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WOMEN, SUSTAINABLE ECOSYSTEM MANAGEMENT, AND ADAPTATION TO CLIMATE CHANGE IN THE ANDEAN REGION: A POLICY-ORIENTED REVIEW

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INTRODUCTION AND OBJECTIVES

Identify the scientific evidence on women's management of terrestrial ecosystems that guides public policy and decision-making

Climate change and biodiversity are inextricably linked: climate change is a driver of biodiversity loss, and biodiversity conservation and the sustainable use of ecosystems are critical to climate change adaptation and mitigation (IPBES 2019; IPCC 2020).

Mountain areas are especially important and vulnerable to climate events, as are the human communities that live there. They are home to approximately 12 percent of the world's population, and people living in these areas depend primarily on the state of ecosystems for their livelihoods. Yet, mountains are important not only for many local communities but also for the planet as a whole through the ecosystem functions taking place there, for instance, in the Andes are essential for hydrologic recharge affecting even the Amazon basin. More than ever, the Andes face unique challenges due pressures from encroaching human settlement expansion (e.g., increased growth of cities and demand for resources in and around mountain areas) and rapid deterioration due to deforestation, extractive activities, and ice melting, among others (MRE 2014).

Women in rural areas, particularly from peasant and indigenous communities, are critical in various processes related to ecosystems; because of this, international debates have stressed their role in mountain sustainability (Rudaz and Debarbieux 2012). However, in practice, inclusion of a gender perspective in biodiversity policies is limited. For example, based on the analysis if the sixth national reports on the implementation of the Convention on Biological Diversity (CBD), it is unclear the progress on the distribution of benefits deriving from the use of biodiversity among women and other groups (e.g., indigenous peoples) (Aichi Target 14). This shows the limited consideration of women in the implementation of international

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responsibilities. According to Nilsson el al. (2018), other issues that are usually absent in national policies include those impacting women's welfare, the contextual factors influencing their agency, and the mechanisms to addressed them.

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) mentions that women are disproportionately affected by biodiversity loss (IPBES 2019). Therefore, a lack of consideration in policymaking for the different roles of women and contextual factors affecting them exacerbates their vulnerability, particularly in scenarios of climate change where the realization of human rights may be especially jeopardized (Knox 2009; Maguire and Lewis 2018; Nobre et al. 2017). Yet, acknowledging contextual factors is insufficient to strengthen women's agency in sustainable ecosystem management and to increase their participation in biodiversity governance and climate justice (Maguire and Lewis 2018). Efforts need to be complemented with processes that foster the conditions for realizing women's rights, including the right to own land, access to and use of productive resources, access to support services, and full and effective participation in decision-making (Guareña and Wegerif 2019).

Gender-responsive policies are particularly important in the Andean region due to: (i) the increasing feminization of agriculture and other social-ecological dynamics (e.g., care duties) (McLanahan and Kelly 2006); (ii) rising social vulnerabilities and tensions (e.g., food insecurity, poverty, and inequality); and (iii) increased biodiversity loss as a result of climate change and other anthropogenic factors (IPBES 2018; Ulloa et al. 2008; Wheeler and Von Brown 2013).

In this context, this research paper focuses on identifying, through a literature review, scientific evidence for the management of terrestrial ecosystems carried out by women in the Andean region, with the aim to appraise what scholar research is guiding the corresponding policies and decision-making. For this purpose, the specific objectives are to:

- Examine the scientific literature regarding: (i) the role of women in the management of ecosystems in the Andean region; (ii) the corresponding relationship with biodiversity conservation, the sustainable use of ecosystems, and adaptation to climate change; and (iii) the contextual factors influencing women's agency in ecosystem management; and

- Reflect on the findings in light of the Sustainable Development Goals (SDGs) 13 and 15, and the water–food–energy nexus, as well as on the knowledge gaps related to the design and implementation of gender-responsive policies and decision-making.

02

METHODOLOGY

The literature review was divided into three phases: (I) retrieval and preliminary selection of the literature; (II) in-depth reading, final selection, and data extraction and consolidation; and (III) analysis of the information.

2.1 Phase I. Retrieval and Preliminary Selection of the Literature

This phase included two steps:
(A) search and retrieval, and
(B) preliminary selection of articles.

(A) Search and retrieval. This entailed probing Scopus and Scielo (to access articles in Spanish and Portuguese) for indexed scientific articles using the key terms listed in Table 1. The selection criteria relate to the scope of the literature review (i.e., mountain terrestrial ecosystems and agrobiodiversity); general categorization (i.e., management, conservation, and the use of and effects on ecosystems and agrobiodiversity, as well as climate change, sustainability, and the SDGs); and subject matter (i.e., all terms associated with women in the Andean region).

The key search terms were tested in various syntax options on Scopus to identify the best syntax for the research objectives and optimize the number of articles returned.

To gather a comprehensive collection of papers, the retrieval period did not specify a starting year. Aside from no limits on the date of publication, it was not imposed any restrictions on the scholar discipline. The retrieval was completed on June 1, 2020.

Table 1. Search Criteria and Key Terms for the Literature Review

CRITERIA	KEY SEARCH TERMS
Scope of the literature	ecosystem* OR mountain* OR terrestrial OR agr* OR biodivers*
General categorization	management* OR use OR utiliz* OR conservat* OR climate* OR adapt* OR effect OR sustainab* OR sdg
Subject	women OR woman OR gender
Geographic focus	Andean* OR andes* OR ecuador* OR colombia* OR peru* OR bolivia* OR chile* OR argentin* OR venezuel*

(B) Preliminary selection. The retrieved articles were pre-selected based on two inclusion criteria: (i) subject matter and (ii) review status. Regarding the subject matter, publications from various disciplinary fields were considered that reported on or discussed activities, roles, and/or influencing factors related to women's terrestrial ecosystem management in the Andean region relevant to biodiversity (conservation and sustainable use) and adaptation to climate change. In relation to the review status, only peer-reviewed scientific publications in English, Spanish, and Portuguese were considered. The pre-selection criteria were applied to the abstracts of all retrieved articles.

2.2 Phase II. In-Depth Reading, Final Selection, and Data Extraction and Consolidation

The pre-selected papers passed through an in-depth revision, which allowed a final selection of research that addressed: (a) terrestrial ecosystem management, (b) climate change adaptation, (c) women, and (d) the Andean region.

Data were extracted from the final group of papers by applying parameters set *a priori* and *a posteriori*, as follows:

a. *A priori* parameters:

• ***Related to research focus:*** (i) research type; (ii) disciplinary approach; (ii) country of research; (iv) duration of the research (in case of empirical work); (v) approach to biodiversity; (vi) approach to climate change adaptation and mitigation; (vii) gender differentiation; (viii) geographic identity; (ix) cultural identity; (x) women's roles; and (xi) generation analyzed.

• ***Related to women's role in management of terrestrial ecosystems:*** (i) type of management; (ii) biological scale of the biodiversity managed; (iii) time scale of the management activity carried out by women; (iv) type of effect from the management applied; (v) ecosystem functions positively affected; (vi) ecosystem functions negatively affected; (vii) type of knowledge applied; (viii) actors affected by women's activities related to ecosystem management; (ix) geographic scale of the contributions of women's ecosystem management; and (x) women's participation in benefit sharing.

• ***Related to the relevance of women's management of terrestrial ecosystems:*** (i) relevance to climate change; (ii) relevance to the water–food–energy nexus approach; and (iii) relevance to the SDGs considered in the study.

• ***Related to contextual factors:*** (i) land ownership; (ii) form of organization for carrying out ecosystem management; and (iii) type of contextual factors affecting women's agency (according to the factors addressed in the article).

b. *A posteriori* parameters:

• Complementary elements related to the *a priori* aspects characterized.

• General aspects: (i) policy-relevant factors; (ii) linkages between biodiversity and climate change; and (iii) elements relevant for gender responsiveness.

The extracted data were consolidated in an Excel matrix that, under the parameters used in the in-depth reading of articles, allowed for a qualitative data synthesis applying nominal scales for each set of analysis.

2.3 Phase III. Analysis of the Information

The analysis of the information followed a thematic interpretative approach of the data collected. This analysis considered frequently reported information, complemented with examples from situations or processes, attempting to portray the variety of issues addressed as well as issues seldom documented in the literature.

The analysis was guided by specific research questions (listed below) with the intention to integrate the findings (abstraction stage). In this process, the extracted and consolidated data were subjected to two subsets of interrelated analysis:

(A) Quantitative analysis. This refers to the arithmetical consolidation and numeric representation of the extracted and consolidated nominal data, according to the guiding *a priori* and *a posteriori* parameters.

(B) Qualitative analysis. This includes the reflections on: (a) the contextual factors influencing women's agency in ecosystem management; (b) women's approach to these contextual factors; (c) the relevance of the findings from a global policymaking perspective, with a focus on the SDGs; and (d) knowledge gaps.

The combination of these two analytical approaches allowed the researchers to answer the following questions in relation to the Andean region:

a. What are the key features of the literature reporting on women's management of terrestrial ecosystems?

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b. What are the documented roles of women's management of terrestrial ecosystems?

c. What are the contextual factors that influence women's agency in the management of terrestrial ecosystems, and what is women's approach toward these factors?

d. What are the key knowledge gaps in the literature?

e. What is the relevance of the findings regarding conservation and sustainable use of biological diversity, adaptation to climate change, and the corresponding SDGs (SDG 13 and 15)?

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03

WOMEN AND ECOSYSTEM MANAGEMENT IN THE ANDES AS REPORTED IN THE LITERATURE

The process of retrieval according to the search syntaxis used yielded a total of 507 documents (457 from Scopus and 150 from Scielo). From this, 139 articles were preliminary selected. After an in-depth reading, a total of 95 papers were integrated in the review.

3.1 Findings Regarding the Research Focus Applied

3.1.1. Research Type and Disciplinary Approach

More than 80 percent of the reviewed literature reports on findings from empirical research, both qualitative and quantitative (Table 2). As a result, most of the studies and conclusions are based on field observations and/or measurements. Methodological reflections on the research topic —management of terrestrial ecosystems by women in the Andes—is limited, perhaps because of the search criteria used in this work. Based on this, it may be worthwhile to conduct additional research on the methodological approaches and gaps. Information on the latter —methodological gaps— is particularly important considering that more than two-thirds of the research (77 percent) has a social focus, with an interdisciplinary ecological (33 percent), economic (32 percent), or cultural (12 percent) emphasis (Table 3).

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The transdisciplinary approach[1] is rather limited (8 percent) in the papers reviewed, reflecting the shortcomings in the dialogue of disciplines to co-produce knowledge on women's roles in terrestrial ecosystem management in the Andes (Mauser et al. 2013; Max-Neef 2005).

Within the papers with a social focus, common topics addressed are traditional knowledge and practices (mainly on seed production and medicinal plants), and women's participation in care and productive activities (e.g., agriculture, harvest exchange, and involvement in commercialization circuits). The social focus is by no means negative; yet, such strong concentration found in the literature on the social dimension of women's roles in terrestrial ecosystem management fails to recognize their contributions at the ecological and political level. In the articles with an ecological (two papers) and biological (three papers) perspective follow a very specific disciplinary approach and are concerned with the effects of ecosystem degradation (e.g., Arancibia et al. 2019) and the health impacts of ecosystem management activities in which women participate (e.g., Cuenca et al. 2019). Three papers have a political perspective addressing violence against women (Acosta 2018), economic issues affecting them (Arguello 2010), and land restitution and gender justice (Meertens 2015). Once again, while these topics are important, they do not reflect the wide spectrum of roles and contributions of women in ecosystem management at the ecological and political level.

The ecological relevance of women in terrestrial ecosystem management are mostly addressed in papers with a socio-ecological and transdisciplinary approach, combining the analysis of productive and care activities. These highlight the conservation of on-farm agrobiodiversity, forests, and grasslands as a result of sustainable management (i.e., agroecological and traditional farming), and include a few examples of pastoralism and harvesting from the wilderness.

[1] While the "interdisciplinary" approach focuses on the interactions and complementation of specific disciplines, the 'transdisciplinary' approach goes further by establishing links and transcends specialized fields of knowledge to foster a more integrative, holistic, dynamic, and co-produced analysis of whole systems (Choi and Pak 2006; Nicolescu 2010).

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TABLE 2. RESEARCH TYPE	
Empirical	83%
Analytical / essay-type	14%
Methodological	3%
Theoretical	0%
Total	100%

TABLE 3. DISCIPLINARY APPROACH	
Socio-ecological	33%
Socio-economic	32%
Socio-cultural	13%
Transdisciplinary	8%
Biological and/or ecological	5%
Political	3%
Economic	1%
Others	5%
Total	100%

3.1.2. Country of Research

Except for Venezuela (none of the papers relate to this country), the research is fairly equally distributed among the Andean countries, either specifically or jointly with others (Table 4). In the literature, there is a slight predominance of research in Peru (21 percent of the articles), with an emphasis on women's terrestrial ecosystem management in traditional agricultural or agroecological systems, focusing exclusively or in part on indigenous knowledge. The second most referred country is Argentina (17 percent), where ecosystem management relates to different types of agricultural production (e.g., traditional, agroecological, and conventional) and, to a lesser extent, home gardens. The research in Bolivia, Chile, and Colombia considers wild harvesting, and some of the studies in Argentina, Bolivia, and Ecuador refer to the effects from the use of agricultural pesticides.

In general, the research that addresses specific elements of climate change is scarce. In a range of 4 to 6 articles per country, Bolivia, Ecuador, and Peru are mentioned in the context of climate change, mainly from the perspective of adaptation. Regarding the SDGs, the SDG 5 (gender equality) is addressed in a limited number of papers, mostly indirectly, in the research in Peru and Colombia.

TABLE 4. COUNTRY OF RESEARCH	
Argentina	17%
Bolivia	11%
Chile	15%
Colombia	14%
Ecuador	16%
Peru	21%
Venezuela	0%
Varios	7%
Total	100%

3.1.3. Duration of the Empirical Research

In the literature reviewed, 39 percent refers explicitly to short-term empirical research (less than 3 years), while 9 percent and 8 percent of the literature referencing medium- (between 4 and 10 years) and long-term (more than 10 years) research, respectively (Table 5).This distribution reveals that the empirical research on the management of terrestrial ecosystem by women in the Andes consists primarily of very specific appraisals in terms of time, which may prevent the identification and understanding of long-term social-ecological trajectories (Leach et al. 2010). Additionally, almost a third of the papers with empirical content do not clearly indicate the years of study, preventing a temporal contextualization of the reported findings.

TABLE 5. DURATION OF THE EMPIRICAL RESEARCH	
Short-term (< 3 years)	39%
Medium-term (4 – 10 years)	9%
Long-term (>10 years)	8%
Not clear	28%
Not applicable	17%
Total	100%

3.1.4. Approach to Biodiversity and Climate Change Adaptation and Mitigation

Regarding the ***biodiversity*** managed by women in terrestrial ecosystems, most of the papers have an emphasis on species or ecosystem, either separately or in relation to other levels of biodiversity (e.g., varieties) (Table 6). An important portion of the articles reviewed (41 percent) are vague on the biological scale of analysis, providing very general indications of landscapes or biomes. This avoids identifying the biological levels where women have management roles in terrestrial ecosystems.

A small group of papers concentrate on crop ***varieties***, referring mainly to different varieties of potato (*Solanum*

tuberosum), beans *(Phaseolus vulgaris)*, maize *(Zea mays)*, quinoa *(Chenopodium quinoa)*, and ulluco *(Ullucus tuberosus)*. In these studies, the focus is on women's role in the conservation of native varieties through seed production and cultivation in traditional agroecosystems. Regarding seed production, it is reported that women mostly produce their own seeds or obtain them from within their communities. The increase in the relevance of women's role in seed management and the conservation of native varieties due to the feminization of agriculture is reported in research such as Zimmerer (2003b). The management of native agrobiodiversity is also linked to wider aspects of welfare: "landrace-level agrobiodiversity use and knowledge are considered as enabling capacities for food cultivation amid environmental constraints, e.g., soil moisture, and ensuring food access; these resources can, in turn, aid social-ecological resilience […] Women comprise the large majority of persons providing the labor and knowledge for the use of diverse maize landraces." (Zimmerer 2014, n.p.).

Rafael Rodriguez

Some papers also refer to ***species***. Both vegetal (mainly horticultural cropping and infrequently those used in agroforestry systems) and animal (i.e., small-sized domestic animals) species are studied.

According to the literature, the ***ecosystems*** managed by women in the Andes include particularly: (i) agroecosystems, dedicated mostly to crop production, and, to a lesser extent, agroforestry; (ii) wilderness referring to flora gathering (e.g., medicinal and ornamental plants as well as flora used in local rituals); and (iii) grasslands native pastures for producing small- (e.g., sheep) and medium-sized (e.g., llamas and alpacas) animals. Valdivia et al. (2013, p. 77) describe that "Aymara women are stewards of the rangelands, because they have been traditionally in charge of livestock herding and management." In a previous study, Valdivia (2001, p. 29), clarifies that women's roles in the decision-making of native pastures is subject to income generation: "[…] in activities that are not mayor cash income generating, or deal with herding, women take the lead in decisions regarding the management of grazing areas."

In terms of ***climate change***, 17 percent of the articles reviewed show that women's management of terrestrial landscapes is focused on adaptation (Table 7). Here, the main approaches are traditional agriculture and agroecological farming, in many cases integrating local crop and animal agrobiodiversity to foster more resilience. Zimmerer (2014, n.p.) states that "[l]andrace diversity can aid the capacity for […] resilience in the context of global environmental and socioeconomic changes that include climate and development shocks." In the literature reviewed, there is scarce integration of adaptation and mitigation approaches, and when addressed, it is mainly in papers related to agroecological management.

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In an important number of papers (34 percent), the approach to climate change is not clear, as its possible influence on women's ecosystem management is usually not explicitly addressed. This is a critical knowledge gap, especially considering: (i) the contributions to biodiversity conservation by women practicing biodiverse farming in traditional or agroecological systems and the role of biodiversity in climate change adaptation and mitigation; and (ii) the increasing feminization of agriculture placing rural women at the center of climate change processes.

TABLE 6. APPROACH (SCALE) TO BIODIVERSITY	
Species	21%
Varieties	1%
Ecosystems	21%
Various*	16%
Not indicated / unclear	41%
Total	100%

* Various refer to the combination of the different pre-defined criteria for consolidating the data.

TABLE 7. APPROACH TO CLIMATE CHANGE ADAPTATION AND MITIGATION	
Adaptation	17%
Adaptation + mitigation	5%
Mitigation	1%
Not clear	34%
Not applicable	43%
Total	100%

3.1.5. Gender and Generation Approach

Combining the articles that concentrate only on women or refer to them and other sexes, the majority (91 percent) make a clear distinction between women and men in terms of roles and management responsibilities (Table 8). This is a relevant and positive feature of the literature, as common "gender" indications avoid recognizing the activities, knowledge, and strategies exercised by women.

Referring to the generations involved in ecosystem management, 57 percent of the research documents relate to adult women, and 31 percent have a multi-generational approach, integrating adult women and girls (Table 9). References to girls and children often concentrate on two processes: (i) sharing women's care and productive tasks with children (mostly animal herding) (e.g., Valdivia 2001); and (ii) women's childcare activities and expenses covered with the income they generate from agricultural production and animal husbandry (e.g., Suárez et al. 2018). Irrespective of this multigenerational approach, there is a predominant gap in the reviewed research on the roles of girls and female elders in terrestrial ecosystem management in the Andes.

TABLE 8. GENDER DIFFERENTIATION	
Women	59%
Women + other sexes	32%
Not clear	9%
Total	100%

TABLE 9. GENERATION RESEARCHED	
Girls	1%
Youth	3%
Adults	57%
Elders	1%
Multi-generation	31%
Not clear	7%
Total	100%

3.1.6. Identities Addressed

Rural identities dominate the research (80 percent), followed by mixed ones (12 percent). The latter includes to rural and (peri)urban women mostly as agricultural workers in conventional systems (Table 10). As for cultural identity, the literature centers on peasant women (36 percent) and indigenous peoples (34 percent) (Table 11).

TABLE 10. GEOGRAPHIC IDENTITY	
Rural	80%
Peri-urbana	2%
Urban	3%
Mixed	12%
No clear	2%
Not applicable	1%
Total	100%

TABLE 11. CULTURAL IDENTITY	
Peasant	36%
Indigenous	34%
Afro	0%
Urban	1%
Various*	8%
Others**	2%
Not clear	15%
Not applicable	4%
Total	100%

* Various refer to the combination of the different pre-defined criteria for consolidating the data.
** Others refer to categories not included in the pre-defined criteria for consolidating the data.

3.1.7. Women's Roles in Ecosystem Management

More than two-thirds (71 percent) of the papers reviewed refer to both care and productive roles in relation to women's terrestrial ecosystem management, while 22 percent deal only with their productive activities (Table 12). The roles of women in ecosystem management are approached in the literature mainly from a social perspective.

Regarding ***productive roles***, women are mentioned as engaged in small-scale farming and peasant agriculture in 37 percent and 18 percent of the documents, respectively (Table 13). In 23 percent of the research papers, it is reported that they also have a combination of different responsibilities highlighting women's multiple productive tasks, such as agricultural activities (i.e., diversified production, mainly for family or local consumption and seed production), wild harvesting, care of small-sized farm animals, and/or pastoralist activities. In the literature reviewed, none of the studies indicate that women are exclusively dedicated to one production activity. Other tasks performed by women are fishing, support in husbandry of large ruminants (e.g., dairy cattle), ecotourism, commercialization of their own or the whole household's produce, and participation in paid labor in the agroindustrial farming and agricultural export sector.

In terms of women's ***care roles***, various responsibilities are mentioned in 43 percent of the literature, followed by the specific tasks of food preparation (8 percent) and health care (7 percent) (Table 14). The category "various responsibilities" includes a wide diversity of care roles. Besides food preparation, it is documented that women are involved in early childhood education, recreational activities for children, elderly care, provision of clothing, cleaning and other domestic chores, drying and storage of medicinal plants, firewood collection, preparation of inputs for social and ritual events, and follow-up communal activities, among others. This wide range of roles highlights the socioeconomic importance of activities performed by women that are directly or indirectly related to ecosystem management.

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TABLE 12. WOMEN'S ROLES	
Care	3%
Productive	22%
Care + productive	71%
Not clear	1%
Not applicable	3%
Total	100%

TABLE 13. WOMEN'S PRODUCTIVE ROLES	
Peasant agriculture	18%
Farming – small scale	37%
Farming – other scales	1%
Harvesting from the wild	3%
Farm worker – local	5%
Farm work – immigrant	2%
Varius*	23%
Others**	5%
Not clear	3%
Not applicable	2%
Total	100%

* Various refer to the combination of the different categories pre-defined criteria for consolidating the data.

** Others refer to categories not included in the pre-defined criteria for consolidating the data.

TABLE 14. WOMEN'S CARE ROLES	
Food preparation	8%
Health	7%
Education	1%
Protection	2%
Varius*	43%
Others**	9%
Not clear	9%
Not applicable	19%
Total	100%

* Various refer to the combination of the different categories pre-defined criteria for consolidating the data.
** Others refer to categories not included in the pre-defined criteria for consolidating the data.

3.2 Findings Related to Women's Role in Terrestrial Ecosystem Management

3.2.1. Management Roles

Basically half (49 percent) of the research papers show that women involved in the management of terrestrial ecosystems focus on their use, followed by a combination with activities related to conservation (41 percent) (Table 15). A small number of studies concentrate merely on conservation, referring to plant genetic resources preserved by women, especially those from indigenous peoples (e.g., Parada and Salas 2019 regarding the Mapuche nation).

In the research focused on the ***use of ecosystems***, most of the reviewed literature involves small-scale women farmers who primarily use communal

lands for combing crops with animal husbandry (Table 16). One-fourth of the papers (26 percent) refer to traditional agriculture, 16 percent to agroecological management, and 21 percent to conventional agriculture.

The research on conventional agriculture deals with the pollution and health effects of agricultural pesticides, over-exploitation, and its impact in terms of ecosystem deterioration (e.g., Meertens 2015; Zimmerer 2003). It is also addressed the challenges that conventional agriculture represents to rural women's agency from a socio-productive perspective (e.g., Paulson 2003). For instance, some papers analyze the impact of intensive and commercial agricultural production on women's conservation and productive activities. Valdivia (2001, p. 33) notes that "[w]ith alfalfa [production replacing native pastures], the amount of fields in fallow decreases, with a potential negative impact on women that depend on these for herding sheep".

In the studies on the management that combines both ***conservation and the use of ecosystems,*** none refer to conventional agriculture; instead, they specifically indicate traditional agriculture and agroecology. This underlines the relevance of traditional and agroecological knowledge and practices in the sustainability of women's ecosystem management. In 17 percent of the studies, various forms of conservation and use management are combined (e.g., grazing or cropping with wild harvesting), and a few papers address only wild harvesting, focusing mainly on the use of medicinal and ornamental plants.

Among all the different types of women's ***ecosystem uses***, the most frequently referenced in the literature is traditional agriculture (by itself or

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combined with conservation), followed by agroecological production and wild harvesting (Table 16). Almost half of the research papers (49 percent) mention women's involvement in sustainable ecosystem management, which occurs primarily on communal lands.

In summary, the most frequent indications of women's participation in ecosystem management includes: (i) decisions regarding the types of crops to plant for household consumption and the agrobiodiversity to be preserved; (ii) implementation of a combination of agriculture and forestry; and (iii) ecotourism.

Rural Andean women's notorious involvement in different versions of biodiverse agriculture has at least three implications for their roles in ecosystem management:

1. Biodiversity and soil conversation, as well as their corresponding ecosystem functions (Altieri 2021; FAO 2016). This resulting from the agriculture Andean women tend to practice, particularly agroecology and other forms of biodiverse traditional farming.

2. Strengthening the multifunctionality of ecosystem management, such as from agroecology, that assists them in fulfilling various productive and care roles because it adapts to their constrained circumstances, which include limited access to productive resources (e.g., see Zuluaga-Sánchez & Arango-Vargas 2013, included in the literature review and supported by complementary research reported by Llanque et al. 2018; Siliprandi 2015; and Velarde Ponce de León & Catacora-Vargas 2021).

3. Sustainable management of the commons primarily through communal land organization schemes.

TABLE 15. FOCUS OF ECOSYSTEM MANAGEMENT

Conservation	2%
Use	49%
Conservation + use	41%
Not applicable	7%
Total	100%

TABLE 16. TYPES OF USES IN ECOSYSTEM MANAGEMENT		
Sustainable management	Traditional agriculture	26%
	Agroecological production	16%
	Harvest from the wild	5%
	Agroforestry systems	2%
Conventional agriculture		21%
Eco-tourism		1%
Varius*		17%
Others**		3%
Not clear		1%
Not applicable		7%
Total		100%

* Various refer to the combination of the different categories pre-defined criteria for consolidating the data.
** Other refers to categories not included in the pre-defined criteria for consolidating the data.

3.2.2. Geographic and temporal scales of Women's Ecosystem Management

Almost half (47 percent) of the literature reviewed refers to the ***physical / geographical scale*** of women's terrestrial ecosystem management as small-scale (Table 17). About one-fourth of the papers (26 percent) refer to the scale of women's ecosystem management as "various," which includes a combination of small- and large-scale communal lands or commercial cropping (the latter, in terms of providing assistance to their partners).

Small-scale management takes place mostly in reduced farming plots (38 percent) and household producción of vegetables and domestic animals (32 percent) (Table 18). Zimmerer (2003a) indicates that plots have an area less than two hectares per household. As for medium-scale management, it often is implemented in communal lands (24 percent) (Table 19), while large-scale management (18 percent) is applied in relation to ecosystems, landscapes, or territories (Table 20). These different scales of management demonstrate not only the multitasking but also the multiscale nature of women's care and productive roles.

Regarding ***temporal scales***, more than one-third of the reviewed literature (35 percent) describes women as being involved in the management of terrestrial ecosystems for periods longer than ten years (Table 21). This points to the long-term relevance of the women's ecosystem management, particularly small-scale and communal traditional agriculture through biodiverse systems (see sub-section 3.2.1). Another 18 percent of the papers are about women's short term (less than 5 years) ecosystem management, while 31 percent of the research is not clear on the temporal scale.

TABLE 17. SCALE OF WOMEN'S ECOSYSTEM MANAGEMENT	
Small scale	47%
Medium scale	12%
Large scale	5%
Various*	26%
Not clear	1%
Not applicable	8%
Total	100%

* Various refer to the combination of the different pre-defined criteria for consolidating the data.

TABLE 18. TYPE OF SMALL-SCALE MANAGEMENT	
Household garden	32%
Community garden	1%
Family greenhouse	0%
Small-scale plot	38%
Others	2%
Not clear	3%
Not applicable	24%
Total	100%

TABLE 19. TYPE OF MEDIUM-SCALE MANAGEMENT	
Communal ecosystem	24%
Surrounding ecosystem	3%
Others	4%
Not clear	3%
Not applicable	65%
Total	100%

TABLE 20. TYPE OF LARGE-SCALE MANAGEMENT	
Ecosystem	8%
Landscape	6%
Territory	4%
Not clear	4%
Not applicable	77%
Total	100%

TABLE 21. TIME SCALE OF WOMEN'S ECOSYSTEM MANAGEMENT ACTIVITIES	
Short term <5 years	18%
Medium term (6 to 10 years)	6%
Long term >10 years	35%
Not clear	31%
Not applicable	11%
Total	100%

3.2.3. Effects from Women's Management of Terrestrial Ecosystems

A bit more than one-fourth of the reviewed literature (26 percent) indicates that the main effect of women's management of ecosystems is conservation, followed by restoration (11 percent) (Table 22). This relates to research on women engaged in biodiverse production systems i.e., traditional agriculture, agroecology, and agroforestry (e.g., Cid and Latta 2005; Deaconu et al. 2019; Fadiman, 2005; Finerman and Sackett 2003; Gray 2009; Home and Vieli 2020; Mathez-Stiefel et al. 2016; Mann 2019). Pollution (9 percent of the papers) and overexploitation (6 percent) are also addressed in the studies on medium- to large-scale scale conventional agriculture.

Concerning the ***ecosystems positively affected*** by women's management, 39 percent of the literature reviewed report joint effects ("various" and "others" in Table 23), mainly on ecosystem functions such as water and nutrient cycling improved by the biodiverse production systems they implement. The studies dealing with both women's ecosystem use and conservation mention the maintenance and enhancement of agrobiodiversity. In many cases, agrobiodiversity also includes animal husbandry, with an integration of agroecological and/or traditional production of crops. The literature refers to the role of trees in terms of production and conservation, providing habitat for both domesticated animals and wildlife (e.g., Mathez-Stiefel et al. 2016), enhancing sustainability in grazing systems (e.g., Valdivia 2001), and maintaining forest landscapes. For example, Fadiman (2005) studied the multi-purpose traditional system of the Chachi people in Ecuador and found that they (including women) keep most of their land as forests. Another important activity to ensure the sustainable use and conservation of ecosystems is soil management by recycling of nutrients (e.g., using vermicompost and incorporation of organic matter) or implementing locally adapted technologies (e.g., infiltration and retention ditches, terraces, contour ridges, minimum tillage, and management of water streams) (Hidalgo Zapata et al. 2019; Huenchuleo et al. 2012).

Ecosystems negatively affected by women's management relate directly or indirectly to conventional agriculture. In addition to detrimental impacts on soil erosion and water and nutrient cycling, the literature also refers to a decrease in the possibility of restoration (Table 24). Furthermore, research on conventional agriculture reports the loss of women's traditional knowledge, forced migration, pesticide exposure, and intrafamily and other forms of violence (usually linked to production and income stress) (e.g., Paulson 2003; Peredo Parada & Barrera Salas 2019; Perona 2012).

TABLE 22. TYPE OF EFFECT FROM WOMEN'S ECOSYSTEM MANAGEMENT	
Conservation	26%
Restoration	11%
Re-valuation	2%
Degradation	3%
Over-exploitation	6%
Pollution	9%
Others	8%
Not clear	26%
Not applicable	7%
Total	100%

TABLE 23. ECOSYSTEM FUNCTIONS POSITIVELY AFFECTED BY WOMEN'S ECOSYSTEM MANAGEMENT	
Water cycling	0%
Erosion / landslide prevention	1%
Pollination	0%
Soil nutrient cycling	4%
Climate regulation	1%
Varius*	18%
Others**	21%
Not clear	34%
Not applicable	21%
Total	100%

* Various refer to the combination of the different categories pre-defined criteria for consolidating the data.
** Others refer to categories not included in the pre-defined criteria for consolidating the data.

TABLE 24. ECOSYSTEM FUNCTIONS NEGATIVELY AFFECTED BY WOMEN'S ECOSYSTEM MANAGEMENT	
Water cycling	2%
Erosion / landslide prevention	3%
Pollination	0%
Soil nutrient cycling	4%
Climate regulation	0%
Varius*	11%
Others**	14%
Not clear	41%
Not applicable	25%
Total	100%

* Various refer to the combination of the different categories pre-defined criteria for consolidating the data.

** Others refer to categories not included in the pre-defined criteria for consolidating the data.

In relation to the ***people affected*** by women's terrestrial ecosystem management, the members of the woman's own household (43 percent) and communities (14 percent) are the most salient in the literature revised (Table 25). Consistent with previous analysis, the affected geographic scale concentrates also on the household and the community (Table 26). The findings suggest that more attention is needed to the effects of women's management on larger scales, such as ecosystems.

TABLE 25. ACTORS AFFECTED BY WOMEN'S ECOSYSTEM MANAGEMENT	
Women	11%
Men	1%
Children	4%
Elders	0%
Whole household	43%
Organization	1%
Community	14%
Sector	3%
Varius*	17%
Not clear	3%
Not applicable	3%
Total	100%

* Various refer to the combination of the different categories pre-defined criteria for consolidating the data.

TABLE 26. GEOGRAPHIC SCALE OF THE EFFECTS OF WOMEN'S ECOSYSTEM MANAGEMENT	
Small scale / Household	51%
Medium scale / Community	14%
Large scale / Ecosystem	6%
Large scale / Ecosystem functions	9%
Varius*	9%
Not clear	5%
Not applicable	5%
Total	100%

* Various refer to the combination of the different categories pre-defined criteria for consolidating the data.

3.2.4. Knowledge

The reviewed literature revealed three main types of knowledge that women applied in their management of terrestrial ecosystems (Table 27): (i) indigenous (22 percent) and peasant (19 percent), and the combination of one of these with technical knowledge (26 percent); (ii) technical (12 percent), mainly related to agricultural extension services in conventional agriculture; and (iii) academic, which only occurs in a few records (2 percent), generally in papers on climate change.

The traditional knowledge reported has a high level of detail and specificity, particularly the one described in indigenous communities. For instance, Nahuelhual et al. (2008, p. 101) indicate that between "78% and 95% of the local plants have known uses" by indigenous women in the community of San Juan de La Costa, Chile (Valdivian Rainforest Ecoregion), who harvest and sell wild ornamental flora.

Regarding the analysis of gender studies on the application of knowledge, Arias Toledo & Trillo (2018) argue that it is not enough to measure and recognize differences in the level of expertise (e.g., identification of plant species). Importantly, the social-ecological context where knowledge is developed and used also needs to be addressed to identify crucial "differences in the way in which men and women transit and appropriate the environment" (p. 2). For instance, they indicate that "[w]omen tend to be responsible for the maintenance of family health through the knowledge and application of wild medicines while men know significantly more about woody species" (p. 2).

TABLE 27. TYPE OF KNOWLEDGE APPLIED BY WOMEN IN ECOSYSTEM MANAGEMENT	
Indigenous	22%
Peasant	19%
Indigenous or peasant + technical	26%
Technical	12%
Academic + other types of knowledge	2%
Others	3%
Not clear	12%
Not applicable	4%
Total	100%

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3.2.5. Benefit Sharing

The use of ecosystems is linked to women's productive activities (e.g., agriculture or wild harvesting), from which some participation in benefit sharing emerges (addressed in 38 percent of the literature reviewed) (Table 28). In 15 percent of the literature that relates to the use of ecosystems, there is no indication of benefit sharing, and it is unclear in 23 percent of the papers. When benefit sharing does occur, it is reported to be monetary (13 percent of the papers), in-kind (9 percent, in terms of land use, access to seeds, knowledge sharing, and access to harvests), or a mix of both (16 percent) (Table 29).

Women tend to use the benefits they accrue, particularly monetary, to

maintain their autonomy in decision-making regarding the productive activities they carry out or participate in (particularly in commercialization). Nahuelhual et al. (2008) also state that in the case of monetary and in-kind benefits, women to use them, primarily if not exclusively, for household needs (e.g., children's schooling, clothing, etc.).

TABLE 28. WOMEN'S PARTICIPATION IN BENEFIT SHARING DERIVED FROM ECOSYSTEM MANAGEMENT	
Yes, they participate	38%
No, they don't participate	15%
Not clear	23%
Not applicable	24%
Total	100%

TABLE 29. TYPE OF BENEFIT SHARED WITH WOMEN FROM ECOSYSTEM MANAGEMENT	
Monetary	13%
In-kind	9%
Mixed	16%
Not applicable	38%
Not clear	24%
Total	100%

04

CONTEXTUAL FACTORS INFLUENCING WOMEN'S ECOSYSTEM MANAGEMENT IN THE ANDES

4.1 Contextual Factors Affecting Women's Agency

There are various contextual factors that affect women's agency in terrestrial ecosystem management. In the literature analyzed, the most frequently mentioned are ecological (in 14 percent of the papers, referring mainly to ecosystem degradation), institutional (12 percent), and economic (12 percent). A combination of these and other contextual factors are addressed in 44 percent of the papers (Table 30).

TABLE 30. TYPE OF CONTEXTUAL FACTORS AFFECTING WOMEN'S AGENCY IN ECOSYSTEM MANAGEMENT

Regulatory	3%
Institutional	12%
Infrastructural	4%
Services	3%
Socio-cultural	2%
Ecological	14%
Economic	12%
Varius*	22%
Others**	22%
Not clear	5%
Not applicable	1%
Total	100%

* Various refer to the combination of the different categories pre-defined criteria for consolidating the data.

** Other refer to categories not included in the pre-defined criteria for consolidating the data.

- **Ecological Factors**

i. Expansions of conventional agriculture in ecosystems where women carry out their own activities (e.g., wild harvesting or grazing small animals). For example, Valdivia (2001) illustrates the effects and tradeoffs involved in the expansion of alfalfa monocrops in areas of natural pastures used by women. The author reports that alfalfa is used to feed cattle, which are managed by men, and the land devoted to it reduces natural pastures, resulting in fewer areas for women to graze their animals and to implement fallow rotation; moreover, it increases ecological pressure on remaining grasslands and the management and productive challenges for women.

ii. Pollution from the use of agricultural pesticides. The literature reports that the increase in areas dedicated to conventional agriculture is associated with a rise in pollution from pesticide, which particularly has a negative effect on small-scale production (Alwang et al. 2017). The research papers reviewed on this issue link human and environmental health problems with the use of agricultural pesticides, especially among women (Cuenca Barrón et al. 2019).

In the analyzed research, these ecological factors relate to other systemic challenges affecting women's ecosystem management. Some of them involve the persistent and increasing inequities in the determinants of health in the Andes (e.g., nutrition) (Cole et al. 2011). Other challenges are associated with the current model of globalization and the dominant food system, which exerts pressure to expand conventional and industrial agriculture and livestock production, even in ecologically fragile sites (e.g., hillsides).

• Institutional and Tenure Factors

Institutional factors that limit efforts to foster adequate conditions for women involved in ecosystem management include a lack of recognition of land tenure rights and limited support services, which are mainly adapted to men's conditions. For example, women have difficulties in obtaining credit and other economic assistance that would allow them to improve their livelihood opportunities (e.g., to incorporate adequate technologies into their production systems or projects) (Guzmán 2016).

Part of the literature mentions that the implementation of ***land rights*** rarely guarantees land tenure, access, and use to women, and community land management schemes are increasingly limited (Bose 2017; Deere, et al. 2001) or restrict women's land tenure rights (Wiig 2013). This is consistent with other research not included in the literature reviewed (e.g., Nobre et al. 2017). In general, in the majority of the papers, there is scarce focus on the institutional factors that impact land tenure, and 36 percent of the papers refer to women who own land either individually (the least common) or collectively (the most frequent), while only 4 percent deal with landless women (Table 31). Moreover, 44 percent of the literature does not specify the type of land ownership of the ecosystems managed by them, adding to the lack of consideration and visualization

TABLE 31. LAND OWNERSHIP BY WOMEN IN THE ECOSYSTEMS THEY MANAGE

Owner	36%
Renter	0%
Landless	4%
Not clear	44%
Not applicable	16%
Total	100%

In terms of the ***types of organizations*** related to ecosystem management in which women are involved in, the literature focuses primarily on indigenous (16 percent) and local community (12 percent) organizations (Table 32). Participation in peasant associations and unions is scarcely mentioned (in 5 percent of the papers). All together represent 33 percent of the research referring to women joining organizations that include both sexes. Only 13 percent of the papers refer to those specifically created for women, which have distinctive advantages for them, such as more opportunities for effective participation and companionship in shared challenges (Zuluaga Sánchez 2011; Zuluaga-Sánchez & Arango-Vargas 2013). However, mixed organizations also open up, to a certain extent, different possibilities. For example, Suárez et al. (2018) argue

that, "Being associated with [man] […] allowed [women] […] to participate in masculinized tasks, such as technical assistance, agricultural inputs, financing of productive projects and access to training. As a result, [women] […] were able to generate their own income and have greater autonomy in decision-making" (p. 162).

TABLE 32. TYPE OF WOMEN'S ORGANIZATIONS FOR MANAGING ECOSYSTEMS

Peasant association or union	5%
Indigenous organization	16%
Women's organization	13%
Community organization	12%
Civil society organization	1%
Varius*	3%
Others**	8%
No organization	6%
Not clear	21%
Not applicable	15%
Total	100%

* Various refer to the combination of the different categories pre-defined criteria for consolidating the data.

From a macro perspective, the institutional context described in the literature represents a problematic scenario not only for women, but also for whole communities and territories. For example, it relates to the increasing pressures for rural contexts to transition to agroindustrial monetary economies; economic crises and foreign debt affecting livelihoods; and weakened implementation of national and international regulations intended to foster sustainability and equality (D'Amico 2012; Leisher et al. 2016).

- **Economic Factors**

The literature frequently indicates that there are important differences in acknowledging productive and care work between women and men. This is a major contextual economic factor because of the normalization of women's care work as their inherent duty, even by themselves (Dorrego Carlon 2015). The result is unpaid, underpaid or underrecognized productive and care work (Perona 2012). For example, Maduekwe et al. (2019) report that many women working in Peru's agriculture sector are not adequately recognized for their work. Other contextual factors such as migration contribute to hiding while at the same time increasing women's productive activities. As example, Ataide (2019) explains that female migrants and their children in Argentina are under the tutelage of their husbands or patriarchal fathers. Valdivia et al.(2013, p. 79) describes that "migration wouldonly mean an increase on the demandson women's time and energy without empowering" those who remainin their communities.

The growth of value chains generates further limitations on women's participation in the monetary economy. Armbruster (2019) indicates that the cacao sector in Peru, although it has generated new income opportunities,

has constrained women's decision-making related to the organization and implementation of productive activities in the sector. In terms of agro-industrial production and value chains, Mingo Acuña Anzorena (2014) acknowledges that they have increased women's economic opportunities, but at comparatively lower salary rates than for men, and they are also subject to strong surveillance and pressure by their male co-workers or male partners. As mentioned before, other relevant and interlinked socioeconomic process include the feminization of agriculture, the corresponding overload of women's household work, and, therefore, limited opportunities to access paid jobs. According to Rivero Reyes (2002), "The increased burden of household and agricultural work placed on women in the absence of men posed an acute limitation to their ability to seek paid employment" (p. 62).

The disintegration of rural and peasant economies as a result of changes in rural-urban relations, violence, and illegal activities is another complex and multifaceted contextual factor found in the literature reviewed. According to Zuluaga Sánchez (2011, p. 5949), "The low profitability of peasant economies, the new rural-urban dynamics, illicit crops, and armed conflict negatively affect the conditions of peasant women, increasing their vulnerability while they continue to focus on the agricultural production of small plots and household responsibilities" [own translation from the original text in Spanish].

Miscellaneous or "other" contextual factors referenced in 21 percent of the literature reviewed (Table 32) relate to:

• **Services and physical infrastructure.** Many women lack access to technical assistance (which is also related to

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the institutional context) and socio-productive infrastructure (e.g., access to water).

• **Socio-cultural factors.** These include challenges to women's self-organization and participation in communal decision-making, male violence, erosion of women's self-esteem, and different types of discrimination. Rivero Reyes (2002) provides an example of the multi-faceted discrimination: "Discrimination against women means that women in rural [...] [areas] typically have low access to education, specialist technical assistance, healthcare, or control over the family's productive resources" (p. 61).

• **Regulations and policies.** The absence of differentiated regulatory frameworks, policies and statistics that visualize the realities of women means that "women's role in productive activities has been invisible in registers and statistics, and has not been widely recognized or appreciated" (Rivero Reyes 2002, p. 62).

4.2. Women's Approach to Contextual Factors Related to Terrestrial Ecosystem Management

Despite imposed limitations and challenges, Andean women implement different strategies to respond to the contextual factors that impact their management of terrestrial ecosystems. These can be summarized into socio-cultural, technical, and political approaches, which are interrelated and complement each other.

At the socio-cultural level, women deploy strategies regarding their own and their families' health and physical integrity. These include diversifying the sources of nutrition (e.g., through biodiverse production systems and wild harvesting), collecting medicinal plants from the wild, and, in some cases, resorting to abortion (Acosta et al. 2018). Women also participate in organizations, generally with the support of non-governmental organizations (NGOs), to access technical, financial, emotional, or other kinds of assistance (Zuluaga-Sánchez & Arango-Vargas 2013). Other important socio-cultural strategies that are also technical and political include: (i) participating in networks of peasant women as "seed curators" (Cid Aguayo 2015); (ii) the cultivation and commercialization of landraces (Zimmerer 2014); and (iii) agroecological production on whichever piece of land women have access to. Regarding agroecological production, Zuluaga Sánchez (2011, p. 5956) writes that that agroecological projects allow women to reduce the use of expensive hybrid seeds and agrochemicals, strengthening their autonomy and food sovereignty of their families.

At the technical level, besides applying their knowledge and skills in agroecological production, women are also active in organizing processing initiatives (Avellaneda-Torres 2017 illustrates the case of artisanal cheese production) and cooperatives to jointly pursue markets (Cuellar-Gomez 2009). These initiatives are combined with various self-consumption measures (Cabrera Verdezoto 2013). Moreover,

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many women are engaged in ecotourism to both manage ecosystems and carry out economic activities (D'Amico 2012).

At the **political level,** women participate in local organizations (Arguello 2010) to have a voice in communal decision-making (Valdivia et al. 2013). When possible, they create their own organizations (Deere 2001) or deal directly with existing structures (Córdoba 2020). Women have also been involved in legal court cases regarding their rights to land (Meertens 2015). However, women's political participation is affected by their level of schooling. According to Rivero Reyes (2002), literate women have more access to various types of support and are more likely to participate in decision-making processes. Ames (2013) reports that women gradually participate more when they have at

05

RELEVANCE OF THE FINDINGS IN GLOBAL DISCUSSIONS

The findings of this literature review contribute to relevant discussions on global socio-ecologic and political processes, such as the SDGs, the water–food–energy nexus, and climate change adaptation and mitigation.

5.1.Relevance to the Sustainable Development Goals

While the research findings are directly relevant to five SDGs, the papers reviewed do not explicitly refer to any of them (Cuadro 33). This is noteworthy considering that "SDGs" was included in the syntax search applied, and the topic of research directly relates to many of them.

• SDG 2 – Zero Hunger

Out of the documents reviewed, 8 percent are directly related to SDG 2 on achieving hunger and malnutrition eradication. The productive and care roles linked to women's ecosystem management are related and contribute to this SDG. In light of the context of limited access to resources (e.g., land and support services) and low-income generation among indigenous and small-scale peasant women, the management of biodiverse (agro)ecosystems —e.g., biodiverse traditional agriculture, agroecology, wild harvesting, and agroforestry systems (Table 16)— is especially important to safeguard the right to food and ensure adequate nutrition.

• SDG 5 – Gender Equality

Women's management of terrestrial ecosystems is in many ways relate to SDG 5 on achieving gender equality and empowering all women and girls. In institutional terms, it refers, for instance, to regulations aimed at securing women's rights to productive resources (e.g., land) and to live without violence. Acosta et al. (2018) describe a specific case in which indigenous women pursue mechanisms to guarantee access to justice in situations of sexual and territorial violence.

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Almost one-third of the research papers reviewed (32 percent) relate to gender equality, and the literature is relevant to the following indicators under SDG 5:

• **Indicator 5.1: End all forms of discrimination against women and girls.** The papers identify and address discrimination against rural women, especially issues related to the access to and tenure and use of land and biodiversity (including the ecosystems themselves). This also relates to international instruments, such as the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW). The research findings provide insights to reduce different forms of social, economic, and political violence against women, as well as to protect them from multiple forms of vulnerability. Increasing institutional support and socio-economic opportunities for rural Andean women to continue biodiverse production systems will be important to foster equitable opportunities to generate fair livelihoods from sustainable ecosystem management.

• **Indicator 5.4: Recognize and value unpaid care and domestic work and promote shared domestic responsibilities.** The literature addresses the lack of recognition of women's care work, which is a crosscutting problem that also interrelates with the recognition of women's productive work, particularly when it is carried out close to the household or in coordination with family members (e.g., husband or partner). Considering the various chores and the number of hours women dedicate to care work, it is important to recognize and implement efforts to reduce the share of unpaid care work performed by women.

• **Indicator 5.5: Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making.** The papers address important limiting factors and opportunities for women to participate in decision-making processes and realize their rights in terms of access to land, seeds, decent work, and fair remuneration, as well as to

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water, education, and health, among others. The realization of the rights of women who are indigenous, peasant, and/or small-scale farmers are in accordance with the UN Declaration on the Rights of Indigenous Peoples (UNDRIP), the UN Declaration on the Rights of Peasants and Other People Working in Rural Areas (UNDROP), specific provisions of CEDAW, the International Covenant on Civil and Political Rights (ICCPR), and the International Covenant on Economic, Social and Cultural Rights (ICESCR).

Guaranteeing formal land and labor rights for women is related to SDG 5 and is a crosscutting issue described in the literature as an enabling factor to implement sustainable agricultural and land management (Deere et al., 2001; Deere 2014). Efforts to improve women's labor rights while respecting their care activities are emerging in the Andean region, but they have been insufficient to date. For example, while women have become more visible in the labor force of the export agriculture, it has not been accompanied by policies to support them (e.g., provision of child care to temporary workers) (Bee 2000).

• SDG 12 – Responsible Production and Consumption

Concerning SDG 12 on ensuring sustainable consumption and production patterns, 19 percent of the literature is relevant in terms of connecting women's ecosystem management to their productive and care roles (i.e., food cultivation, preparation, and consumption). The studies reviewed show that biodiverse agricultural systems have an important relationship with SDG 12, among others. The literature links sustainable production and food systems through agroecology (Cid Aguayo 2015), which also increases the quality of the food consumed (Berti 2017; Deaconu et al. 2019), and the restoration of ecosystem functions that women's productive and care activities rely on. However, there are several examples in the literature that show the limitations of achieving SDG 12 through ecosystem management. This is the case of the expansion of conventional agriculture in the Andean region associated with an increase in pesticide use (Cole et al. 2011) and the corresponding human and ecological health effects (Maggioni 2018), pollution, and even worker exploitation (e.g., Korovkin 2003). These challenges prevent efforts to advance the establishment of sustainable consumption and production processes.

• SDG 13 – Climate Action

Although the literature search and retrieval specifically addressed climate change, only 4 percent of the papers reviewed in-depth is directly related to it in terms of women's terrestrial ecosystem management in the Andes. From the perspective of the multifunctionality of biodiverse production systems—the most reported type of ecosystem management by women in the research papers—complementary studies show that these systems contribute to restoring and enhancing different ecosystem functions relevant to climate change adaptation and mitigation (e.g., moisture retention and climate regulation as well as water cycling) (Altieri & Koohafkan 2008; IPCC 2020; iPES-Food 2016).

• SDG 15 – Life on Land

In the literature analyzed, 11 percent of the papers are relevant to SDG 15 in terms of agricultural management. Due to their characteristics, women's management of terrestrial ecosystems have both positive effects (mainly from sustainable biodiverse productions systems, such as traditional agriculture and agroecology) and negative effects (from conventional agriculture). This is linked to biodiversity and

indicator 15.1 on conservation and restoration of ecosystems resulting from agroecological and agroforestry systems, traditional management of landscapes, and sustainable wild harvesting.

One-fifth of the research papers are relevant to more than one of the SDGs, primarily SDG 2, 5, and 15. This highlights the interlinkages between women and ecosystem management and broader aspects of sustainability and welfare.

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TABLE 33. DISTRIBUTION OF THE REVIEWED RESEARCH BY RELEVANCE TO THE SDGS		
SDG 2 – Zero hunger		8%
SDG 5 – Gender equality	SDG 5 (general)	19%
	SDG 5.1 – End all forms of discrimination against women and girls	6%
	SDG 5.4 – Recognize and value unpaid care and domestic work and promote shared domestic responsibilities	4%
	SDG 5.5 – Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making	3%
SDG 12 – Responsible production and consumption		19%
SDG 13 – Climate action		4%
SDG 15 – Life on land	SDG 15 (general)	4%
	SDG 15.1 – Conservation and restoration of ecosystems	7%
Various*		20%
None		3%
Not applicable		1%
Total		100%

* Various refer to the combination of the different categories pre-defined criteria for consolidating the data.

5.2. Relevance to the Water–Food–Energy Nexus

Even though the water–food–energy nexus is not explicitly addressed in the literature search, almost half of the papers (46 percent) refer directly to at least one dimension of the nexus (food is referred to in 23 percent of the papers) and a combination of two dimensions (19 percent, primarily food and water) (Table 34). Specific links to water and energy are minimal (3 percent and 1 percent of the articles, respectively), which is noteworthy considering the benefits of biodiverse systems and the ecosystem functions they enhance regarding water and energy cycles.

TABLE 34 DISTRIBUTION OF THE RESEARCH ACCORDING TO ITS RELEVANCE TO THE WATER–FOOD–ENERGY NEXUS	
Water	3%
Food	23%
Energy	1%
Different aspects of the nexus	19%
Not clear	32%
Not applicable	22%
Total	100%

• Food

The nexus between women's ecosystem management and food materializes in health, nutrition, traditional gastronomy and agrobiodiversity conservation. It does this in terms of the varieties and species managed, as well as in the resulting quality and variety of food. For example, Peredo Parada & Barrera Salas (2019) mention the importance of diverse and healthy food production through agroecological processes managed by women. Moreover, Zimmerer (2003b) indicates that women contribute to seed production and landraces conservation. The same author argues that agrobiodiversity is a crucial element of traditional gastronomy and climate adaptation (Zimmerer 2014).

The literature also reports on the nexus between women's ecosystem management and food in the context of socio-political crisis (e.g., Zuluaga-Sánchez & Arango-Vargas 2013), systemic social processes such as the feminization of agriculture (Gisbert, 1994), and migration (Gray 2009). Additionally, the literature (e.g., Jørs et al. 2013) mentions ecological challenges such as agricultural pesticides polluting food and water systems, negatively affecting the health of people and ecosystems.

• Different Aspects of the Nexus

There are some links made in the literature between food and energy as well as soil and water in ecosystem management processes lead by women. For example, Rodriguez et al. (2018) refer to the relationship between food and energy in terms of collecting wood from the wild, and Zimmerer (2002) reports on the connection between soil and water conservation in terms of food production. These examples show the diverse impact of women's management of terrestrial ecosystems in the Andes on food, water, and energy resources. Moreover, the literature describes the effects of conventional agriculture based on monocrops, commercial seed varieties, and pesticides. Regarding the latter and in consistency with previous points, agricultural pesticides have been reported to affect water and soil cycles (Alwang 2018), resulting in ecological and food pollution (Cuenca Barrón 2019).

5.3. Relevance to Climate Change

The literature on women's management of terrestrial Andean ecosystem in terms of climate action (in line of what was presented under SDG 13) refers mainly to climate change adaptation (26 percent) (Table 35). Adaptation and mitigation jointly are scarcely addressed (6 percent), and mitigation alone was not identified in any of the research papers. Based on the findings, women's strategies seem to concentrate on seeking for resilience by adjusting to current changes. Part of the documents analyzed refers to the particular effects of climate change on women due to their reliance on ecosystems: "New challenges are occurring with respect to climate change, [...] dynamics that have especially affected women. These create numerous ripple effects because women are the family caregivers and stewards of natural resources" (Valdivia et al. 2013, p. 77). Still, few papers refer to women's participation in climate-related policies (e.g., Cook et al. 2019).

TABLE35. DISTRIBUTION OF THE RESEARCH ACCORDING TO ITS RELEVANCE TO CLIMATE CHANGE	
Adaptation	26%
Adaptation + mitigation	6%
Mitigation	0%
Not clear	39%
Not applicable	28%
Total	100%

06

FINAL REMARKS AND GAPS OF KNOWLEDGE

Based on the literature reviewed, women's ecosystem management in the Andes is characterized by four overarching features: (i) the simultaneous participation in different interrelated production and care activities directly dependent on the surrounding ecosystems, accompanied by multitasking and the investment of a large number of hours that often are not recognized; (ii) a focus on the management of biodiverse systems to fulfil production and care roles and achieve different degrees of resilience; (iii) the multiscale nature of the ecosystem management activities; and (iv) the implementation of the previous in contexts with a myriad of limitations resulting from the current institutional, economic, and cultural settings that place rural women in disadvantageous positions.

Regarding ***simultaneous productive and care activities, and the multiple tasks assigned and assumed by women***, Suárez et al. (2018) describe the following based on their field observations of women's ecosystem management in the Andes: "The women were mainly engaged in housework tasks, caring for children and grandchildren, and, in some cases, field work, taking care of and breeding farm animals such as chickens, hens, pigs, and rabbits. They also took care of crops and home gardens and produced and sold cheese, curds, arepas, [wraps] and desserts, among other products" (p. 162). Additionally, the authors observe that the number of hours that women dedicate to productive and care activities is remarkably high: "[W]omen spent more than 18 h a day on average on these kinds of activities, while their husbands or domestic partners devoted themselves mainly to farm work, jobs and livestock" (p. 162).

Moreover, Suárez et al. (2018) point out that "[in] more than 18 h per day [women dedicate] […] to their homes

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and families, producing and processing food, as well as participating in meetings, training, farmer's markets and other activities programmed by their association. […] They are the ones who participate in the whole agri-food chain, guarding seeds, sowing, harvesting, raising animals, milking animals, and processing and/or transforming food; at home, they are responsible for cleaning and keeping things in order; at the food level, they are responsible for selecting, storing, conserving, preparing, distributing, and serving food, making sure all family members have eaten. Also, they are always monitoring food quality and safety" (p. 163).

The multitasking and high number of hours per day devoted by women in productive and care activities are not new in the literature; yet, they remain without sufficient recognition. Perona (2012, p. 745) writes about how the multiple activities performed by women are often not acknowledged in society: "The woman who helps her spouse in planting, harvesting, marketing, administration, etc., is not the 'producer' but the 'producer's wife'. This is one way in which the

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contribution and work of rural women on family farms become invisible." [own translation from the original text in Spanish].

The biodiverse systems implemented and managed by Andean women are salient in the literature. The management of biodiverse systems (using agrobiodiversity cultivated and from the wilderness) has an important social, economic, and political function in supporting women's productive and care roles by adapting to their circumstances. In relation to this, Zuluaga-Sánchez & Arango-Vargas (2013) writes that, "agrobiodiversity has a high gender content, since it is woven by the interests and needs of peasant women in their task of generating food for their families while constituting themselves as subjects with autonomy" (p. 169). The authors point out that "the high diversity of [...] ecosystems is both a cause and a consequence guarding, preserving, and nurturing roles; that is, they gain diversity because they are in the hands of women, and that to the extent that they are more biodiverse, they are more feminized, which distances them from monocultures that have the market as a priority and that have traditionally been in charge of men" (p. 171) [own translation from the original text in Spanish]. Larrauri (2016) adds that diversified productive activities contribute to the family economy, food sovereignty, and biodiversity management, as they are a resilient response to climate change.

Together with the conservation, cultivation, and use of native varieties —particularly in traditional systems— the agroecological management contributes to rural women advance towards self-reliance and resilience. Agroecological approaches to ecosystem management are reported as transformative and able to strengthen women's agency in

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terms of their ecological, nutritional, and productive activities (Deaconu 2019), particularly in comparison to conventional agriculture (Peredo Parada & Barrera Salas 2019). Zuluaga-Sánchez & Arango-Vargas (2013) indicate that "the development of this awareness of the transformative power of agroecology is linked to the acquisition of greater autonomy for women. […] [given that this] awareness […] goes beyond the mere instrumental use of agrobiodiversity" (p. 170) [own translation from the original text in Spanish].

The manifold activities carried out by women in their surrounding ecosystems are multiscale, including to households, communities, and ecosystems themselves. As mentioned previously, the literature documents that rural women in the Andes (both indigenous and peasant) base their activities on biodiverse systems. While these are strategies to achieve autonomy and meet household care needs, they are also relevant at a larger scale, such as at the sustainability ecosystem level. Making explicit this bigger scale of influence prevents limiting women's care to the domestic sphere and its corresponding invisibility, which is a form of exclusion and, as such, can be regarded as a form of violence (Catacora-Vargas 2021). For that reason, another highly relevant area that deserves wider documentation is the importance of women's productive and care activities at the ecosystem level. Such information could provide relevant insights to policy-making processes to improve women's agency and social-ecological resilience, as well as ecosystem conservation and the sustainable use from an integral approach.

Andean women, as rural women from other regions, manage ecosystems within a context characterized by multiple challenges imposed on them. These include a lack of regulatory measures to secure women's rights to implement different forms of sustainable (agro)ecosystem management (e.g., rights related to tenure, access to and use of water, land, and other productive resources). While many rural women are engaged in the sustainable use of biodiversity (either through the sustainable use of both flora and fauna or through the management of biodiverse production systems like agroecological and agroforestry), policies that could support and strengthen their activities are scarce, if any.

Other contextual challenges affecting women's ecosystem management are the pressures to shift to conventional agriculture, resulting in socio-ecological factors that threaten rural women's livelihoods and welfare. This includes the expansion of industrial and market-driven agriculture in indigenous and peasant communities. At the same time, this entails transforming the biodiverse ecosystems managed by women (on which their livelihoods rely heavily), into homogenized agricultural and food systems, dependent on the investment on exogenous inputs and technologies to which rural women seldom have access. Such conversion results in the loss of resources and ecosystem functions that enable women to perform productive and care roles in a sustainable manner, as well as to build self-reliance. This loss frequently occurs in the absence of adequate alternatives for women, as the pressures for fulfilling different tasks remain, while others, such as ecosystem deterioration, are added.

Violence, migration, and the feminization of agriculture are additional contextual factors that have a deep impact on women's agency and the sustainability of their ecosystem management.

Since the contextual factors that affect women's roles in ecosystem management are complex, addressing

them, particularly in regulatory frameworks, requires a holistic approach. The international law, mainly from the perspective of human rights, has a relevant role. Some of the important international instruments are the ILO Convention 169, CEDAW, ICCPR, ICESCR, and the provisions outlined in UNDRIP and UNDROP.

In addition to recognizing the numerous challenges faced by women in the Andes, the reviewed literature helps to identify critical knowledge gaps. The most relevant in terms of research and policymaking (at both the methodological and scoping level) are related to:

• ***The disciplinary approach focused mainly on the social dimensions of women's management of terrestrial ecosystems*** (Table 3). While important, this approach does not explicitly recognize women's contributions at the ecological (e.g., involvement in conservation and restoration), economic (e.g., their productive and care work around sustainable ecosystem management), and political level (e.g., their autonomy in production and food provision).

• ***The large-scale and long-term effects of women's ecosystem management are not sufficiently addressed*** (Table 5, Table 6, and Table 20). The reviewed research focuses on the short-term women's small-scale household and domestic work. This focus contributes to underestimate women's role in large temporal and geographic scales regarding ecosystems management.

• ***Underreporting of girls and female elders*** (Table 9) a***s well as of urban and peri-urban women*** (Table 10), afrodescendents, and other socio-cultural groups inhabiting the Andes (Table 11). This is related to the still weak recognition of diversity within women's groups and their multiple identities.

• ***Lack of documenting the effects on the welfare of children and the elderly from women's ecosystem management*** (Table 25). This omission avoids visualizing the multi- and inter-generational relevance of rural women in the management of biodiversity and terrestrial ecosystems.

• ***Absence of information on the effects women's ecosystem management activities has on themselves and their organizations*** (Table 32). This knowledge gap reflects the realities of many rural women, whose activities often receive limited consideration within their local organizations (Suárez et al. 2018), unless they are specifically established for women (Zuluaga-Sánchez & Arango-Vargas 2013).

• ***Landless women who are either understudied (Table 31) or not explicitly recognized as such.*** Zuluaga Sánchez (2011) argues that not addressing women's lack of ownership and access to land hinders the possibility to accurately assess and resolve the problem. Therefore, tackling issues concerning landless women can foster a better understanding of women's rights and contexts in ecosystem management, while also contributing to efforts to improve their agency (Wiig 2013).

• ***Absence of research on climate change and the corresponding SDGs*** (Table 33) ***as well as the water–food–energy nexus (***Table 34) ***regarding women's ecosystem management in the Andes.*** These areas are not explicitly addressed in the literature reviewed. The integration of climate change adaptation and mitigation in the empirical research is minimal, and the approach to

climate change is unclear in many of the papers. This is a critical gap of knowledge, especially in terms of: (i) the importance of biodiversity management in climate adaptation and mitigation, which is often practiced by women through biodiverse systems; (ii) the growing feminization of agriculture, particularly in rural areas, establishing women as key climate actors and decision-makers on the ground; and (iii) the increasing pressures and the impacts of conventional and industrial agriculture on rural women's ecosystem management and livelihoods.

Finally, the positive effects of rural women's management of terrestrial ecosystems merit more attention in research and policymaking to ensure their management is recognized, valued, promoted, and preserved. Despite the multiple challenges they face and the existing gaps of knowledge, the literature indicates that rural women in the Andes demonstrate a myriad of strengths and roles in terms of their sustainable use of ecosystems (e.g., through traditional biodiverse production systems, particularly agroecology, agroforestry, and wild harvesting), with direct and indirect positive outcomes on food sovereignty, biodiversity conservation, and climate change adaptation. The challenging context these women are in needs to be acknowledged and addressed more closely to ensure women's rights and access to fair and dignifying livelihood opportunities. This will support improving the socio-ecological conditions of rural women in the Andes and the integral welfare of surrounding ecosystems and society as a whole.

07

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08

ANNEX

ANNEX - LIST OF ARTICLES INCLUDED IN THE REVIEW

#	AUTORAS Y AUTORES	TÍTULO	REVISTA	AÑO DE PUBLICACIÓN	PAÍS ANDINO DE INVESTIGACIÓN
1	Acosta et al.	The Colombian Transitional Process: Comparative Perspectives on Violence against Indigenous Women	International Journal of Transitional Justice	2018	Colombia
2	Alwang et al.	Farm Decision Making and Gender: Results from a Randomized Experiment in Ecuador	World Development	2017	Ecuador
3	Ames, P.	Constructing new identities? The role of gender and education in rural girls' life aspirations in Peru	Gender and Education	2013	Peru
4	Arancibia et al.	The neglected burden of agricultural intensification: a contribution to the debate on land-use change	Journal of Land Use Science	2019	Argentina
5	Arguello, R.	Securing the fruits of their labours: the effect of the crisis on women farm workers in Peru's Ica valley	Gender and Development	2010	Peru
6	Arias Toledo & Trillo	Practices and spaces by gender: landscapes and rural tasks of livestock producers of the Sierras Chicas from Córdoba, Argentina	Ethnobiology and Conservation	2018	Argentina
7	Armbruster et al.	Women's time use and implications for participation in cacao value chains: evidence from VRAEM, Peru	Development in Practice	2019	Peru
8	Arroyo et al.	Cultivating Women's Empowerment through Agritourism: Evidence from Andean Communities	Sustainability	2019	Peru
9	Ataide, S.	Gender and migrations. A study about Tarija migrant women around the market of horticultural work of Apolinario Saravia in the province of Salta	Mundo Agrario	2019	Argentina
10	Avellaneda-Torres et al.	Agriculture and life in the paramo: A view from El Bosque rural district (Los Nevados National Natural Park)	Cuadernos de Desarrollo Rural	2014	Colombia
11	Báez et al.	Ecological and social bases for the restoration of a High Andean cloud forest: preliminary results and lessons from a case study in northern Ecuador	Tropical Montane Cloud Forests	2010	Ecuador
12	Bee, A.	Globalization, grapes and gender: Women's work in traditional and agro-export production in northern Chile	The Geographical Journal	2000	Chile
13	Berti & Araujo Cossio	Raising chickens for increased egg consumption in a rural highland Bolivian population	Food Security	2017	Bolivia
14	Bose, P.	Land tenure and forest rights of rural and indigenous women in Latin America: Empirical evidence	Women's Studies International Forum	2017	Bolivia / Colombia
15	Boza et al.	Development programs for female farmers: Identifying clusters for the case of Chile's "Education and training program for rural women"	Revista de la Facultad de Ciencias Agrarias	2018	Chile
16	Bravo, A.	The Impact of Improved Rural Roads on Gender Relations in Peru	Mountain Research and Development	2002	Peru

17	Bulgaroni et al.	Organophosphate pesticide environmental exposure: analysis of salivary cholinesterase and carboxilesterase activities in preschool children and their mothers	Environmental Monitoring and Assessment	2012	Argentina
18	Cabrera Verdezoto et al.	Urban agriculture in the Valdivia city, Chile. A settlement process	IDESIA (Chile)	2013	Chile
19	Cámara-Leret et al.	Geospatial patterns in traditional knowledge serve in assessing intellectual property rights and benefit-sharing in northwest South America	Journal of Ethnopharmacology	2014	Bolivia / Ecuador / Colombia / Peru
20	Castillo Vizuete et al.	Perception and use of cultural ecosystem services among the Andean communities of Chimborazo Reserve	Environmental Engineering and Management Journal	2019	Ecuador
21	Cid Aguayo & Latta	Agro-Ecology and Food Sovereignty Movements in Chile: Socio spatial Practices for Alternative Peasant Futures	Annals of the Association of American Geographers	2015	Chile
22	Cole et al.	An agriculture and health inter-sectorial research process to reduce hazardous pesticide health impacts among smallholder farmers in the Andes	BMC International Health and Human Rights	2011	Ecuador
23	Cook et al.	Gender quotas increase the equality and effectiveness of climate policy interventions	Nature Climate Change	2019	Peru
24	Córdoba et al.	Agroecosystem resilience. A conceptual and methodological framework for evaluation	PLOS ONE	2020	Colombia
25	Cuellar-Gomez, O.L.	Gender and agricultural sustainability: case study of Colombian coffee	International Journal of Innovation and Sustainable Development	2009	Colombia
26	Cuenca Barrón et al.	Pesticide exposure among Bolivian farmers: associations between worker protection and exposure biomarkers	Journal of Exposure Science & Environmental Epidemiology	2019	Bolivia
27	Cuenca Barrón et al.	Increased levels of genotoxic damage in a Bolivian agricultural population exposed to mixtures of pesticides	Science of the Total Environment	2019	Bolivia
28	D'Amico, L.	Environmentalism and gender in INTAG, Ecuador	Gender and Sustainability: Lessons from Asia and Latin America	2012	Ecuador
29	Deaconu et al.	The Agroecological Farmer's Pathways from Agriculture to Nutrition: a practice-based case from Ecuador's highlands	Ecology of Food and Nutrition	2019	Ecuador
30	Deere & Leon	Institutional Reform of Agriculture under Neoliberalism: The Impact of the Women's and Indigenous Movements	Latin American Research	2001	Bolivia / Ecuador / Peru
31	Deere & Twyman	Who makes agricultural decisions? women landowners in Ecuador	Agricultura, Sociedad y Desarrollo	2014	Ecuador
32	Eyssartier et al.	Cultural Transmission of Traditional Knowledge in two populations of North-western Patagonia	Journal of Ethnobiology and Ethnomedicine	2008	Argentina
33	Eyssartier et al.	Traditional horticultural knowledge change in a rural population of the Patagonian steppe	Journal of Arid Environments	2011	Argentina
34	Fadiman, M.	Cultivated Food Plants: Culture and Gendered Spaces of Colonists and the Chachi in Ecuador	Journal of Latin American Geography	2005	Ecuador

35	Finerman & Sackett	Using Home Gardens to Decipher Health and Healing in the Andes	Medical Anthropology Quarterly	2003	Ecuador
36	Furlan & Pirondo	Vínculos y relaciones intracomunitarias a través del uso de plantas protectoras: Formas de construir diversidad desde los sistemas agroforestales familiares	Ethnobotany Research and Applications	2020	Argentina
37	Gay-Antaki & Livermana	Climate for women in climate science: Women scientists and the Intergovernmental Panel on Climate Change	Proceedings of the National Academy of Sciences	2018	Argentina
38	Gisbert et al.	Gender issues associated with labor migration and dependence on off- farm income in rural Bolivia	Human Organization	1994	Bolivia
39	Graham, M.	Food allocation in rural Peruvian households: Concepts and behavior regarding children	Social Science and Medicine	1997	Peru
40	Gray, C.	Rural out-migration and smallholder agriculture in the southern Ecuadorian Andes	Population and Environment	2009	Ecuador
41	Guerra et al.	What influence do empowered women have? Land and the reality of women's relative power in Peru	Review of Economics of the Household	2019	Peru
42	Gutiérrez García et al.	Relevance of local knowledge in decision-making and rural innovation: A methodological proposal for leveraging participation of Colombian cocoa producers	Journal of Rural Studies	2020	Colombia
43	Gutiérrez, T.V.	From the Agricultural Household to cheesemakers masters. The school farm of Tandil (Argentina), 1915-1960	Quinto Sol	2015	Argentina
44	Guzmán, D.	Diversidad biocultural y género: Trayectorias productivas de mujeres campesinas de Chiloé	Revista Austral de Ciencias Sociales	2016	Chile
45	Hamilton, S.	Visible partners: women's labor and management of agricultural capital on small farms in the highlands of central Ecuador	Urban Anthropology	1992	Ecuador
46	Handal & Harlow	Employment in the Ecuadorian cut-flower industry and the risk of spontaneous abortion	BMC International Health and Human Rights	2009	Ecuador
47	Herrera A.D.	From an Intuitive to a Systematic Gender Perspective	Mountain Research and Development	2002	Peru
48	Herve et al.	A modelling approach for analysis of agro pastoral activity at the one-farm level	Agricultural Systems	2002	Bolivia
49	Hidalgo Zapata et al.	Sociodemographic, cultural, environmental and agroecological characterization in order to adopt urban agriculture in the municipality of Tuluá, Colombia	International Journal of Agricultural Science	2019	Colombia
50	Hilgert & Gil	Reproductive medicine in northwest Argentina: traditional and institutional systems	Journal of Ethnobiology and Ethnomedicine	2007	Argentina
51	Home & Vieli	Psychosocial outcomes as motivations for urban gardening: A cross-cultural comparison of Swiss and Chilean gardeners	Urban Forestry & Urban Greening	2020	Chile
52	Huenchuleo et al.	Social psychology predictors for the adoption of soil conservation measures in Central Chile	Land Degradation and Development	2011	Chile

53	Idrovo et al.	Adverse reproductive outcomes among women working in Colombian floriculture: A summary of the evidence through meta-analysis	Biomédica	2007	Colombia
54	Imburgia, L.	Irrigation and Equality: An integrative Gender-Analytical Approach to Water Governance with Examples from Ethiopia and Argentina	Water Alternatives	2019	Argentina
55	Jarvis & Vera-Toscano	Seasonal adjustment in a market for female agricultural workers	American Journal of Agricultural Economics	2004	Chile
56	Jørs et al.	Is Gender a Risk Factor for Pesticide Intoxications Among Farmers in Bolivia? A Cross-Sectional Study	Journal of Agromedicine	2013	Bolivia
57	Korovkin, T.	Cut-Flower Exports, Female Labor, and Community Participation in Highland Ecuador	Latin American Perspectives	2003	Ecuador
58	Kuhnlein, H.V.	Gender roles, food system biodiversity, and food security in Indigenous Peoples' communities	Maternal and Child Nutrition	2017	Ecuador
59	Larrauri et al.	Indicators for the Analysis of Peasant Women's Equity and Empowerment Situations in a Sustainability Framework: A Case Study of Cacao Production in Ecuador	Sustainability	2016	Ecuador
60	Leisher et al.	Does the gender composition of forest and fishery management groups affect resource governance and conservation outcomes? A systematic map	Environmental Evidence	2016	Bolivia
61	Leonard, W. R.	Household-level strategies for protecting children from seasonal food scarcity	Social Science and Medicine	1991	Peru
62	Leonard, W.R.	Age and sex differences in the impact of seasonal energy stress among Andean agriculturalists	Human Ecology	1991	Peru
63	Linardelli, M.F.	Among the farm, the factory, and home: Productive and reproductive work of female migrant farmworkers in Mendoza (Argentina) and its impact in the health disease process	Salud Colectiva	2018	Argentina
64	Lynch, B.D.	Women and irrigation in highland Peru	Society and Natural Resources	1991	Peru
65	Maduekwe et al.	Identifying Human Recognition Deprived Women: Evidence from Malawi and Peru	The Journal of Development Studies	2019	Peru
66	Maggioni et al.	National short-term dietary exposure assessment of a selected group of pesticides in Argentina	Journal of Environmental Science and Health	2018	Argentina
67	Mann, A.	Education for food sovereignty as transformative ethical practice	Policy Futures in Education	2018	Chile
68	Martínez-Ribaya & Areal	Is there an opportunity for product differentiation between GM and non-GM soya-based products in Argentina?	Food Control	2020	Argentina
69	Mathez-Stiefel et al.	Identifying Gender-Sensitive Agroforestry Options: Methodological Considerations from the Field	Mountain Research and Development	2016	Peru
70	Maxwell, K.	Hearth and household economy in an Andean village	Human Organization	2011	Peru
71	Mayorga Muñoz & Treggiari	Commons and social organization: the current experience of the Mapuche communities in Chile	Revista de Derecho	2020	Chile

72	Mayorga-Muñoz et al.	The role of the Mapuche indigenous woman in the preservation of genetic resources and associated traditional knowledge. A legal analysis from the gender perspective	Jurídicas	2017	Chile
73	Meertens, D.	Discursive Frictions: the Transitional Justice Paradigm, Land Restitution and Gender in Colombia	Papel Politico	2015	Colombia
74	Mingo Acuña Anzorena, M.E.	From women's voice: Invisibility, learning and agribusiness female workers labor	Athenea Digital	2014	Argentina
75	Nahuelhual et al.	Potential for greenery from degraded temperate forests to increase income of indigenous women in Chile	Agroforestry Systems	2008	Chile
76	Paulson, S.	Gendered Practices and Landscapes in the Andes: The Shape of Asymmetrical Exchanges	Human Organization	2003	Bolivia
77	Peredo Parada et al.	Participatory evaluation of sustainability in a conventional and agroecological peasant farm of a Mapuche community, Chile	Revista de la Facultad de Ciencias Agrarias - Universidad Nacional de Cuyo	2019	Chile
78	Perez et al.	Determinants of vulnerability of bean growing households to climate variability in Colombia	Climate and Development	2019	Colombia
79	Perona E.	Technological transformation of the agricultural sector in the province of Cordoba: Its effects on women and rural families	Estudos Feministas	2012	Argentina
80	Rivero Reyes, R.	Gendering responses to El Niño in rural Peru	Gender and Development	2002	Peru
81	Roco et al.	Farmers' Options to Address Water Scarcity in a Changing Climate: Case Studies from two Basins in Mediterranean Chile	Environmental Management	2016	Chile
82	Rodríguez Alcántara et al.	Ethnobotany of the Sierra Nevada del Cocuy-Güicán: climate change and conservation strategies in the Colombian Andes	Journal of Ethnobiology and Ethnomedicine	2018	Colombia
83	Rodriguez Castro, L.	The Embodied Countryside: Methodological Reflections in Place	Sociologia Ruralis	2018	Colombia
84	Saldías et al.	A source of conflict? Distribution of water rights in Abanico Punata, Bolivia	WIT Transactions on Ecology and the Environment	2011	Bolivia
85	Suárez et al.	Empowerment and associative process of rural women: A case study of rural areas in Bogotá and Cundinamarca, Colombia	Agronomía Colombiana	2018	Colombia
86	Tinsman, H.	Politics of gender and consumption in authoritarian Chile, 1973-1990: Women agricultural workers in the fruit-export industry	Latin American Research Review	2006	Chile
87	Valdivia, C.	Gender, livestock assets, resource management, and food security: Lessons from the SR-CRSP	Agriculture and Human Values	2001	Bolivia / Peru
88	Valdivia et al.	Andean Pastoral Women in a Changing World: Opportunities and Challenges	Rangelands	2013	Bolivia / Peru
89	Wiig, H.	Joint Titling in Rural Peru: Impact on Women's Participation in Household Decision-Making	World Development	2013	Peru
90	Zimmerer, K.S.	Common field agriculture as a cultural landscape of Latin America: Development and history in the geographical customs of resource use	Journal of Cultural Geography	2002	Peru

91	Zimmerer, K.S.	Just small potatoes (and ulluco)? The use of seed-size variation in "native commercialized" agriculture and agrobiodiversity conservation among Peruvian farmers	Agriculture and Human Values	2003	Peru
92	Zimmerer, K.S.	Geographies of Seed Networks for Food Plants (Potato, Ulluco) and Approaches to Agrobiodiversity Conservation in the Andean Countries	Society and Natural Resources	2003	Peru
93	Zimmerer, K.S.	Conserving agrobiodiversity amid global change, migration, and nontraditional livelihood networks: The dynamic uses of cultural landscape knowledge	Ecology and Society	2014	Bolivia
94	Zuluaga Sánchez, G.P.	Access to land key issue for farmers women in Antioquia, Colombia	Revista Facultad Nacional de Agronomía Medellín	2011	Colombia
95	Zuluaga-Sánchez & Arango-Vargas	Female farmers: Resistance, organization and agroecology in the midst of armed conflict	Cuadernos de Desarrollo Rural	2013	Colombia

CONÉCTATE

CLUSTER OF COOPERATION
IN THE TROPICAL ANDES
AND CENTRAL AMERICA
REGION