Submission by Conservation International on issues related to adaptation and agriculture, as requested in the conclusions of SBSTA 40 (FCCC/SBSTA/2014/2, Item 8, Paragraph 85(c and d)).

Parties and admitted observer organizations have been invited to provide their views on issues relating to the conclusion that SBSTA would undertake scientific and technical work on (c) "identification of adaptation measures, taking into account the diversity of the agricultural systems, indigenous knowledge systems and the differences in scale as well as possible co-benefits and sharing experiences in research and development and on the ground activities, including socioeconomic, environmental and gender aspects," and (d) "identification and assessment of agricultural practices and technologies to enhance productivity in a sustainable manner, food security and resilience, considering the differences in agro-ecological zones and farming systems, such as different grassland and cropland practices and systems." Conservation International is pleased to submit its views on these issues.

Recommendations — SBSTA is encouraged to consider the following with respect to adaptation measures and their co-benefits:

- Ecosystem-based adaptation (EbA) approaches can be implemented by farmers to improve their resilience to climate change while also providing environmental and socioeconomic benefits (e.g., by increasing smallholder and household food security and by increasing or diversifying their sources of income generation through co-benefits) in addition to adaptation benefits.
- EbA practices are already well known and already used by farmers (although this varies across geographies), but current financial, political and technical constraints limit widespread adoption of these practices among smallholder farmers. It is critical that policy makers at all levels (local, national and international) recognize and promote the use of EbA approaches in agricultural development, climate change and environmental strategies, and support their widespread adoption.
- EbA can be used at the farm and at the landscape/regional level to help smallholder farmers adapt to climate change. Many agricultural systems can provide mitigation and adaptation benefits if they are designed and managed appropriately and if the larger landscape context is considered.
- A useful tool to inform sustainable and ecosystem-based practices in agricultural systems at regional and national scales is ecosystem valuation and accounting (EVA), which can enhance use-efficiency of ecosystem services and identify agricultural dependencies on ecosystems and ecosystem services.
- Key dimensions of indigenous knowledge systems foster climate-resilient agricultural systems that can result in climate change adaptation benefits; this multidimensional and multifactorial agricultural approach brings additional co-benefits of increased food security of the families themselves who practice agriculture.

Recommendations — SBSTA is encouraged to consider the following with respect to sustainable increase of productivity, food security and resilience:

- Ecosystem-based adaptation (EbA) practices can provide several socioeconomic and environmental benefits, thereby contributing to food security and resilience in a sustainable way.
- EbA can be implemented in various agro-ecological zones that are or will experience a variety of climate impacts and extreme events.
- Agricultural practices and actions that ensure a climate-smart landscape can be implemented in a variety of farming systems (e.g., maize, coffee, cocoa, livestock).

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1) Evidence of ecosystem-based adaptation as an approach that can sustainably enhance agricultural productivity, food security and resilience in a variety of agro-ecological zones and farming systems

Ecosystem-based adaptation (EbA) is the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people adapt to the adverse effects of climate change. While there is a rapidly growing interest in ecosystem-based adaptation for its potential social, environmental and economic benefits, almost all of the related literature has focused on the adaptation benefits that accrue from the conservation and/or restoration of natural habitats. However, there are also significant opportunities to apply ecosystem-based adaptation in agricultural systems and landscapes.

There are numerous reasons why EbA is appropriate for farmers and can help support sustainable farm and landscape management. Specifically, EbA practices can help to: a) ensure the continued provision of key ecosystem services (e.g., water provision, food provision, nutrient regulation, pest control and pollination) on which farming depends, which is in contrast to non-EbA adaptation measures (e.g., the construction of dams for water irrigation or the increased use of agrochemicals) that confer adaptation benefits but may negatively impact the provision of ecosystem services and may have additional negative environmental off-site effects (e.g., loss of biodiversity or contamination of streams) and socioeconomic impacts; b) diversify production systems and sources of income generation, providing more stability to smallholder farmers and helping improve farmer food security directly and indirectly; and c) mitigate climate change by either reducing the amount of greenhouse gases emitted from agricultural systems or by increasing the overall farm biomass.

EbA can be implemented at the farm scale through the use of agricultural practices at the farm level, or at the landscape or regional scale through the protection and restoration of ecosystems (e.g., tropical, riparian and cloud forests) that provide important services (e.g., water provision for crop production or pollination by native bees) to farmers and other livelihood groups.

Case Study: CI and CATIE (the Tropical Agriculture and Higher Education Center) are conducting a project "Ecosystem-based Adaptation for Smallholder Subsistence and Coffee Farming Communities in Central America" (CASCADE)[1] to develop and test strategies for EbA to help highly vulnerable farming communities cope with climate change. A study conducted by the project aimed to highlight what EbA means in the context of agriculture: agricultural management practices which use or take advantage of biodiversity or ecosystem services or processes to help increase the ability of crops or livestock to adapt to climate change and variability. Examples of EbA practices include on-farm management of genetic biodiversity (e.g., diversification of crop varieties or inclusion of wild relatives) that ensure a broader source of crop resistance-capacity to uncertain occurrence and effects of extreme weather; the use of integrated pest-management strategies (i.e. the integration of cultural, biological and chemical control methods) and new cropping systems to reduce the impacts of pests and diseases; and the implementation of windbreaks, shade trees or cover crops to help reduce the evapotranspiration effect of extreme radiation and/or wind, or the energetic force of extreme rainfall and strong winds on soil structure. Additional details on what EbA means in the context of smallholder farming are provided in Vignola et al. (2015).[2]

Further, data on household surveys and field implementation generated through the CASCADE project shows that EbA practices can be applied in smallholder farmer coffee, cocoa, maize and bean farm systems, as well as in pastoral systems that are expected to experience shortage of water and fodder for animals. EbA can also be implemented in different zones that are or will experience a variety of climate impacts and extreme events.

As part of the CASCADE project, CI has also conducted a diverse set of research to: a) understand how climate change is already affecting smallholder coffee, bean and maize production in Central America; b) understand the

[1] www.conservation.org/cascade

[2] ibid.

role of EbA in helping smallholder farmers adapt to climate change; c) characterize the use of EbA by smallholder farmers; d) identify the technical, institutional and political barriers to broad-scale adoption of EbA by smallholder farmers; and e) identify what information policymakers need to scale up the use of EbA (Donatti et al. subm.).[3] Conservation International is pleased to share the results from this work[4] at the workshop upon request.

Recommendations — SBSTA is encouraged to recognize that:

- *Ecosystem-based adaptation ((EbA) can be implemented by farmers to improve their resilience to climate change while also providing environmental and socioeconomic benefits (e.g., by increasing smallholder and household food security and by increasing or diversifying their sources of income generation through co-benefits) in addition to adaptation benefits.*
- *EbA practices are already well known and already used by farmers (although this varies across geographies), but current financial, political and technical constraints limit widespread adoption of these practices among smallholder farmers. It is critical that policy makers at all levels (local, national and international) recognize and promote the use of EbA approaches in agricultural development, climate change and environmental strategies, and support their widespread adoption.*
- *EbA practices can provide several socioeconomic and environmental benefits, thereby contributing to food security and resilience in a sustainable way.*
- *EbA can be implemented in various agro-ecological zones that are or will experience a variety of climate impacts and extreme events.*

2) Utilizing a climate-smart landscape approach to achieve resilience in agricultural systems

CI, together with its partners, has supported the development of the concept of climate-smart landscapes — i.e., landscapes which are managed to achieve both adaptation and mitigation, as well as environmental and socioeconomic goals. A paper by Dr. Celia Harvey of CI and colleagues[5] demonstrates that many tropical agricultural systems can provide both mitigation and adaptation benefits if they are designed and managed appropriately and if the larger landscape context is considered. Integration of adaptation and mitigation activities in agricultural landscapes offers significant benefits that go beyond the scope of climate change to food security, biodiversity conservation and poverty alleviation. However, achieving these objectives will require transformative changes in current policies, institutional arrangements and funding mechanisms to foster broad-scale adoption of climate-smart approaches in agricultural landscapes. Table 1 summarizes the opportunities for integrating adaptation and mitigation goals in tropical agriculture, through the use of agricultural practices and actions that can provide both adaptation and mitigation benefits, and that can be at the plot, farm and landscape level (e.g., use of agroforestry;

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[3] Donatti, C.I. , C.A. Harvey, M.R. Martinez Rodrigues, R. Vignola, and C.M. Rodriguez. Submitted. What information do policy makers need to develop climate adaptation plans for smallholder farmers? The case of Central America and Mexico.

[4] - Martínez-Rodríguez, R., Harvey, C., Vignola, R., Bautista, P., Donatti, C., Saborío-Rodríguez, M., Avelino, J., Rapidel, B. Ecosystem-based adaptation options for smallholder farmers in Central America: an approach from experts' interviews. Adaptation Futures conference, Fortaleza, Brazil, May 13th, 2014.
- Saborio, M., F. Alpizar, C.A. Harvey, M.R. Martinez-Rodriguez and R. Vignola. 2015. How do coffee farmers adapt to perceived changes in climate? Evidence from Central America. Global Science Conference, Climate Smart Agriculture 2015, Montpelier, France. March 16-18, 2015. (oral presentation).
- Harvey, C.A., F. Alpízar, J. Avelino, P. Bautista, J.M. Cardenas, C. Donatti, M R. Martinez-Rodríguez, B. Rapidel, M. Saborio, R. Vignola and B. Viguera. 2015. Can Ecosystem-based Adaptation address the adaptation needs of smallholder farmers? Insights from smallholder coffee and subsistence farmers in Central America. International Congress on Conservation Biology, Mission Biodiversity: Choosing new paths for conservation, Montepellier, France, August 3-6, 2015 (oral presentation).
- Donatti, C., R. Martinez-Rodríguez, R. Vignola, C.M. Rodriguez and C.A. Harvey. 2015. Information needed for decision makers to take action on climate change adaptation for smallholder farmers—the case of Central America and Mexico. Global Science Conference, Climate Smart Agriculture 2015, Montpelier, France. March 16-18, 2014. (poster).
- Cerda, R., Allinne C., Krolczyk, L., Harvey, C.A., Aubertot, J., Tixier, P., Gary , C., Avelino, J. Ecosystem services provided by coffee agroecosystems across a range of topo-climatic conditions and management strategies. Montpellier, France, Sept. 9th 2015 (oral presentation).

[5] Harvey, C.A. , M. Chacon, C. Donatti, E, Garen, L. Hannah, A. Andrade, L. Bede, D. Brown, A. Calle, J. Chara, C. Celment, E. Gray, M.H. Hoang, P. Minang, A.M. Rodriguez, C. Seeberg-Elverfeldt, B. Semroc, S. Shames, S. Smuckler, E. Somarriba, E. Torquebiau, J. van Etten and E. Wollenberg. 2014. Climate-smart landscapes: Opportunities and challenges for integrating adaptation and mitigation in tropical agricultural landscapes. *Conservation Letter*s, 7(2): 77-90.

use of soil conservation practices; maintenance of landscape diversity including a mosaic of agricultural land and natural habitats, respectively).

Table 1. Examples of agricultural practices and actions that can confer adaptation and/or mitigation benefits at plot, farm and/or landscape scale.

Scale	Practices that primarily confer adaptation benefits	Practices that provide BOTH adaptation and mitigation benefits	Practices that primarily confer mitigation benefits
PLOT	• Use of new crop varieties or livestock breeds that are drought-tolerant, or bred for specific environmental stresses • Adjustments in irrigation practices and systems • Changes in timing of planting, pruning or harvesting • Adjustments in cropping sequence and timing of irrigation or application of fertilizers and pesticides • Changes in timing, duration, and location of animal grazing • Conservation of crop and livestock genetic diversity	• Integrated soil and water conservation efforts • Incorporation of organic fertilizers and cover crops • Reduced or zero tillage • Maintenance of crop residues • Breeding crop varieties for shade tolerance • Use of agroforestry	• Reduced or more efficient use of fertilizers and pesticides • Adjustments in the type of feed provided to cattle • Reduced frequency or extent of fires • Reduced or more efficient use of machinery and fossil fuels • Improved management of cultivated wetland rice areas to reduce methane emissions
FARM	• Changes in rotation or production systems • Improved water harvesting and retention through ponds, dams, etc. • Increased water use efficiency through improved irrigation practices • Conservation of agrobiodiversity • Use of seasonal and multiyear forecasting • Farm insurance or crop or livestock insurance	• Diversification of crops and livestock systems on the farm • Soil conservation practices, including terracing and land contouring • Improved residue management and use of cover crops • Integrated nutrient management • Use of agroforestry • Use of silvopastoral systems (e.g., trees in pastures, live fences, fodder banks) • Appropriate animal rotation practices • Use of conservation agriculture (i.e., minimal soil disturbance, maintenance of mulches, use of crop rotations and intercropping, integrated pest management) • Use of multicropping, intercropping, and crop rotations	• Reduced or more efficient use of agrochemicals • Planting of biofuels and trees for fuel wood • Planting of fast-growing tree plantations • Reduced use of machinery and fossil fuels • Generation of biogas from manure • Use of improved feeding practices for livestock
LANDSCAPE	• Maintenance of habitat connectivity to ensure pollination and pest control • Development of water collector systems, irrigation infrastructure and other engineering solutions to reduce risks of floods, water scarcity, and other climate-related risks • Targeted location of intensive livestock production within the landscape to reduce water contamination • Diversification of farmer income options	• Land-use planning at the landscape level for multiple objectives • Maintenance of landscape diversity—including a mosaic of agricultural land and natural habitat • Conservation and restoration of riparian areas within the agricultural landscape • Conservation and restoration of remaining forest habitat in the surrounding landscape—including formal and informal protected areas • Establishment of agroforestry and silvopastoral systems • Sustainable intensification of livestock production and crop production in some areas, to reduce pressure on fragile areas • Increases in the duration of fallow periods in shift and burn cultivation • Restoration of degraded or fragile lands • Conservation and restoration of wetlands and peat lands • Reduced expansion of cropland into remaining natural habitat	• Planting of biofuel feedstock • Careful management of fires

Recommendations — SBSTA is encouraged to recognize that:

- *EbA can be used at the farm and at the landscape/regional level to help smallholder farmers adapt to climate change. Many agricultural systems can provide mitigation and adaptation benefits if they are designed and managed appropriately and if the larger landscape context is considered.*
- *Agricultural practices and actions that ensure a climate-smart landscape can be implemented in a variety of farming systems (e.g., maize, coffee, cocoa, livestock).*

3) Ecosystem valuation and accounting as a tool to inform adaptation in agricultural systems

CI also leads the Ecosystem Values Assessment and Account (EVA) program. This effort focuses on natural capital accounting for the public sector, through advancing and contributing to the development of the Experimental Ecosystem Account led by UNSD-SEEA (United Nations Statistical Division-System of Environmental Economic Accounting), and for the private sector, through contributing to the Natural Capital Protocol led by the Natural Capital Coalition. EVA pilot tested an accounting framework for ecosystems in Peru — an approach that allows nature's benefits to be incorporated into the official economic statistics, making explicit the contribution of ecosystems and ecosystem services to the economy at large and, as a result, enhancing decision-making and planning. EVA is an official contributor to the development of natural capital accounting guidelines for the private sector that intends to identify the impacts, dependencies, risks and opportunities that may constrain business development or provide business opportunities. Both of these efforts relate to the links between ecosystems, ecosystem services and agriculture. They can help understand issues such as use-efficiency of ecosystem services (thus guiding the need to implement new technologies or improve efficiency) and the dependencies of agriculture on ecosystems and ecosystem services (i.e., help guide resilience and sustainability efforts). For instance, the EVA program in Peru helped the Government consider options related to maintaining wetland ecosystems or expanding rice cultivation. At the landscape level, this approach at both the private sector and public sector levels can support the implementation of EbA practices though identifying: a) the services that are provided by various ecosystems; b) who are the specific users of those ecosystem services; and c) what is the level of use of ecosystem services. The EVA program will provide capacity building for the countries and industries that are interested in pursuing this approach.

Recommendation — SBSTA is encouraged to consider ecosystem valuation and accounting as a useful tool to inform sustainable and ecosystem-based practices in agricultural systems at regional and national scales.

4) Indigenous and traditional knowledge as a contributor to adaptation in agricultural systems

CASCADE project

Household surveys conducted by CI and CATIE in Central America as part of the CASCADE project show that many of the practices that can be considered EbA (e.g., the use of shade trees in coffee systems, the use of live barriers and crop covers, crop and farm diversification in various agricultural systems and conservation of riparian forests) are already well known, reflected in traditional practices, and used by smallholder farmers, although the percentage of farmers that use those practices may vary considerably across geographies. CI has compiled local smallholder farmer knowledge on the effectiveness of different agricultural practices in helping farmers adapt to climate change. We have also compiled knowledge of local technicians on what adaptation strategies they recommend smallholder farmers use to adapt to climate change, so that we can compare local and expert knowledge and identify opportunities for greater knowledge sharing.

Institutional experience of the Association Savia Andina Pukara, in support of agricultural climate change adaptation measures of the Quechuas indigenous communities in the Northern Puno region of Peru.

CI supports indigenous fellows that engage with local indigenous organizations such as Peru's Association Savia Andina Pukara. Through this work, several key dimensions of traditional agriculture which foster climate-resilient agricultural systems have been identified:

1) An inclusive cosmovision that recognizes the spiritual and divine value of nature and biodiversity.

2) Diversity, density, heterogeneity and variability in: (a) agricultural years, (b) weather, climate and microclimates, (c) soils, (d) plant germplasm, (e) specific traditional knowledge, signs and secrets of fostering biodiversity, (f) water cycle, (g) natural fertility and (h) ethnicities and cultures.
3) Attention to agroclimatic signs. In many communities, these are classified into nine categories; for example, between September and November, listening to the intensity and frequency of the fox's howl and the direction of its displacement on the slope helps to understand the situation of the rains and the situation of a crop for the coming agricultural season.
4) Community calendar of agricultural festivals and rituals of care and respect; each community's particular seed rituals are on specific dates, and agricultural work is specific to each species, conditioned by other factors.
5) Agricultural strategies according to time and space; communities or families have three traditional times for sowing seeds; different soils are located in pampa (plain), slope (mid altitude) and hill (highest altitude). The planting of a species based on these factors mainly depends on the agroclimatic conditions.
6) Effective relationship with and cures for pests and diseases; pests are considered as visitors and are invited to leave with a ritual; there are also several processes whereby ash is placed on the plants to make the pests feel disgust and they withdraw.
7) Organization of the family, community and traditional authorities. In the majority of communities, the ancestral form of community organization called the 'ayllus' persists as a mechanism for mutual assistance in farming; in a few communities, traditional authorities continue to care for biodiversity.

Each dimension contains a diverse set of factors. The intensity and frequency of integration of these factors in the performance of traditional agriculture varies from one family to another and from one community to another, and can result in climate change adaptation benefits. Additional co-benefits of this multidimensional and multifactorial agricultural approach are increased food security of the families themselves who practice agriculture, as well as the surpluses offered on the market.

Experiences related to traditional conservation practices and adaptation to climate change have been shared with other communities and policymakers at local, regional, national and international levels. Thematic forums in the Puno region resulted in the issuance of Regional Ordinance 015-2007 to boost recognition and conservation of early agricultural biodiversity of the Lake Titicaca area and recognition of traditional conservation knowledge. This ordinance was in the hands of the Regional Management of Natural Resources and Environmental Management (GRRN y GMA) for implementation. Another focus has been to incorporate these issues into the curricula of local primary schools and universities. Groups of teachers in rural primary schools are encouraged to receive training on how to incorporate traditional conservation knowledge into the educational curriculum. This effort has contributed to the regional curriculum project (PCR) of the Puno region on the issue of intercultural knowledge. It also contributed to the preparation of a draft law on recognition of the authority of traditional wardens of biodiversity in Peru with Congresswoman Hilaria Supa Huamán.

Recommendation — SBSTA is encouraged to recognize that key dimensions of indigenous knowledge systems foster climate-resilient agricultural systems that can result in climate change adaptation benefits; this multidimensional and multifactorial agricultural approach brings additional co-benefits of increased food security of the families themselves who practice agriculture.