**, *44*, 95–99.
146. Paudel, G.S.; Thapa, G.B. Changing Farmers' Land Management Practices in the Hills of Nepal. *Environ. Manag.* **2001**, *28*, 789–803. [CrossRef]

147. Abbasi, N.A.; Xu, X.; Lucas-Borja, M.E.; Dang, W.; Liu, B. The use of check dams in watershed management projects: Examples from around the world. *Sci. Total Environ.* **2019**, *676*, 683–691. [CrossRef]
148. Abedini, M.; Said, A.M.; Ahmad, F. Effectiveness of check dam to control soil erosion in a tropical catchment (The Ulu Kinta Basin). *Catena* **2012**, *97*, 63–70. [CrossRef]
149. Dhital, Y.P.; Kayastha, R.B.; Shi, J. Soil Bioengineering Application and Practices in Nepal. *Environ. Manag.* **2012**, *51*, 354–364. [CrossRef]
150. Kusumandari, A.; Widiyatno; Marsono, D.; Sabarnurdin, S.; Gunawan, T.; Nugroho, P. Vegetation Clustering in Relation to Erosion Control of Ngrancah Sub Watershed, Java, Indonesia. *Procedia Environ. Sci.* **2013**, *17*, 205–210. [CrossRef]
151. Bhatia, K.S.; Choudhary, H.P. Runoff and erosion losses and crop yield from slopy and eroded alluvial soils of Uttar Pradesh in relation to contour farming and fertilization. *Soil Conserv. Dig.* **1977**, *5*, 16–22.
152. Tisdall, J.; Hodgson, A. Ridge tillage in Australia: A review. *Soil Tillage Res.* **1990**, *18*, 127–144. [CrossRef]
153. Koller, K. Techniques of soil tillage. In *Soil Tillage Agroecosyst*; Titi, A.E., Ed.; CRC Press LLC: Boca Raton, FL, USA, 2003; pp. 1–25.
154. Atreya, K.; Sharma, S.; Bajracharya, R.M.; Rajbhandari, N.P. Developing a sustainable agro-system for central Nepal using reduced tillage and straw mulching. *J. Environ. Manag.* **2008**, *88*, 547–555. [CrossRef] [PubMed]
155. Li, L.L.; Huang, G.B.; Zhang, R.Z.; Bellotti, B.; Li, G.D.; Chan, K.Y. Benefits of conservation agriculture on soil and water conservation and its progress in China. *Agric. Sci. Chin.* **2011**, *10*, 850–859. [CrossRef]
156. Pansak, W.; Hilger, T.; Dercon, G.; Kongkaew, T.; Cadisch, G. Changes in the relationship between soil erosion and N loss pathways after establishing soil conservation systems in uplands of Northeast Thailand. *Agric. Ecosyst. Environ.* **2008**, *128*, 167–176. [CrossRef]
157. Lienhard, P.; Tivet, F.; Chabanne, A.; Dequiedt, S.; Lelièvre, M.; Sayphoummie, S.; Leudphanane, B.; Prévost-Bouré, N.C.; Séguy, L.; Maron, P.-A.; et al. No-till and cover crops shift soil microbial abundance and diversity in Laos tropical grasslands. *Agron. Sustain. Dev.* **2013**, *33*, 375–384. [CrossRef]
158. Pheap, S.; Lefevre, C.; Thoumazeau, A.; Leng, V.; Boulakia, S.; Koy, R.; Hok, L.; Lienhard, P.; Brauman, A.; Tivet, F. Multi-functional assessment of soil health under Conservation Agriculture in Cambodia. *Soil Tillage Res.* **2019**, *194*, 104349. [CrossRef]
159. Sornpoon, W.; Jayasuriya, H.P. Effect of different tillage and residue management practices on growth and yield of corn cultivation in Thailand. *Agri. Eng. Int. CIGR J.* **2013**, *15*, 86–94.
160. An, T.X.; Li, C.H.; Wu, B.Z.; Hu, C.Y.; Zheng, A.P. Effects of different intercropping measures about soil and water loss on sloping land. *J. Soil Water. Conserv.* **2007**, *5*, 24.
161. Li, T.; Zhang, L.; Li, Z.L.; Zhang, N.M.; Yue, X.R.; Dao, B.F.; Xia, Y.S. Response of native arbuscular mycorrhizal fungi and maize/soybean intercropping to nitrogen forms changes in runoff on red soil. *J. Soil Water. Conserv.* **2019**, *33*, 21–27.
162. Luo, X.H.; Zhang, J.B.; Huang, Y.B.; Ying, C.Y. Review of the Function of grass on water and soil conservation in red soil region in south of China. Fujian. *J. Agric. Sci.* **2013**, *28*, 1164–1169.
163. Zhong, Z.M.; Zhan, J.; Li, Z.W.; Ying, C.Y. Effects of interplanting Vigna sinensis on soil water stable aggregate of Citrus reticulata orchard in purplish soil erosion region. *Pratac. Sci.* **2015**, *32*, 1940–1944.
164. Chen, Y.Z.; Wang, Y.J.; Wang, X.N.; Wang, R.; Peng, S.F.; Yang, X.H.; Ma, L.; Yang, Y. Effects of interplantation on soil physical and growth of *Camellia oleifera* young forest. *J. Nanjing. For. Univ. Nat. Sci. Ed.* **2011**, *35*, 117–120.
165. Ding, Y.F.; Cao, Y.Q.; Yao, X.H.; Fu, S.L.; Zhang, P.A.; Lou, X.L. Effects of intercropping with different green manures on soil nutrient loss in Camellia Oleifera field. *J. Soil Water. Conserv.* **2018**, *32*, 179–183, 216.
166. Zhao, W.F.; Yang, W.X.; Yang, F.J.; Wei, C.B.; Sun, G.M. Effect of intercropping pineapple on soil loss in young rubber plantations. *Chin. J. Trop. Agric.* **2010**, *30*, 7–9.
167. Medina, S.M.; Narioka, H.; Garcia, J.N.M. Soil conservation and farming systems on slope land in Indonesia and the Philippines. *J. Jap. Soc. Soil Phys.* **2000**, *84*, 57–64.
168. Punyalue, A.; Jongjaidee, J.; Jamjod, S.; Rerkasem, B. Legume Intercropping to Reduce Erosion, Increase Soil Fertility and Grain Yield, and Stop Burning in Highland Maize Production in Northern Thailand. *Chiang Mai Univ. J. Nat. Sci.* **2018**, *17*, 265–274. [CrossRef]
169. Suyana, J.; Senge, M.; Senge, M. Conservation techniques for soil erosion control in tobacco-based farming system at steep land areas of Progo Hulu Subwatershed, Central Java, Indonesia. *Eng. Technol.* **2010**, *4*, 287–294.
170. Acharya, G.P.; Tripathi, B.P.; Gardner, R.M.; Mawdesley, K.J.; Mcdonald, M.A. Sustainability of sloping land cultivation systems in the mid-hills of Nepal. *Land Degrad. Dev.* **2008**, *19*, 530–541. [CrossRef]
171. Gaskin, S.; Gardner, R. The role of cryptogams in runoff and erosion control on bariland in the Nepal Middle Hills of the Southern Himalaya. *Earth Surf. Process. Landf.* **2001**, *26*, 1303–1315. [CrossRef]
172. Mittal, S.; Singh, P. Intercropping field crops between rows of Leucaena leucocephala under rainfed conditions in northern India. *Agrofor. Syst.* **1989**, *8*, 165–172. [CrossRef]
173. Iijima, M.; Izumi, Y.; Yuliadi, E.; Sunyoto, S.; Ardjasa, W.S. Cassava-Based Intercropping Systems on Sumatra Island in Indonesia: Productivity, Soil Erosion, and Rooting Zone. *Plant Prod. Sci.* **2004**, *7*, 347–355. [CrossRef]
174. Liyanage, M.D.S.; Tejwani, K.G.; Nair, P.K.R. Intercropping under coconuts in Sri Lanka. *Agrofor. Syst.* **1984**, *2*, 215–228. [CrossRef]
175. Donjadee, S.; Tingsanchali, T. Soil and water conservation on steep slopes by mulching using rice straw and vetiver grass clippings. *Agric. Nat. Resour.* **2016**, *50*, 75–79. [CrossRef]

176. Li, X.-H.; Zhang, Z.-Y.; Yang, J.; Zhang, G.-H.; Wang, B. Effects of Bahia Grass Cover and Mulch on Runoff and Sediment Yield of Sloping Red Soil in Southern China. *Pedosphere* **2011**, *21*, 238–243. [CrossRef]
177. Moradi, A.; Sung, C.T.B.; Goh, K.J.; Hanif, A.H.M.; Ishak, C.F. Effect of four soil and water conservation practices on soil physical processes in a non-terraced oil palm plantation. *Soil Tillage Res.* **2015**, *145*, 62–71. [CrossRef]
178. Fagerstrom, M.H.H.; Nilsson, S.I.; Noordwijk, M.V.; Phien, T.; Svensson, C. Does Tephrosia candida as fallow species, hedgerow or mulch improve nutrient cycling and prevent nutrient losses by erosion on slopes in northern Viet Nam? *Agric. Ecosyst. Environ.* **2002**, *90*, 291–304. [CrossRef]
179. Cosico, W.C. *Studies on Green Manuring in the Philippines*; ASPAC Food & Fertilizer Technology Center: Taipei, Taiwan, 1990.
180. Dalton, T.J.; Lilja, N.K.; Johnson, N.; Howeler, R. Farmer Participatory Research and Soil Conservation in Southeast Asian Cassava Systems. *World Dev.* **2011**, *39*, 2176–2186. [CrossRef]
181. Kim, M.; Gilley, J.E. Artificial Neural Network estimation of soil erosion and nutrient concentrations in runoff from land application areas. *Comput. Electron. Agric.* **2008**, *64*, 268–275. [CrossRef]
182. Sarkar, T.; Mishra, M. Soil Erosion Susceptibility Mapping with the Application of Logistic Regression and Artificial Neural Network. *J. Geovis. Spat. Anal.* **2018**, *2*, 8. [CrossRef]
183. Wani, I.; Narde, S.R.; Huang, X.; Remya, N.; Kushvaha, V.; Garg, A. Reviewing role of biochar in controlling soil erosion and considering future aspect of production using microwave pyrolysis process for the same. *Biomass-Conversat. Biorefinery* **2021**, 1–27. [CrossRef]
184. Garg, A.; Wani, I.; Zhu, H.; Kushvaha, V. Exploring efficiency of biochar in enhancing water retention in soils with varying grain size distributions using ANN technique. *Acta Geotech.* **2021**, 1–12. [CrossRef]
185. Garg, A.; Wani, I.; Kushvaha, V. Application of artificialintelligence for predicting erosion of biochar amended soils. *Sustainability* **2022**, *14*, 684. [CrossRef]
186. Li, Z.-G.; Gu, C.-M.; Zhang, R.-H.; Ibrahim, M.; Zhang, G.-S.; Wang, L.; Zhang, R.; Chen, F.; Liu, Y. The benefic effect induced by biochar on soil erosion and nutrient loss of slopping land under natural rainfall conditions in central China. *Agric. Water Manag.* **2017**, *185*, 145–150. [CrossRef]
187. Yi, C.; Xiang, J.; Cheng, Z.; Sheng, H.; Ping, Y.; Zhang, J.; Yang, Y.; Bing, X. Effects of different cultivation methods on soil nutrient losses, yield and quality of flue-cured tobacco. *Chin. Agric. Sci. Bull.* **2014**, *30*, 174–179.
188. Chen, J.R.; Liu, J.; Wang, H.M.; Xiong, H.F.; Liu, H.; Xu, C.X. Effect of conservation tillage on soil nutrient loss from a steep hillslope soil. *Soil Fertil. Sci. Chi.* **2018**, *1*, 146–152.
189. Dano, A.; Midmore, D. Evaluation of Soil and Water Conservation Technologies in vegetable-based upland production system of Manupali watershed, Southern Philippines. In Proceedings of the 13th International Soil Conservation Organisation Conference, Brisbane, Australia, 4–8 July 2004.
190. Huang, L.; Peng, Y.X. The influence of differnet cultivation on soil and water losses of slopes lands on the three gorges reservoir region. *J. Huazhong. Agric. Univ.* **1998**, *17*, 45–49.
191. Jiang, C.L.; Peng, L.Z.; Cao, L.; Chun, C.P.; Ling, L.L. Correlation between farming methods and soil erosion in the purple soil slope of citrus orchard in the Three Gorges Reservoir area. *J. Soil Water. Conserv.* **2011**, *25*, 26–31, 35.
192. Kurothe, R.S.; Kumar, G.; Singh, R.; Singh, H.B.; Tiwari, S.P.; Vishwakarma, A.K.; Sena, D.R.; Pande, V.C. Effect of tillage and cropping systems on runoff, soil loss and crop yields under semiarid rainfed agriculture in India. *Soil Tillage Res.* **2015**, *140*, 126–134. [CrossRef]
193. Liu, H.T.; Yao, L.; Zhu, Y.Q.; Wang, H.; Xu, W.Z.; Lin, C. Characteristics of water and nutrients loss under subsoiling and straw mulching in purple soil slope cropland. *J. Soil Water. Conserv.* **2018**, *32*, 52–57, 165.
194. Tian, T.Q.; He, B.H.; Huang, W. Characteristics of runoff and sediment production under differnt fertilization and tillage patterns in Three Gorges Reservoir Area. *Res. Soil Water. Conserv.* **2014**, *21*, 61–65.
195. Wang, J.; Wang, Y.Q.; Ye, Y.; Meng, C.F.; Wang, D.Z.; Guo, X.S. Effect of agronomic measures on phosphorous loss via runoff in sloping croplands around Chaohu Lake. *Chin. J. Eco-Agric.* **2017**, *25*, 911–919.
196. Wang, S.B.; Wang, K.Q.; Song, Y.L.; Chen, X.; Wang, Z. Effects of contour reverse-slope terrace on nitrogen and phosphorus loss in sloping farmland in the water resource area of Songhua Dam in Kunming City. *J. Soil Water. Conserv.* **2017**, *31*, 39–45.
197. Yuan, D.H.; Wang, Z.Q.; Chen, X.; Guo, X.B.; Zhang, R.L. Properties of soil and water loss from slope field in red soil in different farming systems. *J. Soil Water. Conserv.* **2001**, *15*, 66–69.
198. Zhang, C.L.; Chen, D.B.; Liu, S.Y. Effects of soil-and-water conservation by planting herbals on the sloping red soil land of an orchard. *Acta Agrestia Sin.* **2006**, *14*, 365–369.
199. Zhong, Y.J.; Ye, C.; Huang, Q.R.; Zhang, X.L.; Wu, L.; Sun, Y.M.; Qin, J.T.; Zhong, Y.J.; Ye, C.; Huang, Q.R. Benefit analysis of different soil and water conservation measures at sloping Arachis hypogaea land with red soil. *Sci. Soil Water. Conserv.* **2011**, *9*, 71–74.