



# Climate Change, Natural Resources and Management of Production Risks Program



**Inter-American Institute for  
Cooperation on Agriculture  
HEADQUARTERS**

P.O. Box 55-2200 San José  
Vázquez de Coronado, San Isidro 11101- Costa Rica  
Phone: (506) 2216-0222 • Fax: (506) 2216-0233  
[iicahq@iica.int](mailto:iicahq@iica.int)/[www.iica.int](http://www.iica.int)

**Director General:** Manuel Otero

**Director of Technical Cooperation:** Federico Villarreal

**Manager of the Climate Change, Natural Resources and  
Management of Production Risks Program:**

Karen Montiel ([karen.montiel@iica.int](mailto:karen.montiel@iica.int))

**Members of the Program:**

Abimbola Abiola ([abimbola.abiola@iica.int](mailto:abimbola.abiola@iica.int))

Kathya Fajardo ([kattia.fajardo@iica.int](mailto:kattia.fajardo@iica.int))

Laura Meza ([laura.meza@iica.int](mailto:laura.meza@iica.int))

Chaney St. Martin ([chaney.stmartin@iica.int](mailto:chaney.stmartin@iica.int))

Kelly Witkowski ([kelly.witkowski@iica.int](mailto:kelly.witkowski@iica.int))

**Advisory Committee:**

Desirée Elizondo

James Fletcher

María Beatriz (Pilu) Giraudo

OCTOBER 2019

The Institute encourages the fair use of this document. Proper citation is requested. This publication is also available in electronic (PDF) format from IICA's website (<http://www.iica.int>).

Also published in English.



# Climate Change, Natural Resources and Management of Production Risks Program



Climate Change,  
Natural Resources and  
Management of Production Risks









The world depends on two basic elements for food production: climate and natural resources. In 2050, we will need to be able to feed an estimated global population of around 9.8 billion people (United Nations 2017), but with fewer resources than at present and while contending with the challenges of environmental degradation and climate change.

Changes in climate and environmental conditions are already affecting many economic sectors and intensifying problems such as poverty, migration, food insecurity, environmental degradation, and conflicts over natural resources, among others. The 2018 special report of the Intergovernmental Panel of Experts on Climate Change (IPCC) underlines the differences between a world with a 1.5°C rise in average temperature and one with a 2°C increase. It also warns of the urgent need to speed up climate action and the transition to a low-carbon economy (IPCC 2018). Climate change has different effects on economic activities, and a particular impact on agriculture<sup>1</sup>.

---

<sup>1</sup> Unless explicitly stated otherwise, the term “agriculture” is used to refer to both crop and livestock production and agribusiness activities.

Over the last 30 years, global agricultural production has fallen by between one and five percentage points per decade, with tropical areas recording the biggest declines. While higher temperatures have boosted production in some temperate areas, agricultural productivity worldwide will continue to fall even if the rise in temperature is kept below 2°C.

Agriculture is an activity inherently linked to ecosystems and natural resources. Those links are two-way, since it is an economic activity that not only changes the environment, but is also conditioned by it. The relationship between agriculture and the environment varies considerably from area to area, making it necessary to analyze each context individually in order to understand the various synergies and tradeoffs; identify the different visions, development goals, policies, technologies, and practices; and, based on that information, determine the best political and institutional course of action.

The conversion of natural ecosystems and forests into agricultural production systems has negative effects on the environment, even though societies are necessarily dependent on natural resources for their development. Agriculture consumes the lion's share of the world's water resources, with roughly 70% of freshwater being used to produce food (OECD 2010). Land is utilized to produce 95% of all foodstuffs (Weigelt *et al.* 2015; FAO 2015). Furthermore, the cumulative degradation of ecosystems and natural resources affects agricultural productivity levels. It is estimated that the agriculture sector as a whole generates nearly one quarter of global greenhouse gas (GHG) emissions (Blanco *et al.* 2014).

One of the main challenges facing agriculture is the need to raise productivity levels while at the same time reducing the degradation of natural resources, especially water and soils (Foley 2011). More than 22% of soils in LAC are located in degraded areas and classified as severely or very severely degraded, and reversing this situation is a challenge for the region (UNEP 2016). It is also estimated that, if the current conditions of agricultural land use in Latin America and the Caribbean (LAC) remain unchanged, by 2050 roughly 50% of it will be subject to desertification processes, which are increasing due to the growing number of extreme weather events and inappropriate soil management practices. The degradation of natural ecosystems reduces their capacity to provide ecosystem services that are of vital importance for agriculture,



such as pollination and the regulation of the water cycle, climate, and nutrient cycles (Zhang *et al.* 2007).

The global challenge is to produce more food, but sustainably and tackling climate change at the same time. This makes it essential to achieve an effective transition away from current production systems toward others capable of simultaneously promoting food and nutrition security, increasing agricultural productivity, and ensuring prosperity for present and future generations. And all this has to be done without degrading natural resources and ecosystems, and actually reversing current degradation conditions.

Achieving such a transition calls for the application of integrated approaches and constant, robust efforts that incorporate the management of production risks. According to Lavell *et al.* (2012), climate change is both a problem inherent in development and a product of the current model. This calls for incremental and transformational changes in the approaches to development that assign greater importance to risk management (as a complex social and political process), and development goals, policies, and practices (Lavell 2003).



## Definitions

**Climate change:** a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods. (UNFCCC 1992).

**Climate change adaptation:** adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including preventive and reactive, public and private, and autonomous and planned adaptation (IPCC 2001).

**Climate change mitigation:** an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases (IPCC 2001a).

**Ecosystem services:** Benefits that nature supplies to society. They include water supply services, food and raw materials, as well as the regulation of local climates, carbon sequestration, water purification, pollination, support for species' habitats, and biodiversity conservation, among others (IPCC 2013).

**Greenhouse gases (GHG):** gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of terrestrial radiation emitted by the Earth's surface, the atmosphere itself, and by clouds. A change in the concentration of GHG because of anthropogenic emissions contributes to an increase in the surface temperature of the earth (IPCC 2013).

**Resilience:** the capacity of a production system, individual or ecosystem to withstand or recover from stresses and shocks, and bounce back to the previous level of production or growth. (The Montpellier Panel 2012).



# Agriculture and the environment: conceptual development

Agricultural production and productivity and environmental problems are both fields in which the technical, political and institutional issues are highly complex, and considerable interaction is required to arrive at agreements that yield benefits for all the parties involved. Presented below are three areas in which greater interaction between the environmental and agricultural institutional frameworks is needed if the sector's goals are to be achieved successfully.

## a) Agriculture in global agreements and on domestic agendas

It is only since 2011 that agriculture has been seriously involved in the discussions of the climate negotiations under the aegis of the United Nations Framework Convention on Climate Change (UNFCCC). The



Paris Agreement (PA), adopted in 2015, and the nationally determined contributions (NDCs) submitted by the countries assigned agriculture a key role in tackling climate change. In 2016, the Parties took a substantive decision in the process of integrating agriculture into the UNFCCC when they created the *Koronivia Joint Work on Agriculture* (KJWA) (FAO 2018). This is important, because it can help the countries to establish more ambitious mitigation and adaptation goals, which have to be submitted in 2020 in the next round of NDCs, when the PA enters into force (FAO 2018).

LAC has witnessed significant institutional advances in the design of specific policies for the agriculture sector, and capacity building to address climate change within the sector<sup>2</sup>. This issue is becoming a more prominent feature of the research agendas of national agricultural research institutes (NARIs). Some (albeit insufficient) progress has also been made with support mechanisms and financial innovations for the achievement of sustainable, low-carbon, climate resilient production.

Furthermore, the private sector is increasingly engaging with climate issues. The efforts spearheaded by this sector also recognize the key role that the agriculture sector will play in efforts to address the challenges associated with mitigation, adaptation, and the management of production risks. In particular, the nationally appropriate mitigation actions (NAMAs) call for the participation of farmers in the work related to each agricultural product and activity.

While LAC has achieved notable advances, the region is yet to tackle the challenge of adopting, over time and on a significant scale, the adaptation measures needed to address climate change, particularly in the most vulnerable territories and those that have been the first to feel the impact of this phenomenon.

## b) Contribution to global food security with fewer carbon emissions

LAC has more good quality water and land for potential future agricultural expansion than any other region of the world (Truitt Nakata 2014). It is also a food exporter with a growing share of world trade, thus contributing to global

---

2 Brazil, Chile, Costa Rica, Peru, Panama and a number of other countries already have plans to address climate change in agriculture. At the time of writing, Argentina, Colombia, Guatemala and Uruguay were drawing up sectoral adaptation plans.

food and nutrition security. If it is to continue to play this leading role, economic growth and climate action can, and should, feed off each other.

One of the challenges facing the sector is the need to limit agricultural expansion that reduces forest cover, a dominant trend in many countries, so as to halt biodiversity loss and reduce GHG emissions and soil and water degradation and contamination. Various mechanisms are required to raise productivity by surface unit without compromising the region's natural capital<sup>3</sup>.

The gaps in agricultural productivity must be addressed, especially in family farming, and efforts made to promote more efficient use of production inputs and thereby reduce GHG emissions. The promotion of sustainable agricultural production systems is an effective way to protect agroecosystems, safeguard agrobiodiversity, and offer mechanisms capable of dealing with climate change.

Carbon capture, the sustainable use of biodiversity and various options relating to the value of ecosystem services can become useful alternatives for helping producers to diversify their income. Sustainability indicators are becoming an increasingly important factor in global agrifood trade, including radical changes in food consumption and production patterns, and the use of natural resources. Internalizing the care of natural resources is not only the key to the sustainability of the agrifood system, but also a conditioning factor in international trade whose importance will continue to grow.

### c) Adaptation and resilience in agriculture in response to climate change

Given the highly heterogeneous nature of production in LAC, there are no one-size-fits-all measures for achieving the resilience of different production systems. Resilience can, however, be improved by recognizing the diversity of systems and enhancing their adaptability to climate change and their capacity to respond to it (Darnhofer *et al.* 2010).

In the tropics, where temperature ranges are more limited for most crops, structural changes in food production will be required in the medium and long

---

<sup>3</sup> The term “natural capital” refers to natural assets in their role of providing natural resource inputs and environmental services for economic production, such as reserves of natural resources, land and ecosystems that are essential for the long-term sustainability of development (United Nations 1997).





terms. Farmers need flexible production systems that will allow them to manage climate variability and future climate changes.

Experts are agreed on the need to abandon the focus on adaptation to the climate changes that will inevitably occur in favor of an approach geared to sustainable development based on investment in resilient, low-carbon agriculture. In broad terms, actions are required aimed at implementing research, policies, investments, and strategically planned modifications on different spatio-temporal scales, and with a more proactive approach that makes it possible to anticipate the next changes. Efforts to achieve this objective should be intensified, as groups of farmers and the most vulnerable territories are already experiencing the initial effects of those changes.

# Technical cooperation for resilient, low-carbon agriculture

International technical cooperation plays an important role in promoting a more productive, competitive, and sustainable agriculture sector. In the Americas, IICA works with its member countries to promote the resilience of rural territories and agrifood systems through a range of coordinated actions under a hemispheric action program.

## Climate Change, Natural Resources and Management of Production Risks Program

The objective of this program is to assist the countries with institution building, the efficient development of technical expertise, and knowledge management, all with a view to achieving efficient, climate-resilient, low-carbon agriculture. This program integrates the issues of innovation and technology and gender and youth, which are a key, cross-cutting element of its efforts.

In its 2018-2022 Medium-term Plan (IICA 2018), the Institute states that the aims of the Program are to:

- a. Contribute to capacity creation and institution building for the development of conceptual frameworks and the implementation of public policies.*
- b. Promote technical-political dialogue and the implementation of direct technical cooperation with multilevel actions.*

To achieve those aims, the Program is focusing on the following three areas of work:

- **Strengthening of institutional frameworks for low-carbon agriculture resilient to climate change**

Considering climate's huge impact on the agriculture sector, farming's effect on the environment and the intrinsic relationship between natural resources and production, it is vital that the sector participate in discussions and decision-making about these issues at the global, regional, and national levels.

Through this area of work, the Program helps the countries to participate in an active and informed manner in international forums, particularly in the UNFCCC and related public policy frameworks, and in national and international forums on water. It also seeks to make their climate actions (NDCs) more effective.

The countries need to develop an integrated vision of the interrelationships between farming and the environment, one that includes an agriculture sector prepared to deal with the effects of a changing climate, given the production and climate risks. Accordingly, the Program supports national efforts to build the agriculture sector's capacity to:

- Provide follow-up to the global agreements (the 2030 Agenda, the UNFCCC, the World Water Forum and the United Nations Convention to Combat Desertification, among others), and the regional agreements adopted by the agricultural councils (the Central American Agricultural Council and the Southern Agricultural Council), and other intergovernmental coordination bodies in the hemisphere.
- Promote the design, analysis, development, implementation, and monitoring of public policy instruments, such as national adaptation plans, NDCs, climate financing, NAMAs, and territorial planning, among others.
- Establish dialogues between scientists and politicians. Interaction between different actors, on various scales, and between countries is vital for the design of the policies and methods needed to address climate change. The use of science and the management of knowledge and information are vital to support effective, informed decision-making about policies and investments.

The Program also helps countries to promote intersectoral coordination among the public entities responsible for agriculture, the environment, and



water management; and the strengthening of links with the private sector and civil society for climate action.

### ● **Promotion of efficient, sustainable, low-carbon agriculture**

In this area, the Institute supports the countries in their efforts to achieve efficient, sustainable, low-carbon agriculture. The work includes building technical capacity and managing knowledge related to technologies and methods for the sustainable intensification of food production—in other words, producing more with fewer resources, reducing environmental impact and ensuring resilience to a changing climate.

Maintaining and increasing production is essential for the adoption of sustainable forms of agricultural production, combining GHG adaptation and mitigation actions with sustainable natural resource management.

In this area, the Program focuses on:

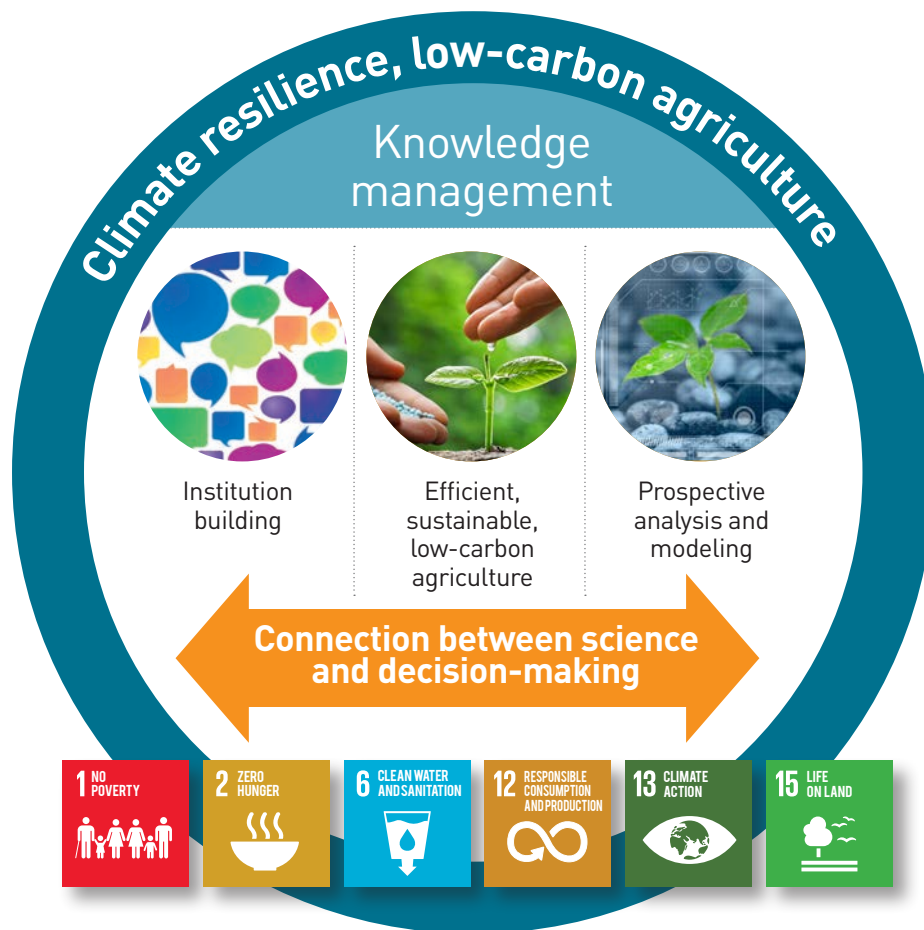
- Efficient water use, including nature-based solutions for dealing with aspects of droughts, floods and the recycling of water in agriculture.
- Sustainable soil management, using practices designed to improve soil health, natural fertility, and biodiversity, including the improvement of the soil's organic carbon, and techniques that increase soil productivity while at the same time reversing its degradation and contamination.
- Sustainable intensification, through networks for the sustainable production of specific crops, e.g., the System of Rice Intensification (SRI).
- Sustainable, low-emission livestock production, based on approaches such as integrated (agro-silvopastoral) systems, sustainable management and the restoration of pastureland, manure management, etc.

### ● **Prospective analysis and the use of information and data to promote changes in production**

Working within the framework of the current convergence of digital, physical, and biological technologies, the Program helps the countries to access digital and satellite information that can be used to make decision-making more effective and efficient, and to conduct prospective analyses.

This area focuses on the following actions:

- The use of geospatial approaches to carry out agro-climatic vulnerability and risk analysis assessments.
- The development of integrated models and prospective scenario analysis that contribute to climate change adaptation and mitigation in agriculture in new agroecological contexts, and facilitate a better understanding of the synergies and tradeoffs related to different adaptation and mitigation options.
- Produce sector risk management scenarios, including early warning systems.



# Technical cooperation and knowledge management: the modus operandi

The technical cooperation offered by the Program is based on knowledge management. The Program organizes professional networks and establishes interinstitutional agreements with a wide range of public and private sector and civil society agencies and institutions in order to provide technical cooperation of excellence. Within IICA, the Program draws on a network of specialists on various issues (risk management, natural resources, innovation, climate change and public policies) based at Headquarters and in the Institute's 34 delegations. Furthermore, the Program has a network of over 25 nationally and internationally recognized external specialists that supports and makes it possible to significantly broaden the technical cooperation activities that the Institute implements to meet its clients' needs.

The Program's initiatives also benefit from the strengthening of strategic partnerships with the cooperation for innovation mechanisms in which IICA participates directly, such as the cooperative innovation and research programs





(PROCI), the Forum of the Americas for Agricultural Research and Technology Development (FORAGRO), the Inter-American Commission on Organic Agriculture (ICOA) and the Regional Fund for Agricultural Technology (FONTAGRO), among others.

In addition, the Program promotes the construction of robust strategic partnerships with research and knowledge generation centers with a proven record of achievement, such as the Tropical Agriculture Research and Higher Education Center (CATIE), the International Center for Tropical Agriculture (CIAT), the Agricultural Model Improvement and Intercomparison Project (AgMIP), Cornell University, the University of California (Davis), the University of the West Indies (UWI), and many other national and international institutions.

Under the Program, IICA also collaborates with international cooperation for development agencies of the United Nations System, such as UN Environment, the Economic Commission for Latin America and the Caribbean (ECLAC), the United Nations Food and Agriculture Organization (FAO), and the International Fund for Agricultural Development (IFAD), among others. The Institute also maintains strong relations with various national cooperation agencies, including the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the Spanish Agency for International Development Cooperation (AECID), the United States Department of Agriculture (USDA), and others. The Program has also worked on sustainability issues with a large number of nongovernmental organizations, including The Nature Conservancy, Conservation International, and Garden Pool, among many others.



## About IICA

As the agency of the Inter-American System specializing in agriculture, the Inter-American Institute for Cooperation on Agriculture (IICA) supports the efforts of the Member States to achieve agricultural development and rural well-being. Since 1942, the Institute has promoted hemispheric cooperation designed to achieve a more competitive, inclusive and sustainable agriculture sector capable of feeding the region and the world.

IICA works with its Member States to identify technical cooperation needs and requirements, and provide the most appropriate responses to them. In doing so, it draws on knowledge management under the leadership of its technical specialists, and works in tandem with hemispheric programs, partner institutions and networks of leading professionals.

The region's main challenges include the urgent need to work with the member countries to make rural territories more resilient to climate change and extreme events, while at the same time raising agricultural productivity.



IICA's current technical cooperation model consists of five technical hemispheric action programs and two cross-cutting issues:

**The technical programs are:**

- Bioeconomy and Production Development
- Territorial Development and Family Farming
- International Trade and Regional Integration
- Climate Change, Natural Resources and Management of Production Risks
- Agricultural Health and Food Safety and Quality

**The cross-cutting issues are:**

- Gender and Youth
- Innovation and Technology

The five programs coordinate with one another and adopt an interdisciplinary approach to provide comprehensive solutions to the challenges faced by the Institute's 34 Member States.

With a permanent presence in each of those states, IICA is perfectly placed to facilitate and help improve agricultural policies and practices in the Americas.



## References

- Blanco, G; Gerlagh, R; Suh, S; Barrett, J; de Coninck, HC; Diaz Morejon, CR; Mathur, R; Nakicenovic, N; Ofosu Ahenkora, A; Pan, J; Pathak, H; Rice, J; Richels, R; Smith, SJ; Stern, DI; Toth, FL; Zhou, P. 2014. Drivers, trends and mitigation (on line). *In* Climate change 2014: mitigation of climate change. Cambridge, United Kingdom, Cambridge University Press. Consulted on 7 August 2018. Available at: [https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc\\_wg3\\_ar5\\_chapter5.pdf](https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_chapter5.pdf).
- Darnhofer, I; Fairweather, J; Moller, H. 2010. Assessing a farm's sustainability: insights from resilience thinking. *International Journal of Agricultural Sustainability* 8(3):186-198.
- FAO (Food and Agriculture Organization of the United Nations, Italy). 2015. Healthy soils are the basis for healthy food production (on line). Rome, Italy. Consulted on 14 December 2018. Available at: <http://www.fao.org/soils-2015/news/news-detail/en/c/277682/>.
- FAO (Food and Agriculture Organization of the United Nations, Italia). 2018. The Koronivia joint work on agriculture and the convention bodies: an overview (on line). St-Louis, M; Schlickerrieder, J; Bernoux, M. Rome, Italy. Consulted on 31 May 2019. Available at: <http://www.fao.org/3/ca1544en/CA1544EN.pdf>.
- Foley, JA. 2011. Can we feed the world & sustain the planet? (on line). *Scientific American* 305(5):60-65. Consulted on 7 August 2018. Available at <http://doi.org/10.1038/scientificamerican1111-60>.
- Gibbs, HK; Ruesch, AS; Achard, F; Clayton, MK; Holmgren, P; Ramankutty, N; Foley, JA. 2010. Tropical forests were the primary sources of new agricultural land in the 1980s and 1990s (on line). *Proceedings of the National Academy of Sciences of the United States of America* 107(38):16732-16737. Consulted on 7 August 2018. Available at: <https://www.pnas.org/content/pnas/early/2010/08/30/0910275107.full.pdf>.
- IICA (Inter-American Institute for Cooperation on Agriculture, Costa Rica). 2018. 2018-2022 Medium-term Plan (on line). San Jose, Costa Rica. Consulted on 11 November 2018. Available at: <http://repositorio.iica.int/bitstream/11324/7192/1/BVE18040249i.pdf>.
- IPCC (Intergovernmental Panel on Climate Change, Switzerland). 2001a. Annex B: Glossary of Terms (on line). Geneva, Switzerland. Consulted on 22 May 2017. Available at: <https://archive.ipcc.ch/pdf/glossary/tar-ipcc-terms-en.pdf>.
- IPCC (Intergovernmental Panel on Climate Change, Switzerland). 2001b. Overview of Impacts, Adaptation, and Vulnerability to Climate Change. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. McCarthy, JJ; Canziani, OF; Leary, NA; Dokken, DJ; White, KS (eds.). Cambridge, United Kingdom, Cambridge University Press.
- IPCC (Intergovernmental Panel on Climate Change, Switzerland). 2007. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Parry, ML; Canziani, OF; Palutikof, JP; van der Linden, PJ; Hanson, CE (eds.). Cambridge, United Kingdom, Cambridge University Press.
- IPCC (Intergovernmental Panel on Climate Change, Switzerland). 2013. Glossary. Planton, S. (ed.). *In* Climate Change 2013. The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Stocker, TF; Qin, D; Plattner, GK; Tignor, M; Allen, SK; Boschung, J; Nauels, A; Xia, Y; Bex, V; Midgley, PM (eds.). Cambridge University Press, Cambridge, United Kingdom.



- IPCC (Intergovernmental Panel on Climate Change, Switzerland). 2018: Global warming of 1.5°C: An IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty (on line). Geneva, Switzerland. Consulted on 31 May 2019. Available at: <https://www.ipcc.ch/sr15/>.
- Lavell, A. 2003. La gestión local del riesgo: nociones y precisiones en torno al concepto y la práctica. Guatemala, UNDP.
- Lavell, A; Oppenheimer, M; Diop, C; Hess, J; Lempert, R; Jianping, L; Muir-Wood, R; Myeong, S. 2012. Climate change: new dimensions in disaster risk, exposure, vulnerability, and resilience. In *Managing the risks of extreme events and disasters to advance climate change adaptation*. Cambridge, United Kingdom, Cambridge University Press.
- OECD (Organisation for Economic Cooperation and Development, France). 2010. *Sustainable Management of Water Resources in Agriculture*. London, United Kingdom.
- The Montpellier Panel. 2012. *Growth with resilience: opportunities in African agriculture* (on line). London, United Kingdom, Agriculture for Impact. Consulted on 21 June 2019. Available at: <https://europa.eu/capacity4dev/hunger-foodsecurity-nutrition/document/growth-resilience-opportunities-african-agriculture-2012-montpellier-panel-report>.
- Truitt Nakata, G. 2014. *The next global breadbasket: how Latin America can feed the world: a call to action for addressing challenges and developing solutions* (on line). Washington, D. C., United States of America, IDB. Consulted on 17 June 2019. Available at <https://publications.iadb.org/en/publication/17428/next-global-breadbasket-how-latin-america-can-feed-world-call-action-addressing>
- UNEP (United Nations Environment Programme, Kenya). 2016. *GEO-6 regional assessment for Latin America and the Caribbean*. Nairobi, Kenya.
- UNFCCC (United Nations Framework Convention on Climate Change, Germany). 1992. *United Nations Framework Convention on Climate Change* (on line). Bonn, Germany. Consulted on 21 June 2019. Available at: <https://unfccc.int/resource/docs/convkp/conveng.pdf>.
- United Nations, Department of Economic and Social Affairs, Population Division. 2017. *World Population Prospects: The 2017 Revision, Key Findings and Advance Tables*. New York, United States of America. (Working Paper No. ESA/P/WP/248).
- United Nations. 1997. *Glossary of Environment Statistics* (on line). New York, United States of America. (Studies in Methods, Series F, No. 67). Consulted on 21 June 2019. Available at: [https://unstats.un.org/unsd/publication/SeriesF/SeriesF\\_67E.pdf](https://unstats.un.org/unsd/publication/SeriesF/SeriesF_67E.pdf).
- Weigelt J; Müller, A; Janetschek, H; Töpfer, K. 2015. Land and soil governance towards a transformational post-2015 development agenda: an overview. *Current Opinion in Environmental Sustainability* 15:57-65.
- World Bank. 2019. *Climate Change Knowledge Portal* (on line). Washington, D. C., United States of America. Consulted on 22 May 2019. Available at <https://climateknowledgeportal.worldbank.org/>.
- World Economic Forum. 2018. *Mapping Global Transformations* (on line). Cologny, Switzerland. Consulted on 21 October 2018. Available at <https://www.weforum.org/about/transformation-maps>.
- Zhang, W; Ricketts, TH; Kremen, C; Carney, K; Swinton, SM. 2007. Ecosystem services and dis-services to agriculture (on line). *Ecological Economics* 64(2):253-260. Consulted on 7 August 2018. Available at <https://www.sciencedirect.com/science/article/pii/S0921800907001462>.





**Inter-American Institute for  
Cooperation on Agriculture  
HEADQUARTERS**

P.O. Box 55-2200 San José  
Vázquez de Coronado, San Isidro 11101- Costa Rica  
Phone: (506) 2216-0222 • Fax: (506) 2216-0233  
[iicahq@iica.int](mailto:iicahq@iica.int)/[www.iica.int](http://www.iica.int)

