Opportunities for harnessing Zero Hunger in Asia

EXECUTIVE SUMMARY
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Editors
Xuan Li, Mahmoud El Solh and Kadambot H.M Siddique

Food and Agriculture Organization of the United Nations
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Mountains are home to one tenth of the world's population, and cover one fifth of the world's land mass. To most of us, mountain regions offer landscapes of spectacular scenic beauty – but what we don't see are the lives and struggles of the people who live in the mountains, many of whom are poor and marginalized. Going by the global average, one in eight persons is food insecure, but in rural mountain areas this ratio is one out in two. This means that around 300 million mountain people are food insecure, with half of them suffering from chronic hunger. FAO has been providing global leadership on sustainable mountain development for decades, including overseeing the implementation of the mountain-related chapter of Agenda 21, the blueprint for sustainable development of the 1992 UN Earth Summit, and the International Year of Mountains in 2002. While mountain agriculture has made some headway, identifying innovative responsive solutions that target mountains directly in relation to Sustainable Development Goal 2 – Zero Hunger – remains a work-in-progress.

This publication – led by FAO's Regional Office for Asia and the Pacific and partners from national governments, national agriculture institutes, universities, international organizations and international research institutes – aims at raising awareness of the issues encountered by mountain farmers in Asia, and outline how mountain agriculture could better contribute to food security and better nutrition in Asia. The objectives of this publication are to (1) demonstrate constraints, gaps and opportunities in mountain agriculture to tap underutilized areas and resources for Zero Hunger and poverty reduction, (2) identify possible entry points and policy recommendations to develop sustainable mountain agriculture and strengthen food security and nutrition governance, and (3) promote knowledge sharing and exchange of good experience and practices related to mountain agriculture development for Zero Hunger.

Why does mountain agriculture deserve special attention in a Zero Hunger context? Firstly, because hunger remains common in many mountainous areas. While on a global scale, food insecurity has tended to go down, mountain dwellers have fared worse than people living in plains. Secondly, because mountains cover a large part of the world, especially in Asia: the continent hosts more than one-third of the world's mountains. Many Asian countries are dominated by mountains: for instance, nearly the entire land area in Bhutan is mountainous, and Lao PDR has 89 percent of its land area classified as mountainous or upland – farmers have no option but to derive their livelihoods from mountain agriculture. Thirdly, mountain agriculture can produce a large variety of nutritious foods not normally available from large-scale agriculture practised in the plains. Strengthening mountain agriculture must therefore be set as a priority for achieving Zero Hunger.

But how can mountain agriculture be effectively developed to achieve Zero Hunger? Mountain agriculture faces a number of constraints including inaccessibility, shorter and more pronounced agricultural seasons, ecological fragility, limited infrastructure, and distant markets. Yet, mountains contain more diversity than plain regions: their varied landscapes and the changes in altitude have created a multitude of agro-ecological zones. The genetic variety of agricultural crops and farm animals contained in these zones has the potential to provide diversified and nutritious food for all. The potential of mountain agriculture lies in mountain specialty products (e.g. Future Smart Food: neglected and underutilized species that are nutritionally dense, climate resilient, economically viable, and locally available or adaptable), off-season products as well as agrotourism.
Conventional approaches in mountain agriculture have not been able to reduce hunger and malnutrition. The transition to food systems that are nutrition-sensitive, climate-smart and sustainable requires government leadership to reinforce intersectoral efforts and acknowledge the wealth and diversity of mountain agriculture. This publication provides a clear message to policymakers, researchers and practitioners: we must include mountain agriculture in our agendas when tackling hunger and malnutrition, poverty alleviation, conservation and sustainable use of biodiversity, and climate change adaptation. We have to work together in our commitment to include mountain agriculture and “leave no-one behind” on the road towards achieving the Zero Hunger goal.

José Graziano da Silva
Former Director-General
Food and Agriculture Organization of the United Nations
Mountain food security and nutrition are core issues that can contribute positively to the achievement of the Sustainable Development Goals but paradoxically are often ignored in Zero Hunger and poverty reduction-related agenda. Under the overall leadership of José Graziano da Silva, the Former Director-General of FAO, to effectively address this issue and assist Member Countries in tackling food insecurity and malnutrition in mountain regions in the Asia and the Pacific, Kundhavi Kadiresan, Assistant Director-General and Regional Representative of FAO RAP, launched an initiative on mountain agriculture, building on strong foundations and long-standing FAO experience on Mountain Partnership, agricultural diversification, sustainable and integrated farming systems, and sustainable natural resources management and use. The sustainable mountain agriculture development initiative’s priority setting and activities are currently carried out through the Regional Initiative on Zero Hunger (RI-ZH) of FAO RAP. The initiative on mountain agriculture for Zero Hunger received strategic guidance from Daniel Gustafson, Deputy Director-General (Programmes) of FAO, and has been endorsed by the Director-General of FAO.

The RI-ZH of FAO RAP was formulated to assist its Member Countries following the launch of the global Zero Hunger Challenge (ZHC) at the the Rio+20 Conference in June 2012, and the Asia-Pacific regional ZHC in April 2013 organized by the United Nations and associated agencies, with participation by heads of governments, and other high-level and senior officials from across the region. Subsequently, the United Nations Regional Thematic Working Group on Poverty and Hunger, chaired by the FAO, along with UNESCAP and UNDP, prepared the “Regional Guiding Framework for Achieving Zero Hunger in Asia and the Pacific.” This Framework calls for all stakeholders to support and carry the momentum forward with concrete action at the country level. Under this Framework, RI-ZH established three major programmatic work areas in consultation with governments:

1. Creating environments for food security and nutrition.
2. Data collection, analysis, and monitoring on food security and nutrition.
3. Strengthening sustainable agriculture and food systems.

The mountain agriculture initiative has been an integral component under RI-ZH since 2018. The initiative is implemented under the overall Strategic Programmes of the FAO to “contribute to the eradication of hunger, food insecurity and malnutrition,” as well as to “support the rural poor in improving their income-generating capacities through better access to productive resources, markets, services, technologies and social protection” in collaboration with various other strategic programmes.

In the second half of 2018, under the leadership of Kundhavi Kadiresan, RI-ZH and its partners organized an International Workshop and Regional Expert Consultation on Strengthening Mountain Agriculture Development and Food Security and Nutrition Governance for Zero Hunger and Poverty Reduction in Beijing (hereafter “the Mountain Consultation”), which considered key issues in mountain areas in the context of sustainable agriculture development and food systems that drew regional attention, cooperation and policy solutions to enhance food security and nutrition governance in mountainous and hilly areas.
Prior to the Mountain Consultation, conceptualization and partnership building were consolidated based on strong country desires for knowledge sharing at the regional level on promoting sustainable mountain agriculture and enhancing food security and nutrition in mountain areas to address Zero Hunger and poverty reduction. The conceptualization was formulated through close technical consultation with Mahmoud El Solh and Kadambot H. M Siddique. The Mountain Consultation was co-organized by the FAO and University of International Relations in China, in collaboration with The University of Western Australia, International Centre for Integrated Mountain Development (ICIMOD), Mountain Partnership, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), and Center for International Agriculture Research of Chinese Academy of Agriculture Sciences.

The Mountain Consultation received enormous support and dedication from national governments and national agriculture/mountain research organizations, who were engaged in activities before and during the Consultation to address the common challenges that Asian countries face in the sustainable development of mountain agriculture. For instance, high-level experts from the Nutrition Development Foundation and Royal Project Foundation from Thailand contributed technical presentations and successful country studies on nutrition governance, niche and development of local products for value addition, diversified livelihoods and agritourism in the mountains.

In addition, national mountain agriculture experts from national research institutes in nine Asian countries (Bhutan, Nepal, Myanmar, Cambodia, Vietnam, Lao PDR, India, Pakistan and Bangladesh) prepared preliminary Country Reports on Sustainable Mountain Agriculture Development for Achieving Zero Hunger and Poverty Reduction, in coordination with their government officials, based on FAO guidelines. The reports were circulated for international review before the Mountain Consultation. The national mountain agriculture experts presented at the Mountain Consultation to generate further discussion for the preparation of this publication. Moreover, a comprehensive set of Questionnaires on Mountain Agriculture in Asia were distributed to all participants at the Mountain Consultation for the purposes of data gathering and deliberative consultation.

The objectives and outputs of the Mountain Consultation, 30 October–1 November 2018, Beijing are presented below:

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Outputs</th>
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<tbody>
<tr>
<td>1 Identify constraints, gaps and opportunities on mountain agriculture development for poverty reduction and Zero Hunger</td>
<td>1 Key challenges and potential identified for agriculture and food systems in mountain areas (production, agro-processing, marketing and consumption)</td>
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<tr>
<td>2 Facilitate knowledge sharing, lessons learned and good practices on sustainable agriculture development and mountain food security and nutrition governance</td>
<td>2 Good experience, practices and solutions for enhancing sustainable mountain agriculture development (e.g. production, agro-processing, marketing and consumption) and mountain food security and nutrition governance</td>
</tr>
<tr>
<td>3 Identify possible entry points and policy recommendations for promoting sustainable mountain agriculture development, and strengthen food security and nutrition governance</td>
<td>3 Recommendations and roadmaps for the way forward for mountain food security and nutrition governance developed</td>
</tr>
</tbody>
</table>
Compromising five sessions, the first day’s programme was designed for international experts to share advanced experiences/programmes/lessons learned and success stories for sustainable mountain agriculture development from a global policy and technical perspective. International experts led state-of-art presentations on the following topics based on the framework of a sustainable food system: (1) Sustainable Mountain Agriculture Development and its Contribution to Food Security and Nutrition Governance; (2) Mainstreaming Neglected and Underutilized Species (NUS) for Mountain Agricultural Development: The Role of Future Smart Food (FSF); (3) Building Sustainable and Integrated Farming Systems for Mountain Agriculture; and (4) Promoting Integrated Value Chain and Market Access for Mountain Products.

On the second day, experts from nine Asian countries (Bangladesh, Bhutan, Cambodia, Lao PDR, India, Myanmar, Nepal, Pakistan and Vietnam) that have implemented the RI-ZH shared their experience regarding the constraints, gaps and opportunities on sustainable mountain agriculture development for poverty reduction and Zero Hunger. The reports revealed that despite positive developments for reducing poverty nationwide, each country is suffering from similar problems such as the lack of interest of young people in agriculture, outmigration and the feminization of agriculture, degradation of natural resources as well as the serious implications of climate change on natural resource management and mountain agriculture.

On the final day, the experts and participants convened for three policy dialogue sessions to discuss gaps and challenges in mountain agriculture within national policies and strategies for mountain agriculture, food security and nutrition governance development. David Molden, Director General of ICIMOD, highlighted the need to stand up collectively for mountain agriculture issues and raise the voice of mountain people, as mountains are hotspots for Zero Hunger, climate change and migration. As an outcome of the workshop, Mahmoud El Solh presented “Recommendations for Policy Makers for Sustainable Development of Mountain Agriculture”, highlighting that it is crucial to raise awareness internationally on opportunities for sustainable mountain agriculture development for diversified and sustainable food systems. Finally, Daniel Gustafson, FAO’s Deputy Director-General, raised concerns for the existing imbalance between the recognition of mountains internationally and their importance. He advocated for increased joint efforts to add-value to mountain products and to empower mountain people, particularly women. Prof Hui Wu, Vice President, UIR, also offered a closing remark thanking everyone for taking collective efforts in this important area for Zero Hunger.

The challenges and problems facing sustainable mountain ecosystems and mountain agriculture are often complex, transboundary and difficult to be resolved by a single country, a single discipline, or single institution. All national and international partners from different backgrounds have emphasized the need to team up and continue flying the flag for supporting mountain agriculture and mountain people in the Asia region. There is a need to reach out further and communicate globally to increase multi-sectoral policy prioritization, interdisciplinary engagement, and public–private investment for the development of sustainable mountain agriculture.

1 The country study from Cambodia is not included in this publication due to limited national data on mountain agriculture available. To access the presentation from Cambodia at the Mountain Consultation, please visit the website on Regional initiative of Zero Hunger at FAO RAP.
This publication, titled “Mountain agriculture—opportunities for harnessing Zero Hunger in Asia” integrates and moves the outcomes of the Mountain Consultation forward by looking at the status, challenges, opportunities and solutions of sustainable mountain agriculture development for Zero Hunger in Asia. It comprises four parts:

**Part I** sets the scene of the publication, serving as a guiding and introductory passage to outline the context and justification of why mountain agriculture matters and the synergies among mountain agriculture, food security and nutrition in a changing climate.

**Part II** comprises seven thematic chapters (Chapters 2–8) on mountain agriculture that are technical and multidisciplinary in nature with a regional and global outlook, but also practical in terms of conveying hands-on lessons-learned and successful case studies at the local level. They integrate mountain agriculture to rounded debates under a sustainable food system, including the challenges and opportunities that mountain agriculture offers, FSN governance, Future Smart Food, farming systems, value chains, and socio-cultural livelihoods. They also lay the framework for mountain food security and nutrition governance based on a survey conducted in Asian countries.

**Part III** presents eight Asian country case studies on mountain agriculture, covering efforts made by the national government, as well as diverse mountain communities from the public and private sectors, ranging from classic examples of integrated farming systems to innovative new institutional designs, specifically tailored to local contexts and conditions. The country studies presented: (1) an overview of food security and mountain characteristics and the contributions of mountain agriculture in each country; (2) the status, challenges and constraints of mountain agriculture; (3) opportunities and entry points for mountain agriculture development to address Zero Hunger and poverty reduction (from food system perspectives covering production, agro-processing, marketing and consumption); (4) country experiences: main policy measures, initiatives and practices to enhance mountain agriculture development; (5) strategic consideration and suggestions: policies and measures, and governance promoting sustainable agriculture development in mountain areas; (5) conclusion.

**Part IV** concludes the publication with a set of Recommendations to inform the policymakers, development experts, academics and mountain communities who support sustainable mountain development, food security and nutrition. The Recommendations were developed by Mahmoud El Solh, in collaboration with a large group of multidisciplinary, international experts, to put the development of mountain agriculture on a more significant and sustainable path and make it an integral part of the food security and nutrition policy nationally and globally.

Xuan Li, Mahmoud El Solh and Kadambot H.M Siddique
June 2019
We are deeply grateful to everyone who has contributed to the development of this publication – Mountain Agriculture – Opportunities for harnessing Zero Hunger in Asia. The publication offers an in-depth look at the origin and the latest results of the FAO RAP’s Mountain Agriculture initiative.

The subject of mountain agriculture became a focus under the Regional Initiative on Zero Hunger (RI-ZH) and was inspired by the vision of the Director-General in view of the fact that hunger and malnutrition in mountain regions is often more severe than in the rest of the world. It was part of his insight to tap the potential of forgotten foods, which can grow abundantly in mountain regions, as a solution. The Mountain Agriculture initiative to address Zero Hunger has been led by Kundhavi Kadiresan, Assistant Director-General and Regional Representative, FAO RAP, in collaboration with national and international partners, and has been endorsed by José Graziano da Silva, the FAO Director-General. The initiative received strong support from Daniel Gustafson, Deputy Director-General (Programmes), FAO.

This publication reflects the processes and outcomes of the International Workshop and Regional Expert Consultation on Mountain Agriculture Development and Food Security and Nutrition Governance (hereafter “the Mountain Consultation”). This important event was co-organized by the FAO and University of International Relations of China (UIR) from 30 October to 1 November 2018 in Beijing, in collaboration with the University of Western Australia, the International Centre for Integrated Mountain Development (ICIMOD), the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Mountain Partnership (MP), the Center for International Agriculture Research of Chinese Academy of Agriculture Sciences (CAAS).

This publication is the result of collective contributions from all partners, from both international and national organizations, and the key intellectuals in the development of the Mountain Agriculture Initiative. We wish to extend our sincere appreciation to all of them.

We are indebted to Dr Mahmoud El Solh, Vice Chair of the High Level Panel of Experts for Food Security and Nutrition (HLPE), the Committee on World Food Security (CFS) of FAO, IFAD and WFP, and Professor Kadambot H.M. Siddique, FAO Special Ambassador of the International Year of Pulses, who have been the intellectual driving force behind the Mountain Agriculture Initiative from the outset and throughout the process. It is their hard work which has made this interdisciplinary mission a success. We would like to acknowledge Dr Suhas P Wani, former Research Programme Director, Asia, and Director of ICRISAT Development Centre for his excellent support and scientific advice to this initiative. We wish to extend our gratitude to Dr Xuan Li, Dr Thomas Hofer, Dr Prakash C.Tiwari, Professor Liqun Wang, Dr Bhagwati Joshi, Dr Dinesh K. Marothia, Dr Surendra Raj Joshi, Michelle Geringer, Dr Bingchuan Hu, Dr Min Qingwen, Heyao Li, Lubin Ding and Luis Antonio T. Hualda, for their scientific insights and expertise. They are the main contributors to Part I, Part II and Part IV of this report.
We sincerely acknowledge the commitments and the determination of governments and national agriculture research institutions from the Member States in Asia who have given their feedback and support on the subject of mountain agriculture for Zero Hunger. The National Focal Points of the Zero Hunger Challenge played an important role in the process of collaboration. Nearly ten countries’ national experts on mountain agriculture have been nominated for the Mountain Consultation and have contributed to the development of the country studies on mountain agriculture development found in Part III of this publication. They are from: the Chattogram Hill Tracts Development Board of Bangladesh, Bhutan Ministry of Agriculture and Forests, Sher-e-Kashmir University of Agricultural Sciences and Technology in Kashmir India, Ministry of Agriculture and Farmers Welfare of India, National Agriculture and Forestry Research Institute of Lao PDR, Ministry of Agriculture, Livestock and Irrigation of Myanmar, Ministry of Agriculture and Livestock Development of Nepal, Ministry of Land Management, Agriculture and Cooperatives of Nepal, Pakistan Agricultural Research Council, and Vietnam Academy of Agricultural Sciences. We also thank the Cambodia Government and its National Focal Point for the Zero Hunger Challenge for their nomination and participation in the Mountain Consultation. We also would like to thank those national experts on Future Smart Food who provided technical support for the preparation of country studies on mountain agriculture development.

We acknowledge the strong support from all partners organizations to the Mountain Agriculture Initiative, particularly UIR, ICIMOD, UWA, ICRISAT, Mountain Partnership, Kumaun University of India, Center for International Agriculture Research of CAAS, Institute of Geographic Sciences and Natural Resources Research of Chinese Academy of Sciences (CAS), Institute of Scientific and Technical Information of Chinese Academy of Tropical Agricultural Sciences (CATAS), especially those who nominated international experts to join FAO in reviewing the thematic and country studies on mountain agriculture development for this publication. The international experts who joined the interdisciplinary team and served as peer reviewers for the publication include: Mahmoud El Solh, Kadambot H.M. Siddique, Suhas P. Wani, Golam Rasul, Abid Hussain, Dhrupad Choudhury, Surendra Raj Joshi, John Dixon, Anil K. Choudhary, Prakash C. Tiwari, Michelle Geringer, Zhongjun Du and Bernd Bultemeier.

We would like to express our sincere appreciation to UIR for their excellent contributions. This included, of course, their dedication to organizing a highly successful Mountain Consultation. The collaboration is under the leadership of Professor Jian Tao, President of UIR, Professor Hui Wu, Vice-President of UIR, led by Professor Xiuying Tan, Chief Editor of the Journal of International Security Studies, with able support from Lei Xie, among others.

We would also like to thank Dr David Molden, Director General of the ICIMOD, who shared his vision and provided full support to the Mountain Agriculture Initiative, and who also designated of a team of experts for the Initiative. We especially thank Professor Kraisid Tontisirin, President of Nutrition Development Foundation, Thailand; Professor Fengying Nie, Deputy Director-General, Center for International Agriculture Research of Chinese Academy of Agriculture Sciences; Professor Pongsak Angkasith, Management Board member of Royal Project Foundation and Former President of Chiangmai University, Thailand; and Professor Guoxiang Li, Rural Development Institute, The Chinese Academy of Social Sciences, China, who also presented during the Mountain Consultation and who inspired interventions to realise the potential of mountain agricultures for Zero Hunger in different contexts. We would like to thank Mountain Partnership Secretariat for their strong support for this initiative.
We also want to express our sincere gratitude to FAO colleagues in headquarters, RAP and the respective country offices throughout the birth and progress of the Mountain Agriculture initiative in RAP, including the provision of strategic guidance, the coordination and provision of technical support, organization of the Mountain Consultation, the preparation and review of the report, partnership building and communication. Special appreciation goes to SP3, SP1 and FAO Representation in China who kindly supported the development, partnership building and organization of the Mountain Consultation.

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<th>Acronyms</th>
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<td>ASEAN</td>
<td>Association of South East Asian Nations</td>
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<td>CAS</td>
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<td>CAAS</td>
<td>Chinese Academy of Agriculture Sciences</td>
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<td>CATAS</td>
<td>Chinese Academy of Tropical Agricultural Sciences</td>
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<tr>
<td>CFS</td>
<td>Committee on World Food Security</td>
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<tr>
<td>CHT</td>
<td>Chittagong Hill Tracts</td>
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<td>FAO</td>
<td>Food and Agriculture Organization</td>
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<td>FSF</td>
<td>Future Smart Food</td>
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<td>GAP</td>
<td>good agricultural practices</td>
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<td>Global Important Agricultural Heritage Systems</td>
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<td>MOCHTA</td>
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<td>NUS</td>
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<td>RI-ZH</td>
<td>Regional Initiative on Zero Hunger</td>
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<td>SDG</td>
<td>Sustainable Development Goals</td>
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<td>UIR</td>
<td>University of International Relations of China</td>
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<td>ZHC</td>
<td>Zero Hunger Challenge</td>
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Executive summary

Part I Setting the scene

Chapter 1 Introduction: mountain agriculture: opportunities for harnessing Zero Hunger in Asia, by Xuan Li, Kadambot H.M. Siddique, Mahmoud El Solh and Thomas Hofer, sets the scene and contexts of the whole publication with a focus on mountain agriculture, food security and nutrition from a Zero Hunger perspective.

This chapter sets the scene for the entire publication, which presents a regional overview on mountain agriculture development based on thematic analysis, national studies, and the set of Recommendations on developing sustainable mountain agriculture. It starts with contextualizing why mountain agriculture deserves special attention for Zero Hunger in Asia. It then demonstrates the agroclimatic distinctions between mountains and plains, which implies both challenges and opportunities for mountain agriculture. Moreover, it focuses on the opportunities that mountain agriculture can bring to achieving Zero Hunger with evidence in Asia, examining the subject from four dimensions of food security – to enhance availability, access, utilization and stability of sufficient, safe and nutritious food. Furthermore, it gives a snapshot of the International Workshop and Regional Expert Consultation on Strengthening Mountain Agriculture Development and Food Security and Nutrition Governance which was co-organized by FAO and UIR, in collaboration with various partners, to better understand the challenges and opportunities that mountain agricultures faces and offers, as well as identifying the possible entry points to turn challenges into potential opportunities.

Why does mountain agriculture deserve special attention for Zero Hunger in Asia: Firstly, mountain populations in Asia are face many challenges when it comes to food supply and malnutrition: more than 192 million mountain people in Asia were considered vulnerable to food insecurity in 2012. Secondly, mountains ranges are by no means insignificant in Asia: Asia hosts more than one-third of the world’s mountains and many Asian countries are dominated by mountains ranges. Thirdly, the livelihoods of most mountain dwellers depend heavily on agriculture in Asia with little option to derive from other sources. This means that strengthening mountain agriculture must be a priority for achieving Zero Hunger.

This chapter focuses on opportunities that mountain biodiversity offers for agriculture to achieve Zero Hunger and improve food security from its four dimensions: 1) availability, 2) access, 3) utilization and 4) stability of sufficient, safe and nutritious food. In terms of food availability, mountain agriculture has a substantial comparative advantage when it comes to increasing agricultural production of sufficient, nutritious and safe food based on the vast but underdeveloped land areas, high level of topology diversity, agro-climate specifics of mountain regions, and different growing seasons. In terms of food access, mountain agricultural production has the potential to sustain household food needs, with surplus produce that can be bartered for food or non-food items. Increasing levels of monetary income can lead to cash availability for mountain households to purchase food items and therefore make better food access possible. In terms of food utilization, which concerns the nutritional status of individuals, special and diversified mountain agroclimatic conditions enable mountain agriculture to produce a wide variety of food products to diversify diets for nutritional improvement. In terms of stability, mountain agriculture offers unique opportunities for filling the gap that results from adverse weather...
### Figure 1  The development process of the Mountain Consultation

<table>
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<th>Conceptualizing and planning</th>
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**Evidence-based policies to create an enabling environment for mountain agriculture development and food security and nutrition governance**

- **FAO RAP and UIR**  
  In collaboration with International Crops Research Institute for the Semi-Arid Tropics, International Centre for Integrated Mountain Development, Mountain Partnership and Center for International Agriculture Research of Chinese Academy of Agriculture Sciences

- **Bangladesh, Bhutan, Cambodia, India, Lao PDR, Myanmar, Nepal, Pakistan, Viet Nam**

- **Policy framework for sustainable mountain agriculture development and Strategies to enhance mountain agriculture and food security and nutrition in Asia**

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conditions, political instability or other unforeseen factors. However, considering the existing obstacles in terms of topography, climate, remoteness, etc, mountain agriculture requires much more attention in national and sub-national policies in order to bring its potential to full fruition and so improve the livelihood situation of mountain communities.

This chapter also introduces the background of the report – the International Workshop and Regional Expert Consultation on Strengthening Mountain Agriculture Development and Food Security and Nutrition Governance. (Figure 1). This was organized by FAO and UIR, together with its partners to better understand the challenges and opportunities that mountain agriculture faces and offers, as well as identifying the possible entry points to turn challenges into opportunities. Besides 8 comprehensive country studies on mountain agriculture (Chapter 9-16), the major outcomes of the International Workshop and Regional Expert Consultation event are: the Recommendations for sustainable development of mountain agriculture to enhance food security and nutrition (Chapter 17), and the Policy Framework for sustainable mountain agriculture development (Chapter 8).

In the context of the SDGs and turning the challenges of mountain agriculture into opportunities, promoting Future Smart Food (FSF) which are adapted to mountain cultivation is considered an entry point. FAO, defines Future Smart Food as Neglected and Underutilized Species (NUS) that are nutrition-dense, climate-resilient, economically-viable and locally available or adaptable. This is because mountains host approximately one-quarter of all terrestrial biodiversity and nearly half of the world’s biodiversity hotspots. But to ensure such FSF schemes thrive, government will have to take a leading role and place mountain agriculture at the centre of their national and sub-national poverty reduction, food security and nutrition policies.

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2 The country study from Cambodia is not included in this publication due to limited national data on mountain agriculture available. To access the presentation from Cambodia at the Mountain Consultation, please visit the website on Regional initiative of Zero Hunger at FAO RAP.
It is only with full government backing that mountain agriculture will achieve its potential improve the livelihood of mountain people.

This publication presents a regional overview on mountain agriculture development based on thematic analysis and national studies.

Part II Enabling environment to promote sustainable mountain agriculture development

Based on the analysis on the challenges and opportunities that mountain agriculture entail (Chapter 2), Part II navigates through multiple areas of mountain agriculture in the food systems (Chapter 3–7), to develop a policy framework for sustainable mountain agriculture (Chapter 8). In short, Part II includes seven thematic chapters on the features, challenges, opportunities, case studies and strategies related to the enabling environments required to promote sustainable mountain agricultural development from a food system perspective.

Chapter 2 The status, opportunities and challenges of mountain agriculture development to improve livelihoods and ensure food security and Zero Hunger, by Mahmoud El Solh provides a deep but broad overview of challenges and opportunities of mountain agriculture and farming to improve food security and livelihoods.

The chapter first provides a sketch of the importance of mountain ecosystems for meeting the global Sustainable Development Goal (SDG) challenges on environment, food security and livelihoods, with a highlight on mountain’s special contribution to the water-energy-food nexus. The chapter then examines mountain agriculture’s specific challenges, major production systems and added-value products. These characteristics and different categories of productions systems and products were explained in detail with reference to examples around Asia. The chapter then reviews the role of the UN and other international organizations in enhancing mountain ecosystems and agriculture. There is also a call for international cooperation to tackle the trans-boundary challenges and strengthen mountain agriculture development. A set of recommendations are also included at the end of the chapter.

One of the major difficulties in developing mountain agriculture is the vicious cycle of poverty – natural resource degradation – poverty that exists in many mountain regions. Basically, the higher the poverty level in a mountain community, the greater the exploitation of natural resources, namely soil, water and biodiversity. There are four major production systems in mountain agriculture: (1) pastoral livestock production system; (2) agro-pastoral production system; (3) rain-fed agricultural production system, including fruit trees; (4) irrigated agriculture production systems. This chapter provides detailed technical insights into the involved natural resource, socioeconomic, market and policy factors of each of the production systems with country cases. In general, mountain agriculture production systems are highly diversified and make use of integrated cropping systems in the forms of smallholder and family farming.

Access to markets is an issue in mountain agriculture due to lack of infrastructure and transportation. However, added-value products by mountain agriculture are an important and useful
way of increasing income and improving livelihoods in isolated low-income mountain communities. Added-value products in livestock-based production systems (in both pastoral and agropastoral livestock production systems) include dairy products such as yogurt and cheese produced from cow, goat and sheep’s milk. It is important to train people, particularly women, on how to produce high-quality hygienic yogurt and cheese which can fetch high market prices and increase the income of mountain communities.

Examples of successful stories of wool, walnuts, fresh mint and other Future Smart Food varieties are briefly introduced and explained.

The chapter summarizes the role of the UN agencies, FAO, Mountain Partnership, ICIMOD and other major institutions’ contribution to mountain agriculture. It calls for more collaboration and meaningful technical, policy and financial investment in mountain agriculture development. The sustainable development of mountain agriculture requires long-term investment in holistic and integrated approaches that involve policy, socio-economic and institutional aspects; natural resource management; and crop and livestock improvement. (Figure 2).

Chapter 3 The potential of Future Smart Food for mountain agriculture: nutrition, climate-resilient, economic and social benefits, by Kadambot H.M Siddique and Xuan Li, introduces the concept of Future Smart Food and explores how developing Future Smart Food in mountain agriculture can transform the mountain food systems so that they are more nutrition sensitive, climate resilient, economically viable and locally adaptable.

This chapter starts with the context of major challenges faced by mountain agriculture, challenges which will require the transformation of mountain agriculture from using staple-oriented systems to being more nutrition-sensitive and climate-smart. To show how this is possible, the chapter presents the concept and features of FSF and shows how by making use of such crops, mountain agriculture can help to meet the Zero Hunger goals. On this basis, it analyzes how to mainstream FSF and harness the opportunities they can offer mountain agriculture development, especially in terms of the entry points and government leadership.

FSF is a term used for NUS that are nutrient-dense, climate-resilient, economically viable, and locally available or adaptable. Many countries in Asia have identified the following as Future Smart Food: pulses, cowpea, taro, millets, drumstick, quinoa, buckwheat and moringa. Future Smart Food is key to agricultural diversification and play a significant role in narrowing and closing production and nutritional gaps. Led by FAO RAP since 2016, the FSF initiative has gained a wide range of national and international partners and has been received favourably by academics, policy makers and has attracted broader public attention.

The main multi-dimensional benefits that FSFs with mountain specialty offer are: (1) they are nutrient dense, rich in macronutrients and micronutrients, relative to the staple food crops of mountain populations; (2) they are climate resilient for climate change adaptability in the mountains, to enhance diversification and resilience of agroecosystems and have the ability to grow on marginal land and withstand the impact of climate change scenarios (e.g. drought, cold, increased frequency and intensity of extreme weather events); (3) FSF are economically viable, providing income opportunities for mountain populations and contributing to mountain livelihood improvement based on their higher nutritional and health value. They can also offer a higher level of safety being organic and can supplement year round incomes when grown as off-season products; (4) they are locally available or adaptable, and take into account the traditional knowledge and the cultural identity of indigenous mountain people.

But how to harness the potential of FSF for mountain agriculture development? From a food system perspective, transforming mountain agriculture and food systems so that they are more
diversified, nutrition-sensitive, climate-resilient, economically viable and locally-adaptable is the key to harnessing the potential of FSFs, particularly if they can be mainstreamed. To tap into the opportunities that FSFs offer for mountain agriculture achieving Zero Hunger, focus should be given to identifying and prioritizing FSFs with local mountain specialty in terms of (1) Prioritization: identify and prioritize FSFs with mountain specialty; (2) Production: increase production of mountain FSFs in mountain farming systems adaptable to various agro-ecological zones; (3) Processing: improve the efficiency of post-harvest and processing of FSFs with mountain specialty; (4) Marketing: promote the distribution and marketing of FSFs with mountain specialty; (5) Consumption: Increase the demand for FSFs with mountain specialty among consumers by increasing awareness and knowledge about their multi-dimensional benefits (Figure 3). Government leadership will be indispensable to this end.

Chapter 4 Integrated farming system development for mountain agriculture in Asia, by Prakash C. Tiwari, Liqun Wang, and Bhagwati Joshi provides an overview of the challenges and future development of diverse farming systems in mountains in Asia, covering all land based activities such as agronomic or field crops, horticulture, animal husbandry, poultry and fisheries. It also covers types of conservation practice and their organic and functional links.

The chapter first examines the principle Asian mountain ranges including the Hindu Kush Himalaya, the highlands of Central Asia, the plateau of Tibet and Magnolia and the uplands of Southeast Asia. It then looks at the characteristics of cropping systems in four major Asian mountain integrated farming systems. The chapter also provides analysis of the constrains and emerging threats to these integrated farming systems, as well as approaches of how mountain farming systems can be restored and developed. A section looking at the under-forestry-economy in China is included before the conclusion.

The principal mountain farming systems of Asia are as follows: (1) Himalayan Farming Systems (including a mixed crop livestock farming system, a livestock-pasture farming system and shifting cultivation); (2) Upland Intensive Mixed Farming Systems; (3) Highland Extensive Mixed Farming System; and (4) a Pastoral Farming System. The mountain regions of Asia therefore provide some of the best examples of integrated mountain farming systems.

However, over recent years, the values of traditional mountain farming systems have eroded mainly due to population growth, rapid urbanization, depletion of the natural resource base, economic globalization, market influences and the effects of climate change. However, capitalizing upon both the sociocultural and biophysical strength of the mountain landscape, integrated farming systems have the potential to contribute significantly towards attaining food and nutrition security as well as securing improved and viable livelihood opportunities for mountain communities. The potential of agroclimatic diversity in mountain areas ranging from productive valleys to higher elevation can be optimally utilized for the diversification and integration of agronomic or field crops, livestock farming, horticulture, floriculture, dairying, fishing, bee-keeping and forestry at watershed level. The development of value-addition products would be necessary for ensuring the sustainability of the entire integrated mountain production system in mountain areas.

This chapter also includes a case study on Under-Forestry Economy (UFE) in China. The development of UFE contributes to the
improvement of farmers’ income and rural livelihoods by increasing productivity and profitability of the systems. The related research and assessment results show that the development of the UFE can enhance the income growth of farmers, especially the income growth of low- and middle-income farmers, which means that this integrating practice plays a significant role not only in addressing hunger and malnutrition in poor hill and mountain areas, but also in promoting rural development. Moreover, the development of UFE plays a positive role in protecting the ecological environment and in forming into a multilevel green activity on the landscape through protection of forest resources. Government leadership and choosing the suitable development model is crucial in this success. In addition, integration of the different sectors of mountain economy with local agricultural production systems, the flow of credit to rural areas, and increased investment in mountain agricultural enterprises will help in making all types of mountain farming systems economically viable and ecologically sustainable.

Chapter 5 Sustainable mountain agriculture through integrated and science-based watershed management: a case study, by Suhas P. Wani and Dinesh K. Marothia is a technical contribution on how an integrated watershed management of mountain agriculture can tackle the traditional problems that mountain agriculture has faced, and provide accessible solutions for mountain populations to increase their food security and income levels while retaining their social traditions and respecting the natural resources and ecosystems of mountains.

The chapter first introduces the concept and benefits of participatory, integrated and consortium approaches for watershed management, which could enhance productivity and resilience, improve water budgeting and management strategy. The chapter showcases these advantages through a case study in Lucheba watershed in China. The historical context, cropping systems and forage production and animal-based livelihoods of the Lucheba watershed are included in the study. Special analysis is given to the input utilization, output and income patterns in crop production, emerging market patterns and employment as well as income from farm and non-farm activities. The chapter concludes with key factors that can ensure a successful integrated watershed management and value chain approach.

An integrated watershed management approach provides an entry point for improving food security and livelihoods in mountainous areas. Such an approach also helps to address the issues of sustainable environmental services and climate change and helps to build the resilience of food systems. FSF, which are climate resilient, locally grown, nutritious and ecologically sound, can also help meet the Zero Hunger target. The 50 million tourists who visit mountain regions annually are also a potential way of popularizing FSF and creating extra income and investment for local people.

The case study of the Lucheba watershed in Guizhou Province in southern China clearly illustrates the benefits of adopting a holistic, integrated watershed management approach to improving farmers’ income and achieving better food security. In addition, the approach has helped to develop water resources through catchment management and by reducing water scarcity during dry periods. The watershed management approach has created net present value (NPV) of USD 14.7 million over 10 years with an investment of USD 4.5 million by increasing cropping intensity to 300 percent and creating new links with markets.

Thanks to the increased income from agriculture, most houses in Lucheba are newly constructed with concrete and have the sort of amenities that were, until recently, only seen in urban areas. Farmers now work more collectively having formed a Farmers Association and through the use of new technologies, such as the Internet, they are able to sell vegetables in markets further afield, such as Shanghai and Hong Kong. Per capita income in Lucheba village increased from CNY 6 800 per year in 2011 to CNY 8 100 per year in 2012, which was
twice the provincial per capita income. The many impacts of integrated watershed management at Lucheba will be looked at in more detail throughout this chapter, not only in social terms but also in relation to the environment, the economy and the region’s food security.

Chapter 6 Integrated value-chain development of mountain products for poverty reduction and Zero Hunger by Surendra R Joshi, Michelle Geringer and Bingchuan Hu utilized the approach of integrated value-chain development and applied it to mountain development based on mountain region’s advantages of diversification and value-added products.

The chapter first examines the mountain context and key issues before it moves to introducing high value mountain products, the market opportunities they offer and the many challenges in developing mountain agriculture. The chapter then introduces the integrated value chain development approach as the most effective way of improving mountain food security and building resilient communities in mountain regions. Case studies about the e-commerce development of agricultural products in China, large cardamom pods value chain development in Nepal and the Mountain Partnership Products Initiative (MPP Initiative) are presented to conclude that mountain products have a key role to play in sustainable food systems and improving livelihoods. Not only do they contribute to food security and sustainable food diets, but they are also a means of improving local economies, livelihoods, preserving agrobiodiversity and mountain peoples’ diverse heritage.

For centuries, mountain communities have tapped into their natural resources and built expertise to produce high-quality and unique products such as coffee, cheese, grains, herbs, medicinal plants and spices as well as handicrafts. While small-scale mountain agriculture cannot compete with the volume of lowland production, it can focus on diversification and has the potential to tap into mountain specialty products markets such as organic, fair trade or high-end quality markets and in doing so, fetch premium prices. All evidence shows that high value products can contribute greatly to the economy of mountain areas.

Considering that mountain agriculture is highly diverse, small-scale and inherently green, the MPP Initiative and other organizations such as the ICIMOD strive to create demand for high-quality traditional mountain products, harness comparative advantages and create fair incentives/compensation for mountain farmers, particularly for women, who are often left to manage the farms and households when men migrate to lowland areas in search of additional sources of income. An increased demand for traditional mountain products can increase their income through trade and manufacturing.

The integrated value-chain development approach is a market driven systems approach, which focuses on linking households and/or communities to growing markets, so that they can earn income to purchase additional food while reducing the risks that come with relying solely on their own production. This will be done by striking the balance between improving productivity while ensuring market functionality and sustainability. It emphasizes specific opportunities (e.g. the comparative and competitive advantages of mountain products and services) and challenges to achieving sustainable and inclusive growth.

Within the integrated value-chain development, E-commerce is gaining popularity as a tool for marketing agricultural products in many countries. For example, in China there are some innovative e-commerce models such as “social e-commerce”, and Tik Tok – a media app for creating and sharing short videos – that have brought many positive effects, which include responsible production, environmental protection and sustainable development. Other successful case studies are the large cardamom pods in Nepal related in the ICIMOD Himalica Programme and MPP’s Jumla’s mixed beans story. They have demonstrated that an integrated value-chain development approach can contribute to reducing poverty and contribute
to Zero Hunger, thereby creating shared value through strengthening producers and their groups and organizations to acquire agricultural inputs collectively at lower prices, and helping them to add value and commercialize their products.

Chapter 7 Global Important Agricultural Heritage Systems (GIAHS) and their role in integrated mountain agricultural development, by Qingwen Min, Heyao Li and Lubin Ding illustrates how GIAHS can turn the potential of mountain agriculture into tangible benefits for farmers' food security, cultural traditions and income, as well as offer benefits to the environment.

The chapter first introduces the concept and multi-functionality of GIAHS. It looks at mountainous areas with intensive GIAHS or potential sites. After describing traditional and ingenious agricultural practices in mountainous areas, the chapter introduces three mountain GIAHS sites in China with their key agricultural functions, value-added products, contribution to ecosystems and environment as well as cultural importance. The case studies also highlight the importance of good governance and participation of multi-stakeholders. The chapter concludes with GIAHS’s contribution to Zero Hunger and poverty reduction that they can achieve economic development through the development of multi-functional agriculture, extended value chain, and multi-participation benefit sharing mechanism.

As well as a comprehensive list, the chapter shows that although mountains are considered marginal land and unsuitable for modern commercial farming, among the designated GIAHS sites for the whole world, 60 percent of them are in mountainous areas, and the proportion remains the same for China. It shows that mountain agriculture has great potential for ecosystem preservation and that mountain areas are hubs for plant diversity, cultural diversity and economic potential.

The chapter highlighted case studies in China with evidences from Honghe Hani Rice Terraces Systems; Congjiang Dong's Rice Fish Duck System; and Shaoxing Kuaijijshan Ancient Chinese Torreya. For instance, in the Honghe Hani Rice Terraces System, there are 195 varieties of rice used in the area, including 48 kinds of local rice varieties. The local government pays great attention to the protection and utilization of traditional food crops, and through the establishment of germplasm resources and the promotion of marketization of red rice and purple rice, to achieve the goal of protection and poverty alleviation.

GIAHS are not only rich in resources, but also have a brand advantage. Studies have shown that the pollution-free environment of the GIAHS is suitable for the development of organic production. Endemic plant and animal varieties with the GIAHS brand have higher market value than general varieties. For example, red rice grown in the Hani Rice Terraces System is labeled with national geographical indications and is used as a raw material to manufacture distinctive ecological products. Agricultural organic certification, based on traditional environmentally friendly technology, increases farmer income and encourages traditional agricultural techniques and preserves cultural heritage. In addition, GIAHS area farmers can benefit from tourists who often like to buy local agricultural products when visiting and taking part in tourist activities. The sustainable agriculture in GIAHS sites relies on traditional methods of production, which keeps and improves local biodiversity and develops production and processing of high quality traditional local products, rural tourism and handicrafts.

The designation and conservation of GIAHS is conductive to the recognition and activation of local governments to adopt laws, policies, documents to guarantee and accelerate the dynamic conservation and sustainable development of GIAHS sites. The government’s leadership in creating an enabling environment is essential to make sure that the five key elements of the mountain heritage system (forests villages, terraces, water and culture) are developed in balance. In addition, the designation and conservation of GIAHS is also a process of
multi-participation and coordination. The participation of multi-stakeholders helps to optimize the value distribution and construction of value chains, motivate all players and can create new points of growth and promote the value-addition of the GIAHS sites.

Chapter 8 Strengthening the governance of mountain agriculture and food security and nutrition – An analysis of survey on mountain agriculture in Asia, by Xuan Li and Luis Antonio T. Hualda presents the FAO survey on mountain agriculture and its analysis, results and governance implications. It emphasizes the need to develop a policy framework for mountain agriculture development based on food systems and a value chain approach with guiding principles, and highlights the responsibility of the Government to create an enabling environment for sustainable mountain agriculture development.

This chapter first recognizes that while challenges and potentials co-exist in the mountains, it requires in-depth understanding of the multi-dimensional constraints for mountain agriculture at a country level. It then gives the background about the survey conducted on mountain agriculture in Asian countries, i.e. Bangladesh, Bhutan, Cambodia, India, Lao PDR, Myanmar, Nepal, Pakistan and Viet Nam. The chapter then goes on to present the analysis and results of the survey in terms of the main constraints in biophysical-technical, socio-economic, policy and institutional dimensions. It further presents the results of suggested solutions to address these multi-dimensional constraints facing sustainable mountain agriculture development. On this basis, a policy framework is suggested to rationalize strategies and priorities for sustainable mountain agriculture development.

The survey shows the results of the four-dimensional constraints. In terms of biophysical-technical constraints, “seasonal hazards” and “poor infrastructure” are identified as most important challenges. In terms of socio-economic constraints, “lack of market information” and “poor access to telecommunications” are identified as most important challenges, followed by “isolation and lack of market access/transport network”. In terms of policy constraints, “lack of information and policy support on mountain specialty products” are identified as main challenges. In terms of institutional constraints, “lack of organized institutional support to connect value chain components namely production, processing, marketing and consumption for mountain regions” is identified as most important issue. In short, constraints that were given priority by respondents were those relating to the development of mountain specialty products and to improving opportunities to link with markets.

The survey emphasized that to address multi-dimensional constraints on mountain agriculture development, the most important issues were related to mountain products and market development. Based on the suggested solutions, developing markets for mountain specialty products may be considered as main strategy or “driver” for strengthening sustainable mountain agriculture development. Other identified issues and constraints are linked to product and market development.

To turn challenges into opportunities in mountain areas, it requires multi-dimensional interventions that are rationalized and coordinated through a “driver” strategy to address challenges in mountain areas. From a food system and value chain perspective, the priority should be given to focus on mountain specialty products (e.g. FSF with mountain specialty) with respect to identification, production, post-harvest handling, marketing and consumption. In short, identifying/prioritizing mountain specialty products is a starting point, but emphasis should be given to each stage of the food system and value chain to build strong connectivity between the stages and to bridge gaps between mountains and markets.

To create an enabling environment to turn challenges into opportunities in mountain areas, a policy framework should be established and
developed for mountain agriculture development based on food systems and a value chain approach with guiding principles (Figure 4). It is the government’s responsibility to create an enabling environment conducive to mountain agriculture development. Governments support, especially local governments, is essential for turning these challenges into opportunities, by organizing and mobilizing resources to tap into opportunities and generate outcomes conducive to local development in mountain areas.

Part III Country studies on mountain agriculture development

(Chapter 9 through Chapter 16) includes eight Country Studies on Mountain Agriculture Development (Bhutan, Nepal, Myanmar, Vietnam, Lao PDR, India, Pakistan and Bangladesh) (Figure 4). The country studies cover efforts made by national governments and includes input from diverse mountain communities and the public and private sector. The studies also look at integrated farming systems that use innovative new methods that can be specifically tailored to local contexts and conditions. Each of the country studies include five sections: (1) an overview of food security and mountain characteristics and the contributions/percentage of mountain agriculture in the country; (2) the status, challenges and constraints of mountain agriculture; (3) opportunities and entry points for mountain agriculture development to address Zero Hunger and poverty reduction (food systems perspectives covering production, agroprocessing, marketing and consumption); (4) the country experience: main policies measures, initiatives and practices in mountain agriculture development; (5) Strategic consideration and suggestions: policies and measures, governance promoting sustainable agriculture development in mountain areas; and (5) conclusion.
Chapter 9 Bangladesh, by Prakash Kanti Chowdhury presents the mountain agriculture challenges, opportunities and policy entry points of the Chittagong Hill Tracts (CHTs) which cover almost one-tenth of the whole country and are one of the most economically backwards regions of the country, with one of the highest malnutrition levels in the world. The lean season occurs from May to August; however, due to the high risk of natural hazards during the monsoon, it often extends into September. Each year it is more difficult for people to cope with the lean season, as food stocks from the previous harvest are limited, employment opportunities are few and purchasing power is low.

In terms of agriculture in the CHTs, the hills offer vast scope for the cultivation of a diverse mix of crops – cereals, pulses, oilseeds, vegetables, flowers and fruits. In addition, animal husbandry is an integral part of local farming systems. The temperature and climatic conditions support the growth of certain fruits and vegetable crops that cannot be cultivated in the plains and the produce provides higher dividends to cultivators in the hills thereby raising their economic status. One of the major challenges are land rights. Much of the land of indigenous people is unregistered and liable to be lost to immigrants, particularly where road networks are developed; the insecurity of tenure reduces the incentive for medium- to long-term investments, such as horticulture or timber. Instead, short-term investments in seasonal crops are promoted, which do not provide high incomes for households and are not environmentally beneficial.

Sustainable agriculture development in the mountains can be supported by enabling policy and institutional reforms, promoting mountain niche products like fruits, ensuring tenurial security, generating integrated demand driven technology and service delivery, enhancing access to production assets and resources, credit and markets, and capacity building of farmers with strategic considerations of mountain specificities.
biophysical and socio-economic conditions and livelihood options of mountain people. The Ministry of Chittagong Hill Tracts Affairs (MOCHTA) is responsible for the planning, implementation, and monitoring of development programmes and projects in the CHT. However, the sectoral approach of line ministries and the fragmented work of different non-governmental organizations often leads to overlap and fails to produce the desired development outcomes. To ensure that development activities are more effective and sustainable, and to avoid duplication, MOCHTA should be entrusted with the full responsibility of coordinating development work in the CHT.

Chapter 10 Bhutan, by Kiran Subedi, Sangay Chophel and Loday Phuntsho highlights that Bhutan, as a landlocked mountain country, is known for its strict environmental conservation policies, with a constitutional mandate to maintain at least 60 percent forest coverage. Bhutan faces food insecurity and malnutrition challenges. The National Nutrition Survey of 2015 reported that children under 5 years old 21.2 percent were stunted, the prevalence of wasting was 4.3 percent, 9 percent were underweight and 2 percent were overweight. The same survey found that the prevalence of anaemia was 43.8 percent for children aged 6 to 59 months, 31.3 percent for children and youth aged 10–19 years, 34.9 percent for non-pregnant women aged 15–49 years, 27.3 percent for pregnant women, and 7.8 percent for babies who had low birth weights.

Bhutanese agriculture is largely based on the traditional subsistence-oriented mixed farming system that integrates cropping, livestock rearing and forest products. Rice is the staple crop. Domestic production accounts for half of the rice requirement. The population, particularly the poor, consume maize and other minor cereals such as millets and buckwheat to supplement their carbohydrate requirement. The principal cash crops in temperate areas include apples and potatoes, and in the sub-tropics, oranges, areca nut, cardamom and ginger are grown. Chilies and vegetables are other promising sources of revenue. Over one-third of Bhutanese households grow fruit, such as apples, oranges, peach, plum, persimmon, pear, banana and mango; and nuts, such as walnut hazelnut and betel nut. Domesticated animals include cattle, goat, sheep, poultry and pigs. There are also fisheries. With abundant forests, farmers derive benefits including wild edible mushrooms, bamboo and cane, fern and fuelwood (NSB, 2015).

The mountainous terrain and scattered settlements of Bhutan make agro-processing and value addition cumbersome and the transport of raw materials is expensive and produce can spoil due to roadblock delays. Setting up small-scale facilities will allow local produce to be sold within local regions. Most agricultural and livestock products are sold in raw form, so there is immense opportunity for value addition. The farm shops (government subsidized outlets for supply of farm inputs, groceries and last resort markets for farm produce) offer a buy-back mechanism to cushion farmers against price drops and market gluts. This mechanism needs fine-tuning. The initiative of One Geog (Sub-district) – One Product needs further investment especially in value addition, branding and marketing. Another successful country experience is the Good agricultural practices (GAP) on sustainable and integrated farming in mountain areas. Restrictions on the use of chemicals have helped to promote GAP in agriculture. Bio inputs need to be promoted. The conservation of traditional crop varieties and livestock breeds must continue. Sustainable land management practices must continue and expand.

Mountain agriculture has a unique set of challenges. Considering the limited area of cultivation in the Bhutanese mountains, vertical expansion in terms of productivity gains through agro-ecological intervention and sustainable practices will help to enhance food and nutrition security. Policies geared towards empowering the farming community need to be formulated and implemented. Bhutan’s pristine environment and natural way of farming, coupled with support for enterprise farming, offer immense opportunities for making farming a profitable venture and a successful way of addressing poverty.
Chapter 11 India, by Parshant Bakshi and Dinesh Kumar write that mountain agriculture in India is widespread and varied and despite facing disproportional challenges compared to other agro-ecological regions. The chapter showcases highly promising success stories about crops such as strawberry, sea buckthorn and cardamom as well as agroforestry systems that can increase the countries production of FSF while simultaneously protecting the country’s resource base.

India has seven major mountain ranges with different characteristics, challenges and opportunities. Among these, the eastern extension of the Himalayas, the Purvanchal Range, is one of the wettest places on earth, and the Western Ghats constitute one of the globe’s top ten biodiversity hotspots. However, due to their undulating topography, India’s seven mountain ranges face immense challenges to develop their potential to produce Future Smart Food and simultaneously protect the resource base of the easily eroded soil and increasingly overexploited water resources.

The government has initiated a myriad of regionally targeted initiatives to encourage livelihoods based on the production of FSF in these challenging environments. Among these, strawberry farming has shown to increase farmers income by up to 25 times compared to production systems prior to intensification. Similarly, cardamom agroforestry systems have become a mainstay of Sikkim’s smallholders, supporting many livelihoods while maintaining a healthy forest environment. Lastly, sea-buckthorn production has become a mainstay of many farmers in Ladakh, a success that is showcased by the rising popularity of the Leh Berry brand that is marketing sea-buckthorn juice across the country.

The authors conclude that these success stories should encourage further investments in mountain agriculture with a special focus on the integration of different agricultural sectors such as forestry, livestock and crop production as well as more promote research into harnessing and protecting the natural resource base in a sustainable manner as water scarcity concerns continue to rise.

Chapter 12 Lao PDR, by Bounthanh Keoboualapha shares the experiences of how Lao PDR is developing mountain agriculture for Zero Hunger and how the nation is tackling common mountain challenges with country-specific tactics. Lao PDR is noted as having the highest percentage of steepeland in the Asia and Pacific region with rich ethnic diversities. The chapter also notes that children in rural villages in the northern and southern mountain regions are more likely to be malnourished than those living in plains and urban areas and the central region. The poverty headcount rate in 2013 for the mountains (midland and upland) is high at 28 percent, which is higher than the national average of 23.2 percent. And, while poverty rates in the mountains have declined faster than the country’s average (around 12.1 percent vs. 10.3 percent), mountain poverty is still prevalent.

Diversification is crucial and a key measure in building nutrition level as well as resilience to climate risks. Some forms of traditional farming systems, like shifting cultivation, are highly resilient to a range of shocks and vulnerabilities influenced by external factors. Linking farmers with nutritious food, food safety, value-addition, and quality of life for food security requires “Good Agricultural Practices” (GAPs). In Lao PDR, GAPs are widely promoted to produce safe food, while conserving the environment and increasing the income of farmers. For instance, in the Huaphan province in Northern Lao PDR, benzoin production from indigenous trees were supported by the government to increase cash income for mountain communities. The blend of indigenous technical knowledge and modern tree planting techniques to produce an export product with a ready market is increasingly attractive to farmers. They also benefit from technical assistance related to value-added processing at the family and community levels.

Socio-economic development for agricultural diversification and intensification with increased production and productivity, improved value-addition, and expanded marketing and sales
has occurred in the flatlands along the Mekong corridor. The upland mountains have not benefited as expected despite the abundant agricultural production base and rich natural resource endowments which offer great potential for agricultural diversification and intensification. In rural mountainous areas, acute poverty, chronic malnutrition and natural resource degradation are still prevalent. Rural development addressing the current poverty and malnutrition rate to end poverty and achieve Zero Hunger would require more targeted, multi-sectoral and interdisciplinary efforts in terms of research and development, and monitoring and evaluation. The supports from development partners will be crucial as Lao PDR has committed to graduate from the Least Developed Country status by 2020 and mountain agriculture can help the nation achieve this aim.

Chapter 13 Myanmar, by Sai Than Aung introduces mountain agriculture in Myanmar and the importance of using the nation’s ecosystem service to develop diversified value-added products to increase food security and boost the rural population’s income. The mountain regions of Myanmar are found in five states namely Kachin, Kayah, Kayin, Chin and Shan. This region has a population of about 6.5 million, with the majority living in the Shan State. There are 118 ethnic groups in the mountain region. Most farmers cultivate a wide range of rainfed tree crops and horticulture products along with rice, maize and pulses. Sadly, according to the Myanmar Poverty and Living Condition Survey (MPLCS) 2017 conducted by the World Bank, poverty rates in mountain regions were higher than national poverty rate. Human resource development and economic reform implementations are also insufficient in Myanmar’s mountain region.

Tackling poverty and food insecurity in Myanmar means realizing the huge potential of mountain regions when it comes agricultural diversification and sustainable intensification. This means diversifying crops and moving from staple production to systems that mix crops with Future Smart Foods and shifting from monoculture to diversified and integrated farming systems, animal production and grazing systems, conservation agriculture, etc. Myanmar government has taken on the global GAP and ASEAN GAP initiative to provide protocols and guidelines for some of these unique products in mountains, for instance, the GAP farming and certification are in place for mango, avocado, coffee, tea and sesame in both Shan and Kayah states.

The vision for Myanmar agricultural development in 2030 is to have “an inclusive, competitive, food and nutrition secure and sustainable agricultural system that contributes to the socio-economic wellbeing of farmers and rural people and the further development of the national economy”. Mountain agriculture is going to be a vital part of the country’s farming systems and will require special attention and innovative intervention if Myanmar is to reach its SDG2. Agriculture in Myanmar has changed greatly over recent years, moving from subsistence to commercial farming in some mountain areas, where accessibility and market facilities have improved. But most areas still rely on traditional farming practices for their livelihood. Further economic opportunities certainly exist as most of the mountain region is located on the strategic Asian highway network. Factors such as good communications, transportation and trade policy and the future of ASEAN +3 will further affect farming, so there needs to be a drive to ensure that there are no undesirable impacts on the environment or overuse of resources.

Although Myanmar has some success stories in terms of mountain agriculture, many challenges and constraints remain. There needs to be greater awareness about the role and importance of mountain agriculture among public and all stakeholders. Systematic survey, assessments, plans, programmes, projects, action plans and activities need to be formulated in conjunction with international communities, institutions and development partners, based on the framework of Myanmar Agricultural Development Strategies. To embark on this economic opportunity, Myanmar needs to prepare for the future of mountain agriculture and actively participate with international institutions and entities.
Chapter 14 Nepal, by Rabindra Subedi and Manoj Kumar Yadav shows that Nepal’s Agriculture Development Strategy and the Prime Ministers Agriculture Modernization Plan are promising efforts to revitalize food insecure and poverty stricken mountain areas of Nepal through improved production and processing of future smart foods such as finger millet, buckwheat, fruits (e.g. apple, walnut, almond, and peach), vegetables (e.g. cabbage, cauliflower, carrot, and radish) and medicinal and aromatic plants.

Mountainous regions comprise more than 75 percent of the country and host a large but decreasing part of the population. Migration rates to urban areas, the flat and economically dynamic Terai region or other countries are increasing as a response to high poverty and levels of food insecurity levels in these areas as well as the insufficient infrastructural connectivity to the wider economy. In response to these trends the Government of Nepal is investing in targeted efforts to support agriculture-based livelihoods through a range of initiatives.

These initiatives address multiple constraints including establishing more decentralized food processing centres to provide timely market information and value addition in the mountain regions, promoting conservation agriculture to combat soil erosion and fertility loss, and improving general institutional and governance frameworks to support all of the population in establishing mountain agriculture based livelihoods. For example, the Prime Minister’s Agriculture Modernization Plan declared crop specific development zones in more than 10 mountain district covering more than 500 ha.

The authors conclude that Nepal has initiated ambitious policies to achieve the Zero Hunger target and reach national food self-sufficiency. Their success will depend on continuous efforts to follow through with these ambitions through cooperation and coordination between all three levels of the Government of Nepal.

Chapter 15 Pakistan, by Umar Farooq and Abdul Wahid Jasra raises the importance of developing mountain agriculture in Pakistan and realizing the goal of “capitalizing the potential of mountain agro-ecological zones” in Pakistan’s National Food Security Policy. In Pakistan, more than three-fifths of the total geographical area consists of mountains and rangelands that accommodate more than 50 million people. Most of the rangelands are degraded due to increasing pressure from human and livestock populations coupled with frequent droughts. The fragile mountain ecosystems suffer from degradation of vegetative cover, deterioration of soil, and reduced livestock productivity, which has further impoverished pastoral communities.

However, the contribution of mountainous regions and rangelands to livestock production and high-value agricultural commodities in Pakistan cannot be ignored.

The contribution of mountainous regions to the production of high-value agricultural commodities in Pakistan cannot be ignored. These high-value agricultural commodities, i.e. fruits, vegetables, nuts and animal-based products, can be harnessed by adopting cluster-based value chain approach. However, there is a lack of efficient marketing links, market information and infrastructure required for cluster-based value chain development. Institutional support is available for mountain communities, but most of these institutions operate in isolation or are confined to small pockets that are inaccessible to most. Provincial rural support programmes, which endeavour to connect with mountain farmers, have not had significant impact. In order to rejuvenate and improve farming in mountainous areas, a multi-dimensional approach with institutional collaboration is needed.

In Pakistan, sustainable development of mountainous agriculture requires a long-term investment in a comprehensive and integrated approach involving policy, socio-economic and institutional aspects, as well as governance, natural resource management and crop–livestock
improvement. At the same time, it is important to holistically address the environmental, economic, social, cultural, and political issues to ensure the sustainable development of mountain agriculture. Several suggestions have been put forward to address these aspects for policy planners, development practitioners, R&D organizations, civil society organizations, and social networks working in and for these areas.

Chapter 16 Viet Nam, by Luu Ngoc Quyen, Le Huu Huan, Nguyen Thi Thanh Hai and Le Khai Hoan explains how Viet Nam develops its mountainous regions and the Northern midland, the core region for socio-ecosystem diversity and accounts for almost 30 percent of the country. Around 85 percent of the area has sloping land with many high mountain ranges integrated with valleys, from the highest mountain (Fansipan at 3,142 m) to the Hoa Binh Valley (20 to 30 m above sea level). This topography creates diverse climates with forest vegetation and crops adapted to different elevations. In terms of mountain population, it is also a highly-diversified region, including 30 ethnic groups with their own cultural characteristics and farming practices. Interestingly, the Northern Midland and mountainous region have experienced significantly faster GDP growth than the country overall. This can be explained by the country’s policy attention to these regions, as well as the unique benefits that mountain agriculture can bring to Viet Nam’s economic development and food security.

The diversity of topography, slope, climate and farming practices in the mountainous areas supports a range of farming systems, which can be grouped by slope and elevation. Food crops such as rice, maize and cassava are important for food security. However, the main niche product is tea. In particular, high altitude areas with a suitable chilling temperature are very good for high-quality Shan tea varieties. Fruit trees also have been increasingly used to take advantage of the diverse natural conditions, especially temperate fruit trees that can generate significant income to the local farmers. More importantly, the large forest areas in the mountainous regions provide sustainable exploitation of the forest using a series of agroforestry models. Conservation agriculture, such as mulching, minimum tillage and intercropping with legumes, are other options for protecting the environment and controlling soil erosion. Such systems will need crops adapted to and suitable for the local conditions that could also contribute to a more nutritious diet, e.g. FSF.

The Viet Nam government has explored different options to manage these challenges and provided value-added measures and activities for mountain specialty products. Models of cooperative chain organization associated with processing and consumption have been beneficial for the region. Typically, enterprises and production households are linked through purchase contracts. In short, the Northern Midland and Mountainous region of Viet Nam plays an important role in national security and environmental protection. Socio-economic development in the region promotes natural resource conservation and the sustainable development of Viet Nam. To achieve Zero Hunger in time, the region needs further support to target market-driven agricultural production, build links between producers and enterprises, develop value chains for mountain specialty products, integrate agriculture with tourism, and create jobs.
Part IV Conclusions, recommendations and the way forward

Chapter 17 Conclusions, recommendations and the way forward for the sustainable development of mountain agriculture to enhance food security and nutrition, by Mahmoud El Solh, Kadambot H.M. Siddique and Xuan Li presents conclusions of this publication, that includes the recommendations, mountain agriculture’s implications for food security and nutrition governance and the way forward.

Recommendations

To address the various challenges facing mountain ecosystems and agriculture, the International Workshop and Regional Expert Consultation event offered a set of policy and programming recommendations for the sustainable development of mountain agriculture to enhance food security and nutrition governance in Asia and contribute to the Zero Hunger initiative. The Workshop and Regional Expert Consultation event offered various approaches/modalities for the way forward for sustainable mountain agriculture development to enhance food security, nutrition governance, and improve livelihoods in the region. This will contribute to the eradication of poverty and hunger, which are global and regional priorities as specified in SDG 1 and SDG 2. It is, therefore, an essential component of the FAO Regional Initiative on Zero Hunger, based on country needs, regional priorities, and all Strategic Programmes. It is important to fulfill the strong desire of countries for knowledge sharing and lessons learned at the regional level to promote sustainable mountain agriculture in practice for enhancing food security and nutrition in mountain areas to contribute to Zero Hunger and poverty reduction.

The Workshop and the Expert Consultation concluded their deliberations with the following recommendations that need to be implemented at the national and regional level to contribute to the sustainable development of mountain ecosystems and agriculture (Figure 5).

1 Policy, socioeconomic and institutional support

The Workshop participants emphasized the importance of developing an enabling policy environment by considering the socioeconomic conditions of mountain people, the challenges facing both mountain ecosystems and agriculture, and the institutional support required for its sustainable development. The following are specific recommendations for consideration and implementation by countries to develop an enabling policy environment and institutional support:

- Develop and implement policies, strategies and programmes to address challenges, including the socioeconomic and ecosystem-based challenges facing different farming systems and zones of sustainable mountain agriculture development.
- Increase attention to risk management and develop policies for prevention, mitigation and relief to cope with natural disasters.
- Strengthen existing and establish new national institutions to provide public services, including extension and microcredit to support the development of sustainable mountain agriculture.
- Involve representatives of mountain communities in decision-making, policy development and implementation as well as in initiatives that support the development of sustainable mountain agriculture.
- Increase the enabling environment for land tenure to consolidate land holdings to ensure investment in long-term appropriate land management. Attention needs to be paid to developing farmers’ cooperatives to transfer subsistence agriculture to commercial agriculture for agricultural productivity and income.
- Develop infrastructure in mountain areas to support agricultural development and improve.
- Increase the levels of investment and financial support for the sustainable development of mountain agriculture at national, regional and international levels.
Increase the resilience of mountain farmers and small agro-industrial enterprises by linking them with markets and providing subsidies to add value to mountain products, especially FSF as well as other non-food products, to diversify the incomes of mountain communities, particularly the incomes of women.

Establish a mountain agriculture fund and funding mechanism for both replenishment and support of agricultural services, activities, and value-added products in mountainous areas.

2 Natural resource management
The Workshop participants emphasized the importance of halting and reversing the degradation and unsustainable use of natural resources including water, soil and biodiversity in mountain ecosystems. The following recommendations need to be considered and implemented in this regard:

- Promote the conservation and sustainable use of natural resources of regional and global importance which are also important to mountainous areas: natural resources, water, biodiversity, soil, natural pastures and forests.
- Ensure the adaptation and mitigation of measures to cope with natural hazards as a result of climate change and their pressure on natural resources.
- Prevent land degradation and build up soil fertility through using different types of terracing for efficient farming. Planting along contour lines for better water catchment and the reduction of erosion.
- Diversify cropping systems (including legumes), use mixed and intercropping techniques.
- Promote conservation agriculture, zero tillage and crop rotation.
- Conserve water resources and develop rainwater harvesting through both macro- and micro-watercatchments to conserve water in soil and use irrigation to mitigate and cope with long periods of drought.
- Promote environmentally friendly and ecological practices including biofertilizers and biopesticides to reduce pollution.
- Halt and even reverse the reduction of biodiversity and prevent excessive grazing of livestock as well as emphasize the sustainable use of biodiversity.
- Promote the agroforestry landscape model by growing forage shrubs that reduce the pressure of grazing on rangelands and natural pastures.

3 Crop and livestock improvement and integration
The improvement of crops and livestock production is a precondition for enhancing food production and, ultimately, food security and nutrition. The following recommendations need to be considered by policymakers, researchers, extension workers, farmers and producers involved in mountain ecosystems and agriculture:

- Ensure the development of integrated livestock/crop/rangeland farming systems for effective utilization of natural resources.
- Develop improved crop varieties adapted to the diverse mountain environments and climate change, including NUS that have great potential as commercial FSF.
- Promote the cultivation of traditional crop varieties such as FSF and highlight the crucial role of mountain people as custodians of these varieties.
- Establish livestock community breeding with herders and pastoralists whereby unproductive animals are culled and productive animals are retained to improve livestock populations and herds.
Diversify agriculture production and encourage the production of high-value crops, including fruit trees, vegetable and ornamentals as well as value-added products in both crop and livestock production to improve nutrition, income and livelihoods.

Promote protected agriculture (mulch, row covers, shade structures, greenhouses, etc.) to intensify the production of high-value crops and increase water use and production efficiencies per unit area in mountain agriculture.

4 Research, technology transfer and capacity development

The Workshop participants emphasized the critical importance of making improved technologies and technical know-how available to mountain farmers and producers to bridge the gap between current low productivity and its full potential. This is feasible through the strengthening of specialized well-targeted research in mountain agriculture and the extension of efficient technology transfer to enhance the capacity development of human resources and institutions. The following recommendations address this area:

- Increase the long-term investment of research programmes in national research institutions and universities to enhance capacity and address the specific challenges facing the sustainable development of mountain agriculture.
- Develop and modernize extension institutions that specialize in transfer technologies and technical know-how to mountain farmers and agriculture producers through efficient approaches and make use of the tools and facilities already developed through the revolution in information technology, such as audiovisual aids (e.g., TV programmes) and mobile phones.
- Develop and support capacity building (mountain agriculture curriculum and web-based technology in relevant universities) and extension targeting different stakeholders, including farmers’ programmes to promote the sustainable development of mountain agriculture.
- Establish farmer and pastoralist field schools and women empowerment programmes to transfer/exchange technologies and skills to address the challenges facing these important stakeholders.
- Develop and implement communication programmes and audiovisual aids to promote advanced technologies and knowledge on the development of sustainable mountain agriculture.
- Make use of International Mountain Day on 11 December to organize events and workshops to promote the sustainable development of mountain agriculture.

5 Regional and international cooperation

The challenges and problems facing mountain ecosystems and agriculture are often complex, transboundary and difficult to resolve by a single country or institution. A good example is the challenges and problems of transboundary mountain ecosystems and river basins that originate from mountain areas. Therefore, intercountry regional cooperation should be established in areas of common interest, and the following recommendations need to be implemented at the regional or sub-regional level:

- Strengthen and develop South–South cooperation at the regional level in countries where mountain ecosystems and agriculture constitute a substantial part of the country’s agro-ecologies. This involves national research and development in institutions and universities interested in mountain ecosystems and agriculture.
Strengthen international cooperation with the United Nations, regional and international cooperation, particularly with FAO, Mountain Partnership, ICIMOD, CGIAR and other relevant institutions.

Strengthen Mountain Partnership, considering it is the only United Nations voluntary alliance of partners dedicated to improve the lives of mountain people and protect the world’s mountain environments as well as increase public–private sector attention, commitment, engagement and investment in the development of sustainable mountain agriculture.

Implications for food security and nutrition governance

The sustainable development of mountain ecosystems and agriculture is critical for improving food security and livelihoods in vulnerable mountain communities and protecting mountain natural resources, namely water, soil and biodiversity. These natural resources are also important for food security and improving the livelihoods of people living in the surrounding lowlands. Considering the implications to both upstream and downstream populations, at least one billion people are affected by the sustainable development of mountain ecosystems and agriculture.

Mountain people make use of the variation in climates at different altitudes, with different exposures to sunlight from season to season (FAO, 2011). Traditional land-use systems for agricultural production make use of climate variations through sophisticated techniques. Mountain areas have diverse agro-ecologies and as a result, mountain agriculture has different production systems for farming and natural pastures, including 1) pastoral, 2) agro-pastoral systems (both are important to livestock production), 3) rainfed and 4) irrigated production systems and 5) forestry and agroforestry. Both rainfed and irrigated production systems are important for field crops such as rice, wheat and corn, and horticultural crops including fruit trees and vegetables. The production of livestock, field and horticultural crops are the basis for food security and nutrition.

Mountain areas have many NUS that may be important Future Smart Foods if special attention is given to their nutritional value and adaptation to harsh environments and variable climatic conditions. It is important to assess the nutritional value and adaptation to prevailing NUS in the traditional mountain communities. Furthermore, nutritional value assessments will shed light on their potential to become important commercial crops at national, regional and global levels. A good example is quinoa, which originated in the traditional communities of the Andes Mountains in Latin America that has become a globally important food because of its high nutritional value.

The way forward

The policy, technical, and regional and international cooperation recommendations presented above should be adopted and implemented by national authorities and specialized regional, international and United Nations organizations (where FAO can play an important coordinating role). The implementation of these recommendations will contribute greatly to healthy mountain ecosystems and utilize the full potential of mountain agriculture. This will not only contribute to global food and nutrition security but also ensure the continued services and resources that contribute 70 percent of freshwater resources and various sources of renewable energy to the world community. Both water and energy are critical to the water–energy–food nexus essential for food and nutritional security, environmental sustainability and poverty reduction.
The sustainable development of mountain agriculture requires the leadership from the government to place mountain agriculture in the centre of national and sub-national policies related to Zero Hunger and poverty reduction, and long-term investment in a holistic and integrated approach involving policy, socioeconomic, institutional aspects, natural resource management, and crop and livestock improvement. The investment should be followed by integration among all these factors in farmers’ fields to achieve synergy as a result of the integration of these three important themes 1) sustainable natural resource management and inputs; 2) crop and livestock improvement, and 3) socioeconomic, enabling policies, and institutional support.

Negligence of mountain areas, where about one billion people reside, has contributed greatly to global poverty, food insecurity and malnutrition. It is essential that governments develop specialized institutions at the national level to address the multilateral challenges facing the sustainable development of mountain ecosystems and agriculture. These institutions need to implement the policy, technical and regional cooperation recommendations to improve livelihoods, reduce poverty and enhance food and nutritional security.

Figure 5 An integrated approach for the sustainable development of mountain agriculture

Source: El Solh, 2014
“It is no secret that mountain people endure incredibly difficult environments and face the highest levels of food and nutrition insecurity. However, based on the strong cultural assets of long standing adaptation and resilience and a unique capacity to take advantage of diversity, sustainable mountain agriculture development offers considerable opportunities to achieve the four dimensions of food security. Promoting mountain specialty products (e.g. Future Smart Foods) through identification, production, post-harvest handling and processing, marketing and consumption, should be considered an effective entry point for mountain agriculture to contribute to Zero Hunger and to Sustainable Development.”

Dr Patrick Caron, Chairperson of High Level Panel of Experts (HLPE) of the UN Committee on world Food Security (CFS)

“Mountain agriculture – imperative for livelihoods, nutrition, as well as its role at supporting agricultural diversity – is now at a crucial juncture, given pressures from climate change, disasters and outmigration. Yet, research and support systems pay inadequate attention to mountain farmers and their agricultural systems, which are distinctly different from those found on the plains. The FAO Mountain Agriculture initiative in Asia and Pacific is therefore, importantly positioned and well-timed to draw the necessary urgent attention in support of a prosperous and sustainable transformation of mountain agricultural systems, vital for the world to achieve food and nutrition security and to meet the United Nations’ SDGs.”

Dr David Molden, Director General of the International Centre for Integrated Mountain Development (ICIMOD)

“This FAO publication provides strong and convincing evidence that governments and society as a whole need to pay more attention to the potential of mountain agriculture for achieving food and nutrition security, to improve livelihoods and economic opportunities and to ensure sustainable ecosystems which collectively will lead to SDGs.”

Dr Kraisid Tontisirin, Senior Advisor of the Institute of Nutrition, Mahidol University and Former Director, Food and Nutrition Division at FAO, Rome, Italy