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1/Full title : Climatisation of Agricultural Issues in the International Agenda through Three Competing Epistemic Communities: Climate-smart Agriculture, Agroecology, and Nature-based Solutions

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Climatization, climate-smart agriculture, agroecology, nature based solutions, agriculture, epistemic community, agenda setting

4/ foundings

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1 **Climatisation of Agricultural Issues in the International Agenda through Three Competing** 2 **Epistemic Communities: Climate-smart Agriculture, Agroecology, and Nature-based Solutions**

3 4 5 **Abstract:**

6 While agricultural issues were almost absent from the United Nations Framework Convention
7 on Climate Change adopted in 1992, a window of opportunity opened in favor of their
8 inclusion in the climate agenda during the Conference of the Parties of Durban in 2011.
9 During this period three concepts have emerged in climate agenda-setting: “climate-smart
10 agriculture,” “agroecology,” and “nature-based solutions.” By tracing these three concepts
11 (their origins and scientific and political progressions), we demonstrate that they fostered the
12 “climatisation” of agricultural issues in the late 2000s. These concepts frame agricultural
13 adaptation and mitigation issues regarding climate change in specific ways. The two concepts
14 of climate-smart agriculture and nature-based solutions are recent, while agroecology is a
15 long-standing term that has recently regained popularity to analyze climate issues. These
16 concepts are promoted by three distinct—and sometimes opposed—epistemic communities
17 and contribute to reviving controversy permeating agricultural debates.

18 19 **Introduction**

20 While agricultural concerns remained almost absent from the United Nations Framework
21 Convention on Climate Change (UNFCCC) until the Conference of the Parties (COP) of
22 Durban in 2011 (Hrabanski, 2020; Soto et al, 2018; Caron and Treyer, 2016), they have more
23 recently gained importance in climate negotiations (Chandra et al 2016; Soto Golcher et al
24 2018). Agenda-setting perspectives could help explain the mainstreaming of agricultural
25 issues in current climate policies (Keskitalo et al 2012; Pralle 2009, Andresen et al, 2002).
26 While agenda-setting depends on many factors (Kingdon 1984), in this study, we analyze the
27 specific role played by three scientific concepts that link agricultural and climate issues:
28 climate-smart agriculture (CSA), agroecology, and nature-based solutions (NBS). This article
29 addresses two questions: What are these concepts’ roles in the climatisation of agricultural
30 issues in international agenda? What visions of agricultural and climate issues do they
31 support? Inspired by the “process tracing” method (Beach and Petersen, 2019; Collier, 2011;
32 Georges et al, 2005), we argue that these concepts were promoted by three different epistemic
33 communities (Haas 1992, 2015) that played a decisive role in the emergence of agricultural
34 issues in global climate agenda-setting. Indeed, scientific knowledge production and use are

35 widely recognized as essential elements for environmental and climate standards-setting
36 (Bijker et al 2009; Fischer 2009; Biermann, 2010, Jasanoff et al 1998, 2005); knowledge and
37 policy-making are thus closely interlaced with the climatisation¹ of agricultural issues.

38 The rest of the article is organized as follows. First, we present the theoretical background,
39 based on agenda-setting literature and process analysis. Next, we present the results of a
40 comparative analysis of the three concepts and their dynamic in international agenda-setting
41 on climate. We then analyze the policy window of opportunity for the inclusion of agricultural
42 issues in climate agenda-setting as well as the three concepts' origins and scientific and
43 political progressions. Finally, we discuss the three concepts' competition, controversy, and
44 synergy aspects.

45 **Tracing the rise of CSA, agroecology and NBS in climate political agenda-setting**

46 Kingdon's (1984) benchmark study examined the ways issues emerge and rise on the political
47 agenda through the agenda-setting process. Then, policy agenda setting theory was often
48 revisited (Béland and Howlett, 2016; Baumgartner and Jones, 2010 ; Soroka, 1999). However,
49 Kingdon's approach is the more relevant to analyze the climatisation of agricultural issues in
50 the international agenda. Agendas here are defined as the list of subjects or problems to which
51 governmental officials, and closely associated people outside of governments, give serious
52 attention at any given time (Kingdon 1984, 3). The processes through which agenda-setting
53 occurs among of its varying participants depends on the interactions among three separate
54 streams: "problem streams, which include all the problems and questions raised in society by
55 various groups (which may not receive decision-makers' attention); "policy streams," which
56 correspond to current ideas concerning policy solutions to problems; and "political streams,"
57 which correspond to the political climate, interest groups, political organizations, public
58 mood, and administration that may promote certain agenda items (Kingdon 1984).

59 According to Kingdon's (1984) approach, the convergence of these three streams may trigger
60 change by opening a policy window whereby a problem is recognized, policy solutions are
61 available, and the political climate is favorable. Policy entrepreneurs, or "public entrepreneurs
62 who, from outside the formal positions of government, introduce, translate, and help

¹ This "climatisation" of agricultural issues corresponds to "a dialogical movement between the globalization of the climate and the 'climatisation' of the world" (Aykut 2020; Aykut et al 2017). The author notes that over the last 20 years, the climate issue has become globalized in that it has addressed many other adjacent issues (particularly development and energy) (centripetal aspect). Symmetrically, many actors are concerned by the climate problem, want to be involved in these negotiations, want their concerns to prevail, and translate their interests into climate terms (centrifugal aspect) (Dahan 2018).

63 implement new ideas into public practice” (Roberts and King 1991), typically combine these
64 streams. Policy entrepreneurs involved in the promotion of agriculture in the climate agenda-
65 setting are organized as “transnational epistemic communities,” which, as Peter Haas (1992,
66 2015) proposed, are networks of professionals with recognized expertise and knowledge in
67 their specific field, wielding authority upon policymakers by virtue of their field-specific
68 knowledge. The transnational epistemic community term is used to analyze the building of
69 scientific concepts (i.e., CSA, agroecology, and NBS) to pool agricultural and climate issues,
70 by combining scientific and expert knowledge with political and social beliefs, in turn
71 broadening the prospects for governing the climatisation of agricultural issues.

72 Anchored in a dynamic of inductive and deductive research (Maillet and Mayaux 2018), this
73 study is based on two types of information source. First, our methodology is based on
74 bibliometric and document analysis. We analyzed the emergence of agroecology, CSA, and
75 NBS concepts through a lexical analysis of their citations² in official documents available on
76 the UNFCCC website, including the final and side-event reports of all the COPs, five final
77 Intergovernmental Panel on Climate Change (IPCC) assessment reports published since 1990,
78 and 172 Intended Nationally Determined Contributions (INDCs)³ available in 2016. In
79 addition, we used the SCOPUS database to conduct a bibliometric analysis of scientific
80 publications up to June 2018. We also sought to track and gain insight into the origins of each
81 concept and its use by carrying out a qualitative analysis of these documents’ content.⁴
82 Moreover, we analyzed the websites of organizations such as the Food and Agriculture
83 Organization of the United Nations (FAO), International Union for Conservation of Nature
84 (IUCN), NGOs (Conservation International, World Wide Fund), Via Campesina, and research
85 centers (French Agricultural Research Centre for International Development, CIRAD;
86 Consultative Group on International Agricultural Research, CGIAR; universities).
87 Second, from September 2018 to September 2019, we mobilized information derived from 24
88 semi-structured interviews conducted with key people involved in the agenda-setting process

² The key words used were “Agroecology,” “Agro-ecology”; “Climate-smart agriculture,” “Climate-smart agriculture,” “CSA,” “Climate smart”; “Nature-based solutions,” “Nature based solutions,” “Ecosystem-based management,” “Ecosystem-based adaptation,” and “Ecosystem-based mitigation.”

³ Nationally Determined Contributions (NDC) or Intended Nationally Determined Contributions (INDC) are non-binding national plans highlighting climate actions, including climate related targets for greenhouse gas emission reductions, policies and measures governments aim to implement in response to climate change and as a contribution to achieve the global targets set out in the Paris Agreement

⁴ The content analysis was done using “climate-smart agriculture” and “agroecology” as the reference. Regarding nature-based solutions, other terms were also considered in context such as “Ecosystem-based management,” “Ecosystem-based adaptation,” and “Ecosystem-based mitigation.”

89 for these concepts, including scientists, researchers, international and national civil servants,
 90 and experts from NGOs and international organizations (Table 1). Although this group is not
 91 exhaustive, they represent the main organizations related to the analyzed concepts that we
 92 identified in the previous phase. Either the people contacted were directly identified by their
 93 publication or, they were identified, from person to person, because someone had quoted
 94 and/or recommended contacting another person. We used the qualitative and quantitative
 95 information that was gathered through semi-structured interviews⁵ to capture and compare
 96 four dimensions of the concepts (origin, academic and political dynamics, and standpoints
 97 regarding agriculture and climate issues) as well as the characteristics of their epistemic
 98 communities. Beyond the published publications, the interviews made possible to identify, the
 99 actors' networking, the values and interests that united the researchers and other actors
 100 involved in the promotion of the three concepts and consequently how they formed epistemic
 101 communities. They also constituted clues to identify the key steps and milestones of rise of
 102 the concepts, which enabled the analysis of the agricultural issues' climatisation.

103

Type of actors interviewed	Number of interviews and organization
Scientists	11 (Universities Wageningen, Davis, Berkeley, and Oxford; CIRAD, IRD, CGIAR)
NGO	4 (IUCN, Via Campesina, ATTAC, CCFD)
National government	2 (Dutch and French civil servants)
International organization	6 (FAO)
Private sector	1 (World Business Council on Sustainable Development (WBCSD))

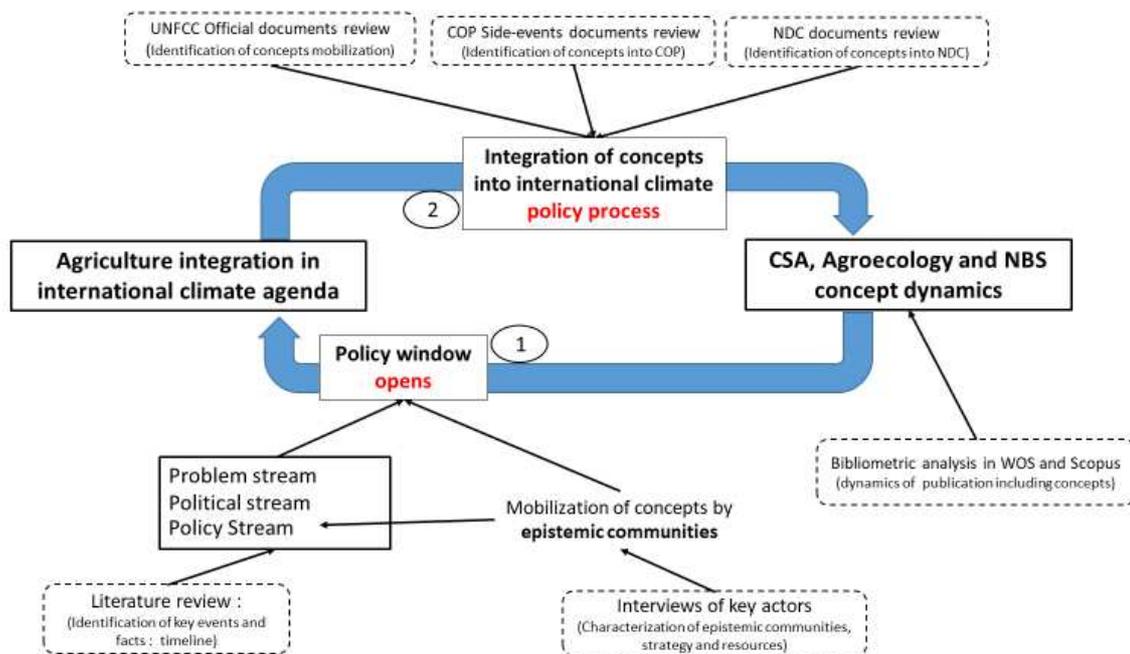
104 Table 1. Number and types of semi-structured interviews, conducted with key people
 105 involved in the agenda-setting process for these concepts from September 2018 to September
 106 2019.

107

108 Figure 1 summarizes our methodological approach mobilizing tracing to analyze the
 109 climatisation of agricultural issues in the international climate agenda. First, we clarified the
 110 two causal relations (represented by blue arrows) between the key processes (in bold) and
 111 proposed to explain the integration of agriculture into the international climate agenda and the
 112 dynamics of CSA, agroecology, and NBS. Second, we formulated two interlinked questions:

⁵ The semi-structured interview guidelines are available as additional material.

113 1) How do concept dynamics affect the integration of agriculture into the international climate
 114 agenda? 2) How does agriculture integration affect the dynamics of the concepts? Third, we
 115 used the theoretical framework, multiple streams framework (Kingdon 1984), and epistemic
 116 community (Haas 1992, 1995) to create a hypothesis for each question (numbers in circle): (1)
 117 The dynamics of concepts contribute to the opening of policy windows through the
 118 mobilization of respective epistemic communities, which enables the framing of agriculture as
 119 part of the climate solution. (2) Agriculture integration in international climate agenda
 120 following the policy windows of 2010 has reinforced the dynamics of analyzed concepts and
 121 its integration into the policy process in international arenas. Further, to address each
 122 hypothesis, we combined different methods and source of information, including desk review
 123 of documents and interviews of key actors.



124
 125 Figure 1. Conceptual framework, hypotheses, and the methodological process⁶.

126
 127 **Results: Comparative analysis of the dynamics of the three concepts**

128
⁶ Bold frames and characters: key explicative variables; normal frame and bold characters: process analyzed; dotted frames: methods used to test hypothesis (data source and analytical process). Blue arrows indicate causal links between the key variables and process, and set the study's interwoven hypotheses: (1) The dynamics of analyzed concepts contribute to the opening of policy windows through the mobilization of respective epistemic communities, which enables the framing of agriculture as part of the climate solution. (2) Integration of agriculture into international climate agenda following the 2010 policy windows reinforced the dynamics of analyzed concepts and its integration into international arenas' policy-making process.

129 *A window of opportunity for the inclusion of agricultural issues in climate agenda-setting*

130

131 Adapting Kingdon's (1984) multiple streams analytical framework to global dynamics
132 (Jakobi 2009), we evidenced the convergence of three streams (problem, policy, and political
133 streams). This created windows of opportunity for the reconciliation of agricultural and
134 climate issues in the international agenda in the late 2000s (Figure 2). The problem stream
135 emerges when problematic situations become evident and when "people are convinced that
136 something can be done to improve the situation" (Kingdon 1984, 119). This happened during
137 the 2000s when several publications fueled the idea that agriculture is partly responsible for
138 greenhouse gas (GHG) emissions. The 2006 FAO report *Livestock's Long Shadow: Environmental Issues and Options* (Steinfeld et al 2006) highlighted livestock's negative
139 environmental impact. One item in the press release especially received public and media
140 attention: "The livestock sector plays a major role, as it is responsible for 18% of GHG
141 emissions measured in CO₂ equivalent. That's more than transport pollutes." This publication
142 has greatly affected the agricultural community, including FAO and research organizations,
143 among national governments and professional agricultural organizations. Shortly thereafter, a
144 2007 IPCC report also highlighted agricultural impact on GHG emissions and even pushed
145 Rajendra Pachauri (IPCC Chair and 2007 Nobel Peace Prize winner) to call for a vegetarian
146 diet in 2008. These publications emphasized agriculture's responsibility for the GHG
147 emissions problem.
148

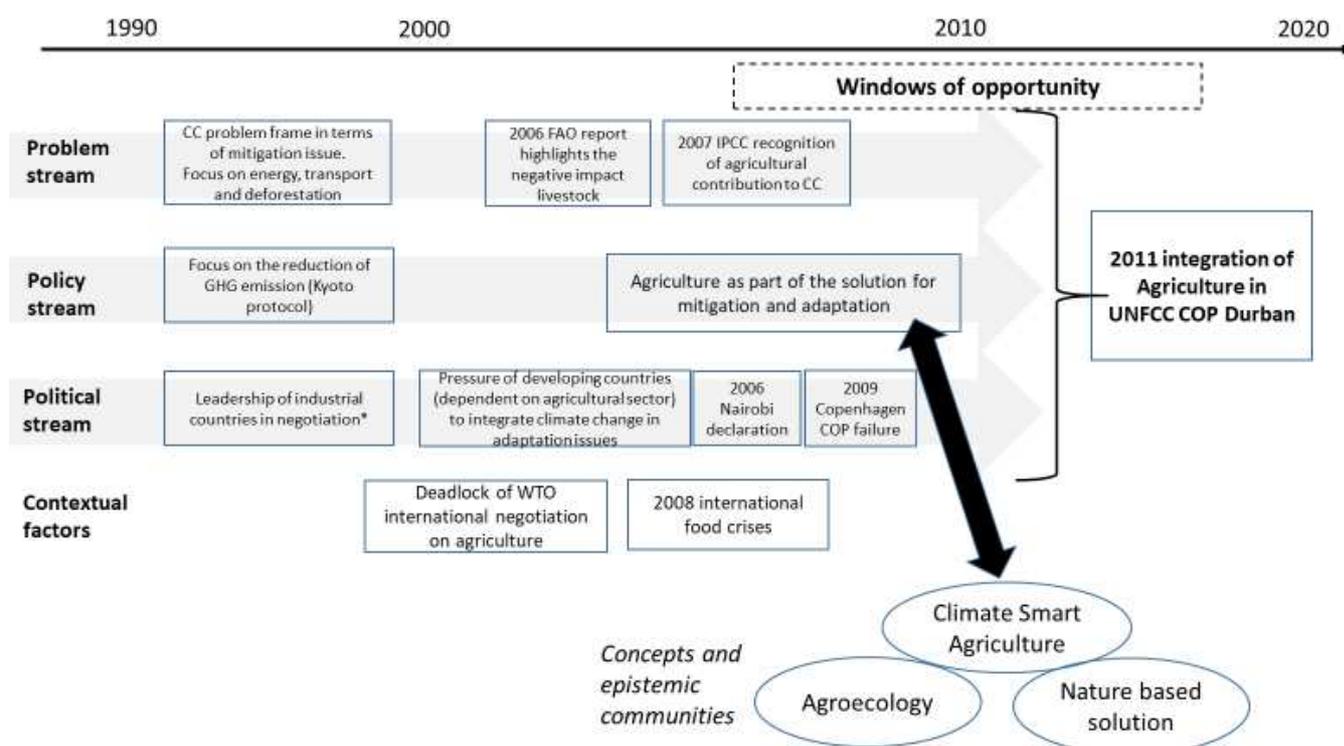
149 Following Kingdon (1984), the problem stream is followed by the policy stream (solution
150 stream), whereby competing alternatives circulate within public policy communities. In 2008,
151 FAO, governments, NGOs, and professional organizations began to reframe the relationship
152 of agriculture with climate. They advocated that agriculture is primarily a victim of climate
153 change, as temperature and precipitation changes, rising sea levels, and the increased
154 likelihood of extreme weather events will significantly affect agriculture by the end of this
155 century. Agriculture, therefore, simultaneously contributes to and is affected by climate
156 change (FAO 2009a, 2009b; Glantz et al 2009; Interdepartmental Working Group on Climate
157 Change 2008). Additionally, they asserted that agriculture is part of the solution because of its
158 capacity to reduce GHG emissions and sequester carbon and highlighted the importance of
159 adapting agriculture to climate change.

160 The political stream must be combined with the first two to create a window of opportunity
161 (Kingdon 1984). In our study, it is part of the international negotiation process, which was

162 marked by three converging movements in the late 2000s. First, agricultural issues were only
 163 addressed within the trade agenda of the General Agreement on Tariffs and Trade (GATT)
 164 and the World Trade Organization (WTO), but they stalled due to the mobilization of civil
 165 society and many developing countries' mistrust (as in Seattle in 1999, and especially Cancun
 166 in 2003 and Porto Alegre in 2005 for the World Social Forum). The deadlock in international
 167 negotiations on agriculture has thus facilitated its emergence in climate negotiations. Second,
 168 the enthusiasm for adaptation in the 2000s fostered the emergence of agriculture in climate
 169 negotiations under pressure from developing countries (Dahan 2014). Although many
 170 publications have underlined agricultural impact on GHG emissions, it could also reduce
 171 emissions. Third, the late 2000s were marked by the 2008 global food crisis, which revived
 172 debates on food security and price volatility, and the failure of the Copenhagen climate
 173 negotiations in 2009 (Bodansky 2010; Dimitrov 2010). Policymakers were therefore willing
 174 to substantially change the content and format of climate negotiations to move forward
 175 (Aykut and Dahan 2011).

176 In short, the mainstreaming of agriculture in climate negotiations occurred in the late 2000s
 177 when policy windows opened at the international level, which allowed CSA, agroecology, and
 178 NBS to emerge. They reflect the desire to include climate and agricultural issues in global
 179 climate negotiations.

180



181

182 Figure 2. Problem, policy, and political streams; concept; and policy windows leading to the
 183 integration of agriculture in UNFCCC Durban COP

184

185 ***Three epistemic communities that promote agriculture in climate agenda-setting***

186

187 As the mainstreaming of agriculture in climate negotiations occurred in the late 2000s, the
 188 three concepts became more visible. While these concepts enabled agricultural issues to
 189 climatize, their history and origins differ, as they promote different framings, and different
 190 groups of actors support them (table 2).

191 Each of these groups is characterized by its own set of principled and causal beliefs or
 192 professional judgment, common notions of validity, and a common policy enterprise and thus
 193 constitute three separate epistemic communities (Haas 1992, 2015).

194

	Agroecology	CSA	NBS
Definition	The agroecological approach regards farm systems as the fundamental units of study, and mineral cycles, energy transformations, biological processes, and socioeconomic relationships in these systems are analyzed as a whole (Altieri 1983).	This is agriculture that sustainably increases productivity and resilience (adaptation), reduces GHG (mitigation), and achieves national food security and development goals (FAO 2009a).	These are actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits.
First proponents	University of California (Stanford/Santa Cruz) Social movements	FAO CGIAR University of California, Davis University of Wageningen CIRAD.	World Bank first, then IUCN
Shared principled beliefs	Agroecology is an interdisciplinary scientific approach that challenged the prevailing agronomic model and a social movement based on the criticism of agricultural modernization.	CSA makes food security, CC adaptation, and mitigation compatible.	Nature provides solutions to CC mitigation and adaptation issues.
Shared causal beliefs or professional judgment	Agrarian sustainability cannot be achieved using only technological (agronomical or environmental) measures but by using agroecology	Promote the whole series of agroindustrial production models as ecological production models insofar as they use certain practices	These often have a more attractive cost/benefit ratio than the investment and maintenance of gray infrastructure or new technologies. They are

	practices.	that favor mitigation and/or adaptation to CC.	also flexible and adaptive by not requiring any heavy high-impact infrastructure.
Common notions of validity	Scientific peer reviewing and validation by social movements	Scientific peer reviewing and usefulness for reaching UN's objectives	Scientific peer reviewing
Common policy enterprise	Redesign agroecosystems sustainably	Produce scientific agricultural knowledge that is "useful" for development and agricultural adaptation to CC	Promote technical and political NBS for nature conservation (biodiversity and CC)

195 Table 2. Definitions of concepts and characteristics of the agroecology, CSA, and NBS.
196

197 ***Agroecology in the context of climate change: The climatisation of an "old" concept***

198 Although agroecology is a long-standing concept that emerged in the 1920s, Miguel Altieri's
199 (1983) *Agroecology: The Scientific Basis of Alternative Agriculture* defined the concept as a
200 scientific discipline at the interface between agronomy and ecology. The University of
201 California (UC) at the Berkeley and Santa Cruz campuses host the main authors of the
202 discipline, including M. Altieri and Stephen Gliessman, respectively. Agroecology is
203 threefold: it encompasses agricultural practices, an interdisciplinary scientific approach that
204 challenged the prevailing agronomic model, and a social movement based on the criticism of
205 agricultural modernization (Wezel et al 2009). Depending countries, conceptions of
206 agroecology can be different, for example, in Europe, agroecology is mainly conceived as a
207 science, followed by as a practice and to a lesser degree as a social movement (Gallardo-
208 López et al, 2018). Authors could consider also that dealing with agroecology, recent studies, are
209 increasingly translating the meaning of this word, also to interpret the past (even if it was not called
210 agroecology). A first conceptual evolution was observed in the early 2000s with a series of
211 publications highlighting the need to dovetail food systems and agroecology (Altieri 2009;
212 Altieri and Nicholls 2008; Francis et al 2003; Gliessman 2011). Thus, agroecology closely
213 intertwines a productive and food system. A second evolution occurred with the increasing
214 visibility of climate change in the late-2010s. Supporters further developed agroecology with
215 new aspects, growing a broad and transnational epistemic community, which united scientists
216 from the North and South in formal dynamics, such as the International Agroecology Action
217 Network (IAEAN) and European Agroecology Association, developmental and
218 environmental NGOs, and peasants' movements. Several publications highlighted
219 agroecology's core adaptation and mitigation objectives (Altieri et al 2015; Altieri and

220 Nicholls 2013) and considered social justice and biodiversity conservation. The agroecology
221 approach seems more focused on adaptation than mitigation (Saj et al 2017). Furthermore, in
222 recent years, many scholars have traced the development of agroecological practices in
223 European countries to the experiences of organic farming, biodynamic and biointegrated
224 agriculture. This offers the opportunity to investigate, especially in relation to the history of
225 organic farming, organic businesses, climate change and the entire agricultural and agri-food
226 production chain that is more attentive to these problems (Wezel and Bellon, 2018). More
227 precisely, global soil quality and food security continue declining, indicating that agriculture
228 and the food system must be adapted to climate change and biodiversity crisis (Ball et al,
229 2017). According to Migliorini and Wezel (2017), to address the global challenges of food
230 supply, biological and cultural diversity, climate change and social justice, there has been a
231 continuous discussion between stakeholders about the future development of agricultural and
232 food systems. In this sense, agricultural ecosystems face the challenge of producing more
233 products with fewer inputs simultaneously to satisfy the demand for more food and reduce the
234 global environmental impact of agriculture (Martinez and Pellerin, 2016). This literature
235 provides scientific background that legitimizes agroecology as a relevant analytical
236 framework for jointly understanding climate and agricultural issues while proposing
237 agricultural solutions to climate issues.

238 ***Climate-smart agriculture: A scientific concept to mobilize agricultural development***
239 ***stakeholders on climate issues***

240

241 The CSA's trajectory differs markedly from that of agroecology as it is designed to
242 encompass agriculture and climate change while being strategically promoted by FAO and
243 scientific partners to legitimize and promote the linking of agricultural and climate issues.
244 CSA aims to make food security and climate change adaptation and mitigation compatible,
245 while promoting agriculture as one of the solutions to climate change, thus legitimizing its
246 integration in climate negotiations. Its implementation needs a change of mentality in the
247 direction of an approach that takes into account how the increase in technologically induced
248 productivity affects climate change (Fusco et al, 2020). The adoption of this approach led to a
249 new evaluation frame of all current practices, including agroecological ones (organic
250 production, soil conservation techniques, natural resources conservation techniques,
251 agroforestry) and allowed agroindustrial production models to be reconsidered as ecological
252 production models insofar as they use practices that favor mitigation and/or adaptation to

253 climate change (e.g., no tillage, genetically modified organisms (GMOs), above-ground
254 production).

255 However, CSA publications understated mitigation (Saj et al 2017). This bias probably
256 reflects poor knowledge regarding the potential of agricultural systems to decrease emissions
257 or sequester carbon, although carbon markets have been operating for some time and recent
258 literature has highlighted the role of agricultural soils in carbon sequestration. The 4%
259 Initiative (Soils for Food Security and Climate) (Minasny et al 2017), launched at UNFCCC
260 COP21, has served as a goal for other CSA promoters.

261 FAO had already informally sought to raise awareness among governments on the importance
262 of linking food security and climate change internally and within the UNFCCC COPs prior to
263 its official CSA presentation at The Hague during the Global Conference on Agriculture,
264 Food Security and Climate Change (FAO, 2009a). By promoting CSA, FAO strengthened its
265 own position on climate change, legitimizing the integration of agricultural issues with the
266 international climate change agenda (Hrabanski 2020; Newell and Taylor 2017).
267 Collaborating with other actors to build the problem and solutions, FAO, as a policy
268 entrepreneur, launched an alliance strategy with research centers and universities. Interviews
269 with CSA's promoters indicated that knowledge produced on CSA should have considered
270 policymakers' needs. Subsequent to the 2010 Hague Conference, FAO and other CSA
271 promoters therefore initiated a two-tailed process of mediatization of the issue: a scientific
272 community-oriented process structured around the organization of international scientific
273 conferences followed by scientific publications and a process to promote CSA in political
274 arenas (Torquebiau, 2017). FAO's CSA at The Hague rapidly became popular within the
275 scientific community, thanks especially to the alliances forged between FAO economists and
276 scientists from the University of Wageningen (WUR) in the Netherlands, UC Davis (USA),
277 CIRAD, and the Climate Change, Agriculture and Food Security (CCAFS) collaborative
278 program of CGIAR. These organizations have different mandates: agricultural education and
279 research with a strong interest in the Global South (WUR and UC Davis), agricultural
280 research for development in tropical countries (CIRAD), and international agricultural
281 research (CCAFS and, more broadly, CGIAR). Despite their differences in status and
282 mandates, the legitimacy of these organizations is based on their ability to produce scientific
283 agricultural knowledge that is "useful" for development. As such, these institutions are jointly
284 part of the academic, scientific, and development fields. Together with FAO, they constitute
285 an epistemic community to foster CSA concepts. For all these organizations, this community
286 is of strategic interest insofar as CSA facilitates the mainstreaming of agriculture and

287 development in climate negotiations. This facilitates access to new funding opportunities for
288 agricultural adaptation to climate change, in a context where this is typically difficult,
289 particularly in developing countries. The CSA concept thus provides a new opportunity to
290 support and manage climate change adaptation funding in the G77 developing nations.

291 Finally, FAO and other promoters have supported CSA on the international climate agenda
292 and become closer to the “4 per 1000 initiatives” promotion goals. In addition, since the mid-
293 2010s, FAO has promoted the agroecology approach (Giraldo and Rosset 2018). Despite
294 differences, FAO uses and simultaneously promotes CSA and agroecology to maintain its
295 position as a forerunner in agriculture on the global climate agenda.

296 *Nature-based solutions: When the conservation community is mobilized in climate*
297 *negotiations*

298

299 The interview with the scientists showed that the emergence of the NBS concept reflects the
300 strategy of conservation actors wishing to integrate climate negotiations. This concept
301 promotes nature as a provider of solutions to climate change mitigation and adaptation issues.
302 It was institutionally defined at the World Conservation Congress in 2016 as “actions to
303 protect, sustainably manage and restore natural or modified ecosystems to directly address
304 societal challenges in an effective and adaptive manner while ensuring human well-being and
305 benefits for biodiversity” (Cohen-Shacham et al 2016). NBS is also an umbrella concept that
306 covers many concepts and practices for adapting ecosystems to climate change, such as
307 nature-based management, ecosystem-based management, ecosystem-based adaptation,
308 ecosystem-based mitigation, and ecosystem restoration (Nesshöver et al 2017). According to
309 IUCN, NBS often has a more attractive cost/benefit ratio than the investment and
310 maintenance of gray infrastructure or new technologies, while being flexible and adaptive by
311 not requiring any heavy high-impact infrastructure. Moreover, NBS can be managed in
312 response to changing circumstances due to climate change.

313 The NBS’s epistemic community is mainly structured around IUCN. This hybrid
314 organization, involved in both scientific and political arenas (Hrabanski and Pesche 2016)
315 first referred to the NBS concept in the early 2000s in several internal documents. Then,
316 inspired by the biodiversity community, the concept was introduced in World Bank’s (2008)
317 entitled *Biodiversity, Climate Change and Adaptation: Nature-based Solutions from the*
318 *World Bank Portfolio*. The advent of NBS coincided with the emergence and increased
319 visibility of climate issues in international negotiations. IUCN (2009) promoted it the

320 following year in its COP15 position paper and (2012) further recognized its importance in
321 2013 when it adopted NBS as the third focus of its 2013-2016 World Programme. In 2014,
322 the concept also appeared in the final report of the 12th CoP of the Convention on Biological
323 Diversity.

324 While NBS was initially widely promoted by IUCN, since 2010, other actors, including
325 scientists (Nature-Based Solution Initiative, Nature-Based Solution Policy Platform, both
326 connected to IUCN) and conservation NGOs have also promoted it. More recently, China and
327 New Zealand, the co-leading countries of the Nature-Based Solutions for Climate Coalition
328 from the 2019 United Nations' Climate Action Summit built the NBS for the Climate
329 Manifesto below to articulate the value and rationale for implementing NBS. The NBS
330 Coalition has expanded to 32 countries plus the EU Commission in 2020, as well as private
331 sector and civil society organizations and coalitions. The NBS Coalition proposed that NBS
332 can provide over one-third of the cost-effective climate mitigation needed between now and
333 2030 to stabilize global warming to below 2 °C. Simultaneously, NBS supports vital
334 ecosystem services, biodiversity, fresh water access, improved livelihoods, healthy diets, and
335 food security from sustainable food systems. Thus, these solutions are presented as a new,
336 fundamental action component for climate and biodiversity. NBS also constitutes an
337 opportunity for conservation actors to access climate finance. Agricultural issues are
338 therefore—for conservation community representatives—an important lever insofar as
339 agricultural production is at the interface of conservation and climate issues (Ezzine et al
340 2016; Hrabanski et al 2013). NBS is a way to go beyond the widely held idea in conservation
341 sphere that agriculture is a problem for or opposed to conservation. NBS, like CSA and
342 agroecology, seemed to focus on adaptation over mitigation⁷. These articles help to better
343 curtail the uncertainty surrounding natural climate solution mitigation estimates. The
344 emergence of the NBS concept reflects the strategy of conservation actors wishing to integrate
345 climate negotiations, and thus access the substantial climate change funding which is much
346 more important than biodiversity funding. They constitute an epistemic community and
347 promote nature as a provider of solutions to climate change mitigation and adaptation issues

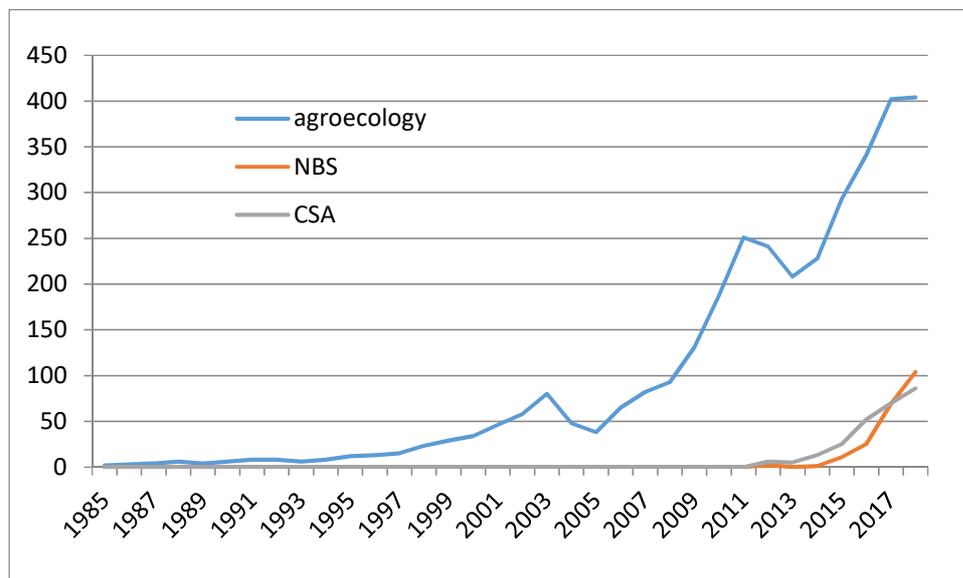
348

349 *Three deeply academically rooted concepts*

350

⁷ However, recent publications have highlighted that NBS approaches contribute to CO₂ mitigation (Cameron et al 2017; Griscom et al. 2017; Turner 2018).

351 Bibliometric analyses provide another perspective to understand the use of these three
352 concepts in literature (figure 3). It confirms the rise in their importance since the early 2010s
353 in research.



354
355 Figure 3. Number of scientific articles from 1985 to 2018 that mention agroecology, CSA, or
356 NBS. Source: SCOPUS.

357
358 The volume of agroecology publications was much greater than that of the other concepts
359 (over 3,100 publications), which could be partially explained by its precedence and history.
360 Agroecology, unlike the other two concepts, was created to tackle neither climate change-
361 related agricultural issues nor mainstream agricultural issues in climate negotiations.
362 However, since the late 2000s, agroecology was more systematically associated with climate
363 change challenges, thus illustrating the willingness of its promoters to support the climate
364 agenda. Topics related to climate and food security in agroecology increased during the 2012–
365 2016 period, from a share of 10% before 2012 to 22% in 2016 (Saj et al 2017). This confirms
366 the climatisation of agroecology.

367 The volume of CSA publications (262) was much more limited, but its growth was
368 exponential after 2010. The number of publications on CSA increased significantly, including
369 official FAO publications, peer-reviewed and high-impact factor journals (thus legitimizing
370 CSA’s scientific validity), and position papers published in prestigious journals such as
371 *Nature Climate Change* (Lipper et al 2014) and *Environmental Sustainability* (Brussaard et al
372 2010).

373 Finally, the bibliometric analysis showed that 216 NBS publications were released since the
374 early 2010s. IUCN was the main promoter, but scientists, mainly from northern European

375 universities (Helmholtz Zentrum für Umweltforschung, Stockholms Universitet, Wageningen
376 University and Research Centre, Humboldt-Universität zu Berlin, Lunds Universitet, Royal
377 Belgian Institute for Natural Sciences, Oxford University, etc.) and more recently from
378 American universities, also started publishing on this topic.

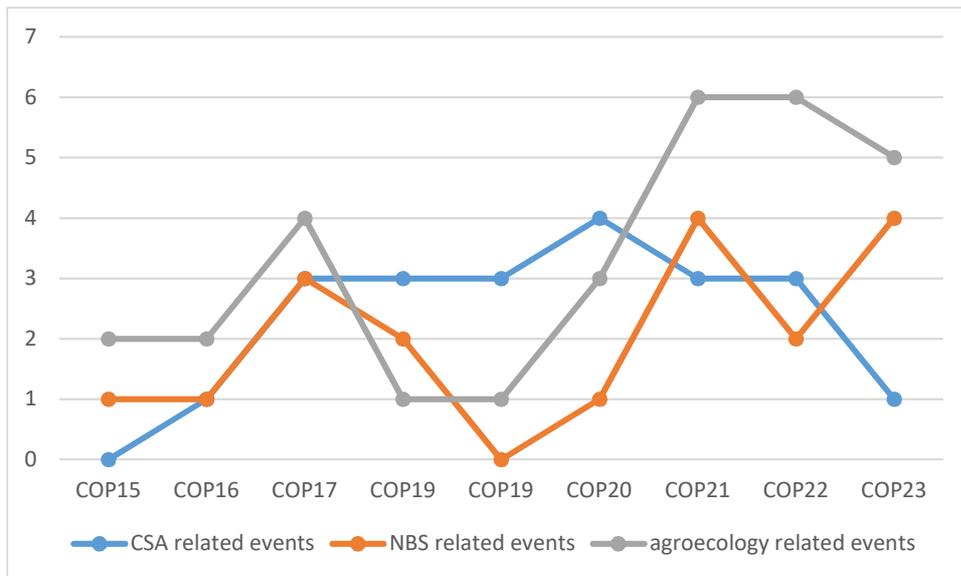
379 Finally, our analysis of the five IPCC reports reveals that these concepts were almost absent
380 from IPCC publications, which form the main science-policy interface for international
381 climate. CSA and agroecology were only briefly mentioned in the 2014 report (only one CSA
382 mention and a bibliography review regarding agroecology). Hence, although these three
383 concepts have a clear international scientific trajectory, their diffusion and mobilization by a
384 science-policy interface (IPCC) seems very limited. To continue the tracing of the three
385 concepts, we analyzed the status of these three concepts in the UNFCCC COPs and in the
386 Nationally Determined Contributions (NDCs) proposed by states within the framework of the
387 Paris Agreement.

388

389 ***Political progressions of the three concepts in the UNFCCC COPs***

390 The use of these three concepts is limited in the political documents. Indeed, these concepts
391 were totally absent from the UNFCCC COP final reports and decisions. The only notable
392 mention concerning CSA in Kofi Annan's opening speech at COP17. Conversely, we found
393 that they were discussed to a greater extent at side events at the various UNFCCC COPs
394 (Figure 6). First, we observed that the concepts emerged almost simultaneously. An initial
395 side event was held in 2009 on the agroecology theme during COP15, while two others were
396 held the following year on NBS and CSA. Second, we observed that in 2017, the cumulative
397 number of side events or exhibits addressing agroecology, CSA, and NBS totaled 22, 21, and
398 18, respectively (Figure 4).

399



400

401 Figure 4. Number of side events related to CSA, agroecology, and NBS at UNFCCC COPs.

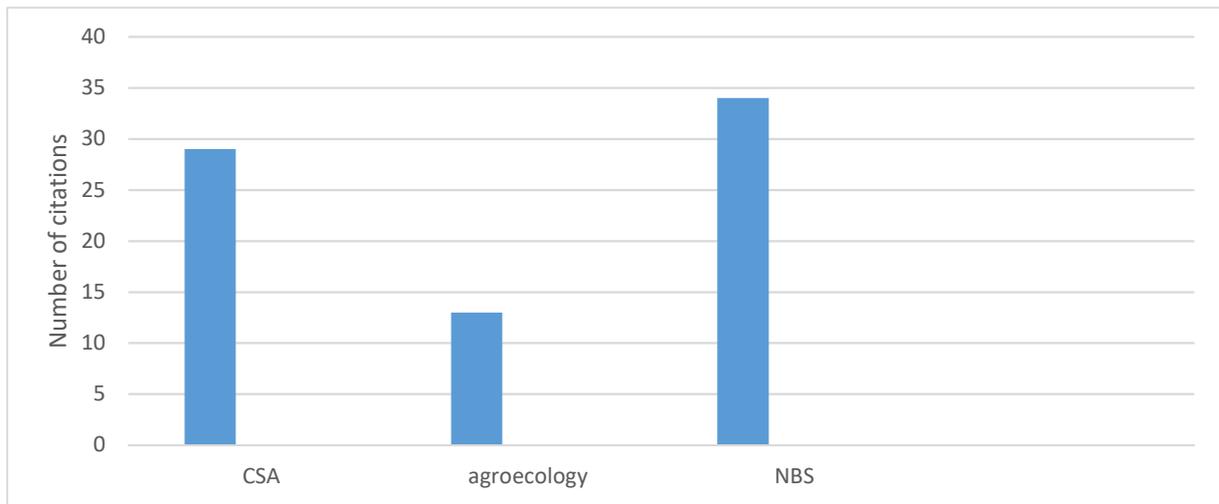
402 *The status of the three concepts in the NDCs*

403

404 Despite their almost invisibility in international official documents (IPCC, COP reports), the
 405 political dissemination of the three concepts was more tangible in NDC policy documents. Of
 406 the 197 states that have drafted an NDC,⁸ 13 addressed the agroecology concept (about 8%)
 407 and 29 addressed CSA (about 15%). A qualitative document analysis revealed that this
 408 concept was mainly related to adaptation and that countries placed great emphasis on the need
 409 for technology transfer. Concerning CSA, African countries were over-represented (22 states).
 410 In addition, three countries addressed the CSA and agroecology concepts simultaneously in
 411 their NDCs: Côte d'Ivoire (two CSA, two agroecology), Zimbabwe (two CSA, one
 412 agroecology), and Uruguay (one CSA, one agroecology). Although NBS was not directly
 413 mentioned, twelve countries mentioned “ecosystem-based management,” twenty mentioned
 414 “ecosystem-based adaptation,” and two mentioned “ecosystem-based mitigation” (Figure 5).

415

⁸ The official UNFCCC website only lists states that had ratified it at the time of the survey: 172 States. Documents available at: <http://www4.unfccc.int/ndcregistry/Pages/All.aspx>



416

417 Figure 5. Number of citations of CSA, agroecology, or/and NBS in 197 NDC, in 2018.

418

419 Such rapid adoption of these concepts (especially CSA) by states in their NDCs could be
 420 explained by the international cooperation bodies of the epistemic community, especially
 421 FAO and CCAFS for CSA, FAO for agroecology, and IUCN and international NGOs for
 422 NBS, in addressing the demand for expertise from states to cast their NDC and integrate
 423 agriculture with climate agenda.

424

425 **Discussion: Competition, controversy, and synergy between the concepts**

426

427 A first split virulently opposed agroecology supporters and CSA promoters, as noted during
 428 the launch of the Global Alliance for CSA (GACSA) in 2014 at the New York Climate
 429 Summit, at the initiative of the Dutch Prime Minister. GACSA aimed to bring together
 430 national governments, NGOs, civil society, and private sector stakeholders in support of the
 431 CSA concept to foster multi-stakeholder ownership of the concept and promote its practical
 432 implementation. At the beginning of the GACSA, American, Dutch, and French governments
 433 were particularly involved. The agricultural sector in their GDP is high, which explains their
 434 support for CSA. Agribusiness actors soon joined GACSA, some of whom favored the use of
 435 biotechnologies (GMOs, soilless farms, etc.) (Newell and Taylor 2017). GASCA's opening to
 436 the private agribusiness sector led a number of civil society organizations to publish an open
 437 letter denouncing the CSA concept and noting FAO's responsibility in this dilemma, given
 438 that the GACSA Secretariat is hosted by FAO (among other agriculture-related hubs it hosts).
 439 In September 2014, at the International Symposium on Agroecology, a network of scientific
 440 experts sent a letter to FAO expressing its opposition to CSA and its associated risks,

441 including the crowding out of social and environmental justice and the lack of civil society
442 support for the CSA concept. Shortly thereafter, 355 NGOs in the run-up to COP21 in Paris in
443 2015 called for a manifesto against CSA, denouncing, *inter alia*, that “60% of GACSA’s
444 private sector members operate in the fertilizer sector” (Chappell 2014). Some multinationals
445 with questionable social and environmental impacts, such as Monsanto, Walmart, and
446 McDonalds, have even launched their own CSA programs.⁹ Second, since the mid-2010s,
447 FAO—which was a forerunner in promoting CSA approaches—has also fostered the
448 agroecology approach (Giraldo and Rosset 2018). At COP23, in 2017), FAO thus showcased
449 agroecology as a way to produce enough food for a growing population while protecting
450 natural resources and livelihoods and responding to climate change.¹⁰ FAO has also approved
451 the 10 Elements of Agroecology as an analytical framework to support the design of
452 differentiated paths for agriculture and food systems transformation (Barrios et al, 2020). It
453 confirmed that agroecology is in fashion and now constitutes a focus of dispute between
454 social movements and several other actors, such as governments, research centers, and
455 international organization (Rivera-Ferre 2018).

456 The enthusiasm and windfall effect linked to the opportunity to raise funds to fight climate
457 change have led many actors to rush into this quest. Suspicions of a CSA catch-all that would
458 be subject to all diversions and recoveries, particularly of the green-washing type, are
459 growing. CSA supporters responded to criticism from agroecology advocates and some civil
460 societies by pointing out that agroecological practices could be considered as CSA practices.
461 Saj et al (2017) thus claimed that “CSA does not have a specific blueprint for climate-smart
462 practices and has rather a strong focus on policies, institutions and financing. Hence
463 agroecology actually responds to the needs of CSA in terms of site-specificity and potential
464 for adoption by farmers because it is strongly based on local practices.” Although some CSA
465 promoters are working toward the reconciliation of agroecology and CSA and some scientists
466 have highlighted links between them, these attempts are politically impossible because of the
467 significant mistrust on the part of agroecology proponents, who are wary of the support
468 gained by agribusiness and GMO promoters in GACSA, particularly since COP21 (Benabou
469 et al 2017). Despite these controversies, COP21 highlighted CSA. In 2016, the World Bank
470 (2016) also announced that it wanted all its programs to be CSA-oriented by 2019, while
471 FAO, despite agroecology proponents’ concerns, continued to promote both approaches
472 simultaneously. The CSA and agroecology concepts are thus in competition, and through

⁹ <https://drive.google.com/file/d/0B0FCnBUG7Lp6UUt4SGhvNzNaTDQ/edit>

¹⁰ <http://www.fao.org/climate-change/news/detail/en/c/1068404>

473 them, old tensions are arising regarding the coexistence of sometimes contradictory
474 production models, policies, and agricultural practices (Newell et al, 2018).
475 Controversies, albeit less politically charged, also affect NBS. The French *Fondation pour la*
476 *Recherche et la Biodiversité* (FRB) thus calls for caution in the use of NBS and especially
477 questions “the degree of matching, filiation, complementarity and competition with already
478 existing terminological approaches such as agroecology.” The NBS approach seems similar to
479 existing approaches in showing that biodiversity and ecosystems can be used to solve a
480 number of societal problems (climate change, sustainability of primary sector activities, urban
481 development, health, etc.). A wide range of NBS seems to resemble ecological engineering.
482 FRB and several scientific publications have thus reported that, although NBS could be an
483 attractive communication tool, it is also risky. Indeed, the concept could limit reflection to
484 ecological engineering while climate change also requires the adoption of political responses,
485 particularly concerning production and consumption patterns.

486

487 **Conclusion**

488

489 We analyzed the contribution of CSA, agroecology, and NBS to the climatisation of
490 agriculture and its integration into international climate agenda. We show that, despite these
491 concepts’ differences regarding their origins and scientific and political progressions, they all
492 contribute to the “climatisation” of agricultural issues. Although they were not central to the
493 process, these concepts and their related epistemic communities contributed to the opening of
494 policy windows, which led to the integration of agriculture in international climate negotiation
495 at the 2011 Durban COP. Then, when policy windows open for agriculture integration into
496 international climate agenda, these concepts boomed and, in response, contributed to further
497 strengthening the agriculture integration and the climatisation of the agriculture issue.

498 These three concepts’ standpoints and climate issue and policy positioning differ. Since the
499 late 2000s, academic and/or civil society supporters of agroecology have stressed that climate
500 change adaptation and mitigation objectives are pivotal to agroecology. Their positioning has
501 been more reactive, as they were initially concerned about proposing an alternative model to
502 the conventional green revolution paradigm. In contrast and from a different perspective, the
503 CSA epistemic community, led by FAO and CGIAR, also worked toward the reconciliation of
504 agriculture and the climate agenda but more proactively by creating the CSA concept
505 intentionally to support agricultural integration into climate arenas. Conventional

506 conservation actors who strive to highlight the role of the ecosystem (including agriculture)—
507 when understood in a systemic way—in GHG reduction objectives and adaptation, support
508 NBS. Finally, beyond the competition and synergies, the concepts’ tracing shows that the
509 CSA, agroecology, and NBS approaches were primarily focused on adaptation rather on
510 mitigation. This confirms that the integration of agricultural issues into climate governance
511 has happened more extensively for adaptation than for mitigation (Soto and Visseren-
512 Hamakers 2018).

513 These concepts were promoted by three different epistemic communities, which have played a
514 decisive role in the emergence of agricultural issues in the global climate agenda-setting. We
515 also highlighted the close link between the political and scientific dimensions inherent to
516 these three concepts. Each concept has both a scientific dynamic, as reflected by the
517 publications reviewed, and a political progression, as highlighted by the analysis of UNFCCC
518 NDCs, COPs, and side events. While they have played a key role in the genesis of agricultural
519 issues in climate agenda-setting, these studied concepts are far from being only scientifically
520 oriented, as indicated by the criticism against them. Each concept has a specific political
521 framing with regard to the agricultural issue. Beyond the shared interest of integrating
522 agriculture in climate agenda, they are competing for the promotion of distinct agricultural
523 models. The scientific and political dynamics of these concepts sometimes blur the situation
524 while confirming that scientific production cannot be separated from political and societal
525 affairs. The key point is that the use of scientific knowledge in global environmental
526 governance provides scientific knowledge and earns its decisive place in the policy-making
527 process at international and transnational levels. In this way, the last *IPCC Special Report on*
528 *Climate Change, Desertification, Land Degradation, Sustainable Land Management, Food*
529 *Security, and Greenhouse gas fluxes in Terrestrial Ecosystems* (IPCC 2019) emphasizes the
530 need for a new approach to agriculture that would feed a growing population while using
531 natural resources more sustainably. We highlight that these conceptual debates must not hide
532 the political stakes they crystallize; behind the concepts presented in climate global
533 governance, some antagonistic agricultural models are promoted. Hence, further path for
534 research agenda would include in-depth analysis of political interest and actors’ interplays in
535 climate global governance. It also should explore more systematically the level and condition
536 of uptake of these concepts in national policy processes and arenas, the design of policy
537 instruments, and the implication of this concept integration in term of governments’ planning
538 and funding decisions in agriculture to face climate issues.

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