

# Chapter 41

## Climate Smart Sustainable Agriculture: Integrated Steps Towards Resilient Farms

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### **ABSTRACT**

*Careful management of agricultural ecosystems is considered a vital procedure to ensure both environmental health and the sustainability of this sector, particularly when, besides all the argumentative used by farmers, there are no globally accepted sustainable management solutions for agriculture. This scenario poses several challenges for the agricultural sector all over the world, especially on an increasing climate change situation, in which extreme weather phenomena tend to be gradually more severe, as is the case of floods and draughts. Still, considering that the last decades were marked by great developments in agricultural management systems as is the case of precision agriculture, hi-tech-agriculture, organic farming, conservation agriculture, sustainable agriculture, smart farming, among others, it is crucial to assess specific case studies, in which the application of predetermined sustainable farming principles and/or procedures contributed to increase their resilience to climate change on a sustainable manner.*

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## INTRODUCTION

Though often described as an old-fashioned economic sector, agriculture is increasingly acknowledged as a crucial catalyzer of the global economy supporting rural development and contributing to poverty mitigation all over the world. This increase of relevance is due because of the modernization of this particular sector which is capable to increase the productivity and the efficiency of agriculture. Still, if the value of agricultural landscapes is progressively acknowledged as a relevant issue, their impact is also gradually discussed, especially in a scenario of growing demand, considering both food and non-food crops, such as biofuels. In this regard, careful management of agricultural ecosystems is considered a vital procedure to ensure both environmental health and the sustainability of this sector, particularly when, besides all the argumentative used by farmers, there are no globally accepted sustainable management solutions for agriculture. This happens not only because agricultural practices are directly dependent on site-specific variables (such as biodiversity, climate, soil characteristics, water availability, and so on) but also because the agricultural sector faces simultaneously two hard challenges: to assure enough high-quality agricultural production to meet world's population growth forecast and to protect biodiversity and ecosystem services on each and every single agricultural landscape.

Still, even if measuring and analyzing the factors that affect agricultural production at different levels has long been the subject of several theoretical reflections and numerous empirical and scientific studies, the fact is that there is a growing urgency to enhance the sustainability of existing and emerging agricultural land. Moreover, summarizing the dynamics and choices involved in this process of sustainable "smartification" is especially hard when the sustainability principles inherent to agriculture are generally applied across different management systems, with different configurations.

As pointed out by Loures (2017), the need to produce food in an increasingly sustainable manner, not only in terms of crop efficiency, but also in terms of land use and biodiversity conservation in natural ecosystem, highlight the necessity to envision the use of new technologies on different productive systems assessing their impact both in environmental, economic and social aspects (Ponisio & Ehrlich, 2016; and Pywell *et al.* 2015). The fact is that, even if several agricultural management systems had been envisioned during the last decades (precision agriculture, hi-tech-agriculture, organic farming, conservation agriculture, sustainable agriculture, smart farming), "recent events" had made clear that we need to move towards a much more integrated concept of agriculture, directly based on site specificity in which all the issues and principles mentioned before are part of the same equation.

Getting this equation right is a challenge that all farmers need to face, if they actually believe in the future of the agricultural sector. CS<sup>2</sup>F - Climate Smart Sustainable Farming - is not a utopia, but rather a simple agricultural management process that aims at bringing together a set of practices and technologies that increase productivity, and build farmers' resilience to climate change, while decreasing inputs and maximizing yields.

CS<sup>2</sup>F is not a matter of changing current agricultural practices but rather an opportunity to reinvent and rearrange them both in ecologic, economic and social terms, enabling agricultural land to totally fulfill its potential. In this regard, there are 5 steps that are considered the basis of this process, namely:

1. To be climate resilient - it is a fact that climate change is increasing the severity and frequency of extreme weather events; still, adequate crop selection reduces the risk of losing productivity. Investments in climate-smart technology, which enables farmers to predict weather variability makes it easier for farmers to control their crop management activities, to select varieties to plant

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