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# 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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**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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**4/ findings**

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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 climatisation<sup>1</sup> 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

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<sup>1</sup> 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 citations<sup>2</sup> 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)<sup>3</sup> 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.<sup>4</sup>  
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

---

<sup>2</sup> 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.”

<sup>3</sup> 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

<sup>4</sup> 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 interviews<sup>5</sup> 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.

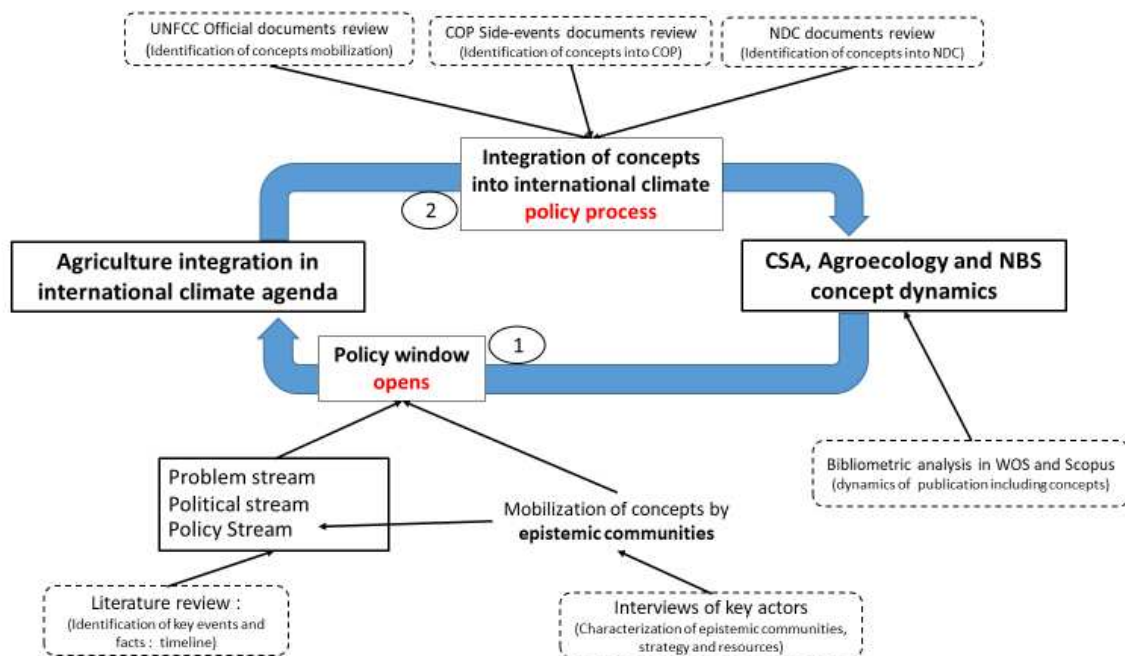
107

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:

---

<sup>5</sup> 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 process<sup>6</sup>.

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

128  
<sup>6</sup> 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 CO<sub>2</sub> 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.

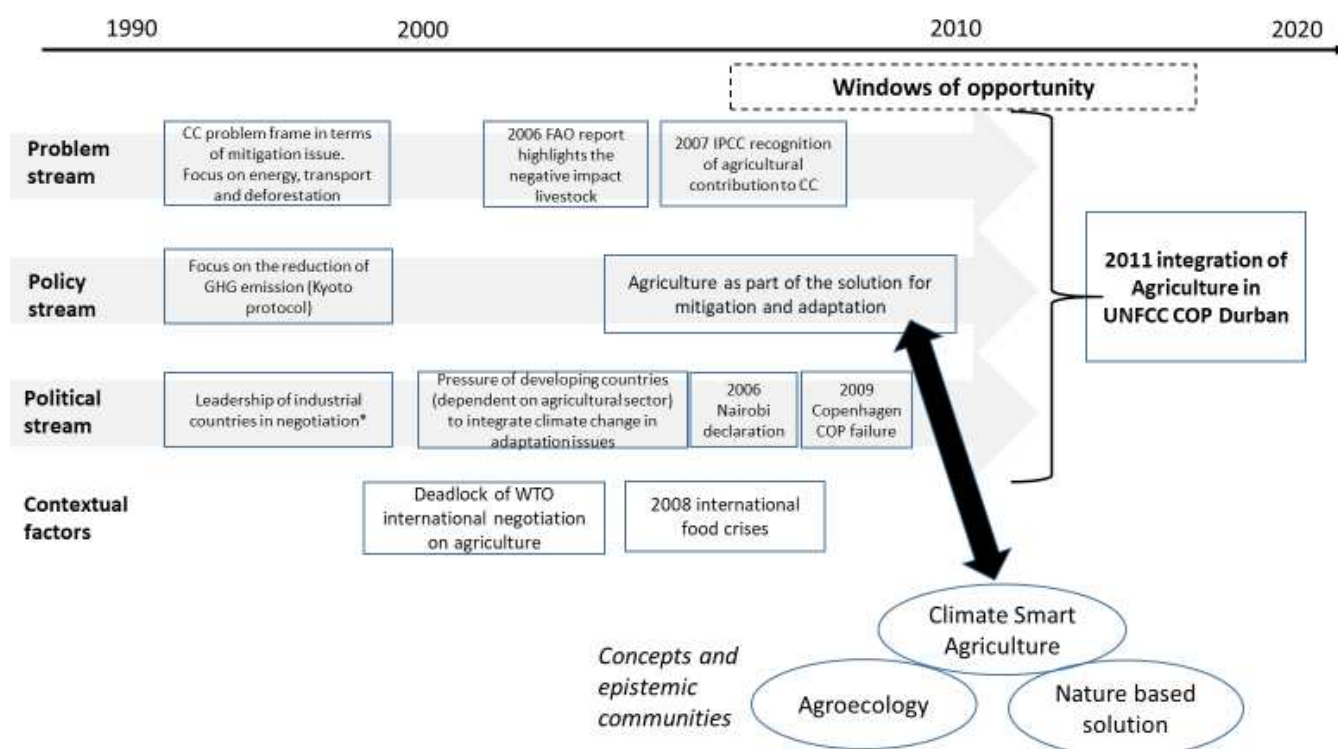
160 The political stream must be combined with the first two to create a window of opportunity  
161 (Kingdon 1984). In our study, it is part of the international negotiation process, which was



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

	<b>Agroecology</b>	<b>CSA</b>	<b>NBS</b>
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 12<sup>th</sup> 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 mitigation<sup>7</sup>. 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

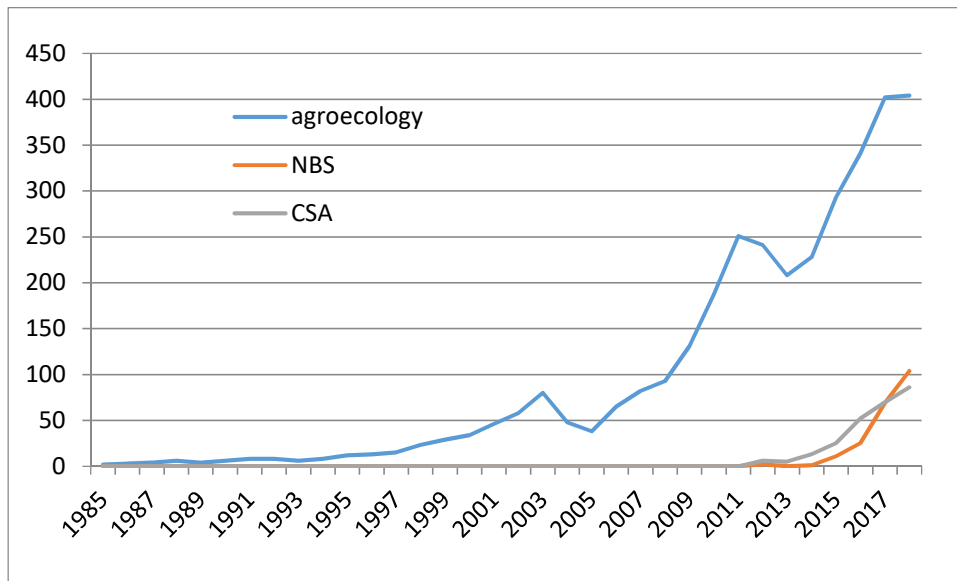
349 *Three deeply academically rooted concepts*

350

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<sup>7</sup> However, recent publications have highlighted that NBS approaches contribute to CO<sub>2</sub> 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.

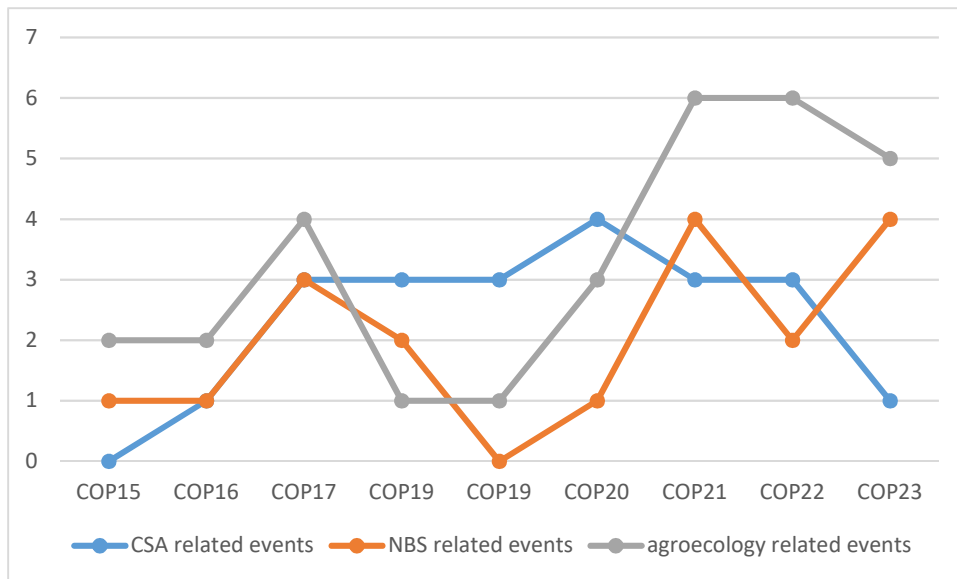
379 Finally, our analysis of the five IPCC reports reveals that these concepts were almost absent  
380 from IPCC publications, which form the main science-policy interface for international  
381 climate. CSA and agroecology were only briefly mentioned in the 2014 report (only one CSA  
382 mention 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.

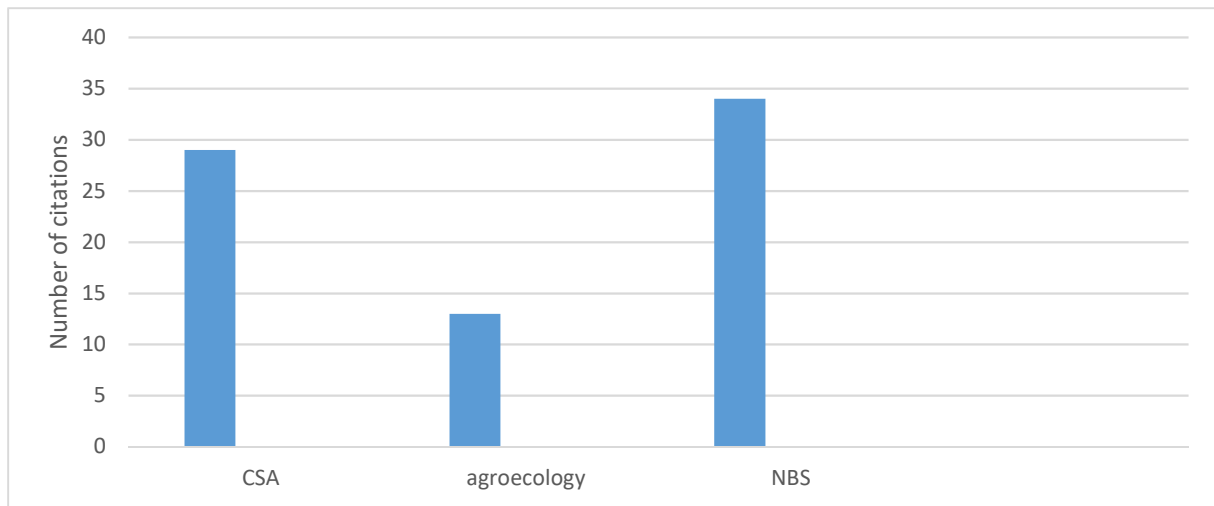
402 *The status of the three concepts in the NDCs*

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,<sup>8</sup> 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

<sup>8</sup> 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.<sup>9</sup> 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.<sup>10</sup> 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

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

<sup>10</sup> <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.

539 References

- 540 Altieri, Miguel A. 1983. *Agroecology: The Scientific Basis of Alternative Agriculture*.  
541 Boulder, CO: Westview Press
- 542 Altieri, Miguel A. 2009. Agroecology, Small Farms, and Food Sovereignty. *Monthly Review*  
543 61: 102-113.
- 544 Altieri, Miguel A. and Clara I. Nicholls. 2008. Scaling up Agroecological Approaches for  
545 Food Sovereignty in Latin America. *Development* 51: 472-480.
- 546 Altieri, Miguel A. and Clara I. Nicholls. 2013. The Adaptation and Mitigation Potential of  
547 Traditional Agriculture in a Changing Climate. *Climatic Change* 140: 33-45.
- 548 Altieri, Miguel A., Clara I. Nicholls, Alejandro Henao, and Marcos A. Lana. 2015.  
549 Agroecology and the Design of Climate Change-Resilient Farming Systems.  
550 *Agronomy for Sustainable Development* 35: 869-890.
- 551 Andresen, Steinar, and Shardul Agrawala. 2002. Leaders, Pushers and Laggards in the  
552 Making of the Climate Regime. *Global Environmental Change* 12: 41-51.
- 553 Aykut, Stefan C. 2020. *Climatiser le monde*, Paris: Éditions Quae.
- 554 Aykut, Stefan C., and Amy Dahan. 2011. Le régime climatique avant et après Copenhague:  
555 sciences, politiques et l'objectif des deux degrés. *Natures Sciences Sociétés* 19: 144-  
556 157.
- 557 Aykut, Stefan C., Jean Foyer, and Edouard Morena. 2017. *Globalising the Climate: COP21*  
558 *and the Climatisation of Global Debates*. London: Routledge.
- 559 Ball, B.C.; Hargreaves, P.R.; Watson, C.A. A framework of connections between soil and  
560 people can help improve sustainability of the food system and soil functions. *Ambio*  
561 2017, 47, 269–283
- 562 Barrios, E., Gemmill-Herren, B., Bicksler, A., Siliprandi, E., Brathwaite, R., Moller, S., ... &  
563 Tittonell, P. (2020). The 10 Elements of Agroecology: enabling transitions towards  
564 sustainable agriculture and food systems through visual narratives. *Ecosystems and*  
565 *People*, 16(1), 230-247.
- 566 Baumgartner, Frank R., Bryan D Jones. 2010. *Agendas and instability in American politics*.  
567 University of Chicago Press.
- 568 Beach, Derek, and Rasmus Brun Pedersen. 2019. *Process-tracing methods: Foundations and*  
569 *guidelines*, University of Michigan Press.
- 570 Béland Daniel, Michael Howlett. 2016. The Role and Impact of the Multiple-Streams  
571 Approach in Comparative Policy Analysis, *Journal of Comparative Policy Analysis:*  
572 *Research and Practice*, 18.3: 221-227.

- 573 Benabou, Sarah, Nils Moussu, and Birgit Müller. 2017. The Business Voice at COP21: The  
574 Quandaries of a Global Political Ambition. In *Globalising the Climate: COP21 and*  
575 *the Climatisation of Global Debates*, edited by Stefan C. Aykut, Jean Foyer, and  
576 Edouard Morena. London: Routledge.
- 577 Biermann, Frank. 2000. Science as Power in International Environmental Negotiations:  
578 Global Environmental Assessments Between North and South. Discussion Paper  
579 2000-17. Harvard Kennedy School, Cambridge, MA.
- 580 Bijker, Wiebe E., Roland Bal, and Ruud Hendricks. 2009. *The Paradox of Scientific*  
581 *Authority. The Role of Scientific Advice in Democracies*. Cambridge, MA: MIT Press
- 582 Bodanksy, Daniel. 2010. The Copenhagen Climate Change Conference: A Postmortem.  
583 *American Journal of International Law* 104: 230-240.
- 584 Brussard, Lijbert, Patrick Caron, Bruce Campbell, Leslie Lipper, Susan Mainka, Rudy  
585 Rabbinge, Didier Babin, and Mirjam Pulleman. 2010. Reconciling Biodiversity  
586 Conservation and Food Security: Scientific Challenges for a New Agriculture. *Current*  
587 *Opinion in Environmental Sustainability* 2 (1-2): 34-42.
- 588 Cameron, D. Richard, David C. Marvin, Jonathan M. Remucal, and Michelle C. Passer. 2017.  
589 Ecosystem management and land conservation can substantially contribute to  
590 California's climate mitigation goals. *Proceedings of the National Academy of*  
591 *Sciences* 114 (48): 12833-12838.
- 592 Caron, Patrick, and Sebastien Treyer. 2016. Climate-smart Agriculture and International  
593 Climate Change Negotiation Forums. In *Climate Change and Agriculture Worldwide*,  
594 edited by Emmanuel Torquebiau, 325-336. Dordrecht: Springer.
- 595 Chandra, Alvin, Karen E. McNamara, Paul Dargusch, Beau Damen, Janie Rioux, Jonas  
596 Dallinger, and Imelda Bacudo. 2016. Resolving the UNFCCC Divide on Climate-  
597 smart Agriculture. *Carbon Management* 7 (5-6): 295-299.
- 598 Chappell, M. Jahi. 2014. Scientists' Support Letter for the International Symposium on  
599 Agroecology, 18–19 September, 2014. Available online at:  
600 [https://www.iatp.org/sites/default/files/2014.09.17\\_AgroecologyFAOLetter.pdf](https://www.iatp.org/sites/default/files/2014.09.17_AgroecologyFAOLetter.pdf), last  
601 accessed September 27, 2020.
- 602 Cohen-Shacham, E., G. Walters, C. Janzen, and S. Maginnis. 2016. *Nature-based Solutions to*  
603 *Address Global Societal Challenges*. Gland, Switzerland: IUNC.
- 604 Collier, David. 2011. Understanding process tracing, *Political Science & Politics*, 44: 823-30.
- 605 Dahan, Amy. 2014. L'impasse de la gouvernance climatique globale depuis vingt ans. Pour un  
606 autre ordre de gouvernementalité. *Critique Internationale* 62: 21-37.



607 Dahan, Amy. 2018. La climatisation du monde. *Esprit* 2018 (1-2): 75-86.

608 Dimitrov, Radoslav S. 2010. Inside Copenhagen: The State of Climate Governance. *Global*  
609 *Environmental Politics* 10 (2): 18-24.

610 Ezzine-de-Blas, Driss, Marie Hrabanski, and Jean-François Le Coq. 2016. Payment for  
611 Environmental Services in Climate Change Policies. In *Climate Change and*  
612 *Agriculture Worldwide*, edited by Emmanuel Torquebiau, 277-288. Dordrecht:  
613 Springer.

614 FAO (Food and Agriculture Organization of the United Nations). 2009a. *Food Security and*  
615 *Agricultural Mitigation in Developing Countries: Options for Capturing Synergies*.  
616 Rome: Food and Agriculture Organization of the United Nations.

617 FAO. 2009b. *Profile for Climate Change*. Rome: Food and Agriculture Organization of the  
618 United Nations.

619 Fischer, Frank. 2009. *Democracy and Expertise: Reorienting Policy Inquiry*. Oxford: Oxford  
620 University Press.

621 Francis, C., G. Lieblein, S. Gliessman, T. A. Breland, N. Creamer, R. Harwood, L.  
622 Salomonsson, J. Helenius, D. Rickerl, R. Salvadaor, M. Wiedenhoef, S. Simmons, P.  
623 Allen, M. Altieri, C. Flora, and R. Poincelot. 2003. Agroecology: The Ecology of  
624 Food Systems. *Journal of Sustainable Agriculture* 22 (3): 99-118.

625 Fusco, G., Melgiovanni, M., Porrini, D., & Ricciardo, T. M. (2020). How to improve the  
626 diffusion of climate-smart agriculture: What the literature tells us. *Sustainability*,  
627 12(12), 5168.

628 George, Alexander L, and Andrew Bennett. 2005. *Case study and theory development in the*  
629 *social sciences*, Cambridge, MA.

630 Giraldo, Omar Felipe, and Peter M. Rosset. 2018. Agroecology as a Territory in Dispute:  
631 Between Institutionalality and Social Movements. *The Journal of Peasant Studies* 45  
632 (3): 545-564.

633 Glantz, Michael H., René Gommès, and Selvaraju Ramasamy. 2009. *Coping with a Changing*  
634 *Climate: Considerations for Adaptation and Mitigation in Agriculture*. Rome: Food  
635 and Agriculture Organization of the United Nations.

636 Gliessman, Stephen R. 2011. *Agroecology and Food System Change*. Boca Raton: Taylor &  
637 Francis.

638 Griscom, B. W., J. Adams, P. W. Ellis, R. A. Houghton, G. Lomax, D. A. Miteva, W. H.  
639 Schlesinger, D. Shoch, J. V. Siikamäki and P. Smith (2017). *Natural climate solutions*,  
640 *Proceedings of the National Academy of Sciences* 114(44): 11645-11650.

641 Haas, Peter M. 1992. Introduction: Epistemic Communities and International Policy  
642 Coordination. *International Organization* 46 (1): 1-35.

643 Haas, Peter M. 2015. *Epistemic Communities, Constructivism, and International*  
644 *Environmental Politics*. London: Routledge.

645 Hrabanski, Marie. 2020. Une climatisation des enjeux agricoles par la science? Les  
646 controverses relatives à la climate-smart agriculture. *Critique Internationale* 86 (1):  
647 189-208.

648 Hrabanski, Marie, Cécile Bidaud, Jean François Le Coq, and Philippe Méral. 2013.  
649 Environmental NGOs, Policy Entrepreneurs of Market-based Instruments for  
650 Ecosystem Services? A comparison of Costa Rica, Madagascar and France. *Forest*  
651 *Policy and Economics* 37: 124-132.

652 Hrabanski, Marie, and Denis Pesche. 2016. *The Intergovernmental Platform on Biodiversity*  
653 *and Ecosystem Services (IPBES): Meeting the Challenge of Biodiversity Conservation*  
654 *and Governance*, London: Routledge.

655 Interdepartmental Working Group on Climate Change. 2008. *Climate Change and Food*  
656 *Security: A Framework Document*. Rome: Food and Agriculture Organization of the  
657 United Nations.

658 IPCC (Intergovernmental Panel on Climate Change). 2019. *Climate Change and Land: IPCC*  
659 *Special Report on Climate Change, Desertification, Land Degradation, Sustainable*  
660 *Land Management, Food Security, and Greenhouse Gas Fluxes in Terrestrial*  
661 *Ecosystems*. Summary for Policymakers, Approved Draft. Available online at:  
662 <https://report.ipcc.ch/srccl/pdf/3.%20Summary%20of%20Headline%20Statements.pdf>  
663 , last accessed September 26, 2020.

664 IUCN (International Union for Conservation of Nature). 2009. No Time to Lose: Make Full  
665 Use of Nature-based Solutions in the Post-2012 Climate Change Regime. Unpublished  
666 paper presented at the Conference of the Parties of the United Nations Framework  
667 Convention on Climate Change (COP15), Copenhagen, Denmark.

668 IUCN. 2012. IUCN Commission on Education and Communication (CEC) Component  
669 Programme Plan 2013-2016. Available online at:  
670 <https://www.iucn.org/content/introducing-iucn-cec-programme-2013-2016>, last accessed  
671 [September 27, 2020](#).

672 Jakobi, Anja P. 2009. *International Organizations and Lifelong Learning: From Global*  
673 *Agendas to Policy Diffusion*. Basingstoke: Palgrave Macmillan.

674 Jasanoff, Shelia. 2005. *Designs on Nature: Science and Democracy in Europe and the United*  
675 *States*. Princeton: Princeton University Press.

676 Jasanoff, S., B. Wynne, F. Buttel, F. Charvolin, P. Edwards, A. Elzinga, P. Haas, C. Kwa, W.  
677 H. Lambright, M. Lynch, and C. Miller. 1998. Science and Decisionmaking. In  
678 *Human Choice and Climate Change, Vol. 1: The Societal Framework*, edited by S.  
679 Rayner and E. L. Malone, 1-87. Columbus: Battelle Press.

680 Keskitalo, E. Carina H., Lisa Westerhoff, and Sirkku Juhola. 2012. Agenda-setting on the  
681 Environment: The Development of Climate Change Adaptation as an Issue in  
682 European States. *Environmental Policy and Governance* 22 (6): 381-394.

683 Kingdon, John W. 1984. *Agendas, Alternatives, and Public Policies*. Boston: Little, Brown.

684 Lipper, Leslie, Philip Thornton, Bruce M. Campbell, Tobias Baedeker, Ademola Braimoh,  
685 Martin Bwalya, Patrick Caron, Andrea Cattaneo, Dennis Garrity, Kevin Henry, Ryan  
686 Hottle, Louise Jackson, Andrew Jarvis, Fred Kossam, Wendy Mann, Nancy  
687 McCarthy, Alexandre Meybeck, Henry Neufeldt, Tom Remington, Pham Thi Sen,  
688 Reuben Sessa, Reynold Shula, Austin Tibu, and Emmanuel F. Torquebiau. 2014.  
689 Climate-smart Agriculture for Food Security. *Nature Climate Change* 4: 1068-1072.

690 Maillet, Antoine, and Pierre-Louis Mayaux. 2018. Le *process-tracing*\_entre narration  
691 historique et raisonnement expérimental. *Revue Française de Science Politique* 68 (6):  
692 1061-1082.

693 Martinez, J.; Pellerin, S. Optimizing n and p recycling from organic amendments via  
694 agroecological incentives and concepts—Scope for further developments. *Soil Use*  
695 *Manag.* 2016, 32, 64–72.

696 Migliorini, P., & Wezel, A. (2017). Converging and diverging principles and practices of  
697 organic agriculture regulations and agroecology. A review. *Agronomy for sustainable*  
698 *development*, 37(6), 1-18.

699 Minasny, Budiman, Brendan P. Malone, Alex B. McBratney, Denis A. Angers, Dominique  
700 Arrouays, Adam Chambers, Vincent Chaplot, Zueng-Sang Chen, Kun Cheng, Bhabani  
701 S. Das, Damien J. Field, Alessandro Gimona, Carolyn B. Hedley, Suk Young Hong,  
702 Biswapati Mandal, Ben P. Marchant, Manuel Martin, Brian G. McConkey, Vera  
703 Leatitia Mulder, Sharon O'Rourke, Anne C. Richer-de-Forges, Inakwu Odeh, José  
704 Padarian, Keith Paustian, Genxing Pan, Laura Poggio, Igor Savin, Vladimir  
705 Stolbovoy, Uta Stockmann, Yiyi Sulaeman, Chun-Chih Tsui, Tor-Gunnar Vågen, Bas  
706 van Wesemael, and Leigh Winowiecki. 2017. Soil carbon 4 per mille. *Geoderma* 292:  
707 59-86.

708 Nesshöver, Carsten, Timo Assmuth, Katherine N. Irvine, Graciela M. Rusch, Kerry A.  
709 Waylen, Ben Delbaere, Dagmar Haase, Lawrence Jones-Walters, Hans Keune, Eszter  
710 Kovacs, Kinga Krauze, Mart Külvik, Freddy Rey, Jiska van Dijk, Odd Inge Vistad,  
711 Mark E. Wilkinson, and Heidi Wittmer. 2017. The Science, Policy and Practice of  
712 Nature-based Solutions: An Interdisciplinary Perspective. *Science of the Total*  
713 *Environment* 579: 1215-1227.

714 Newell, Peter, and Olivia Taylor. 2017. Contested Landscapes: The Global Political Economy  
715 of Climate-smart Agriculture. *The Journal of Peasant Studies* 45 (1): 1-22.

716 Newell, Peter, Olivia Taylor, and Charles Touni. 2018. Governing Food and Agriculture in a  
717 Warming World. *Global Environmental Politics* 18 (2): 53-71.

718 Pralle, Sarah B. 2009. Agenda-setting and Climate Change. *Environmental Politics* 18 (5):  
719 781-799.

720 Rivera-Ferre, Marta G. 2018. The Resignification Process of Agroecology: Competing  
721 Narratives from Governments, Civil Society and Intergovernmental Organizations.  
722 *Agroecology and Sustainable Food Systems* 42 (6): 666-685.

723 Roberts, Nancy C., and Paul J. King. 1991. Policy Entrepreneurs: Their Activity Structure and  
724 Function in the Policy Process. *Journal of Public Administration Research and Theory*  
725 1 (2): 147-175.

726 Saj, Stéphane, Emmanuel Torquebiau, Etienne Hainzelin, Jacques Pages, and Florent Maraux.  
727 2017. The Way Forward: An Agroecological Perspective for Climate-smart  
728 Agriculture. *Agriculture, Ecosystems & Environment* 250 (1): 20-24.

729 Soroka, Stuart. 1999. Policy agenda-setting theory revisited: A critique of Howlett on Downs,  
730 Baumgartner and Jones, and Kingdon. *Canadian Journal of Political Science/Revue*  
731 *canadienne de science politique*, 32, 4:763-72.

732 Soto Golcher, Cinthia, and Ingrid J. Visseren-Hamakers. 2018. Framing and Integration in the  
733 Global Forest, Agriculture and Climate Change Nexus. *Environment and Planning C:*  
734 *Politics and Space* 36: 1415-1436.

735 Steinfeld, Henning, Pierre Gerber, Tom Wassenaar, Vincent Castle, Mauricio Rosales, and  
736 Cees de Hann. 2006. *Livestock's Long Shadow: Environmental Issues and Options*,  
737 Rome: Food and Agriculture Organization of the United Nations.

738 Torquebiau, Emmanuel. 2017. *Climate-smart agriculture: pour une agriculture climato-*  
739 *compatible. Cahiers Agricultures* 26: 66001.

740 Turner, Will R. 2018. Looking to Nature for Solutions. *Nature Climate Change* 8: 18-19.

741 Wezel, A., S. Bellon, T. Doré, C. Francis, and C. David. (2009). Agroecology as a Science, a  
742 Movement and a Practice. A Review. *Agronomy for Sustainable Development* 29 (4):  
743 503-515.

744 World Bank. 2008. *Biodiversity, Climate Change and Adaptation: Nature-based Solutions*  
745 *from the World Bank Portfolio*. Washington, DC: The International Bank for  
746 Reconstruction and Development/The World Bank.

747 World Bank. 2016. World Bank Group Climate Change Action Plan 2016–2020. Available  
748 online at: <https://openknowledge.worldbank.org/handle/10986/24451>, last accessed  
749 September 27, 2020.

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751