

# Communication and Advisory Services to Develop Community Knowledge to Climate Change: Citarum River Basin Context

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**Abstract.** The paper aims to discuss the effects of communication and advisory services on community knowledge and actions to climate change in Citarum River Basin (CRB). Data about community knowledge on climate change were gathered through in-depth interviews, multi stakeholders' dialogues, and rapid appraisal. Programs on community initiative to conserve environment were collected from 2012 to 2019. Printed media with messages on climate change and tips to reduce climate change effects were distributed to the community. Radio and television with similar messages were broadcasted. Data were analyzed qualitatively and quantitatively. The results reveal that advisory services providers for climate change are the government, environmental cadres, community organization and private sector. Rapid appraisal results show that communities upstream and downstream have higher climate risks disaster than those in the middle stream. Communication and advisory services have changed community behavior, from lack of awareness to be more responsive to environment.

**Keywords:** communication, advisory services, climate change, community knowledge and actions

## 1 Introduction

### 1.1 Background

Communication is defined as the process to create and exchange of meaning about the message or information transferred or communicated. More people from various background talk about temperature increased, change on rain falls patterns, wind, or rise sea levels that all are indicators for climate change and require further support from advisory services. Advisory services in this context can be viewed as extension and consulting process to strengthen capability of related stakeholders to understand climate change and take actions. Communicating climate change is not easy (1) because it is scientifically complex, connected

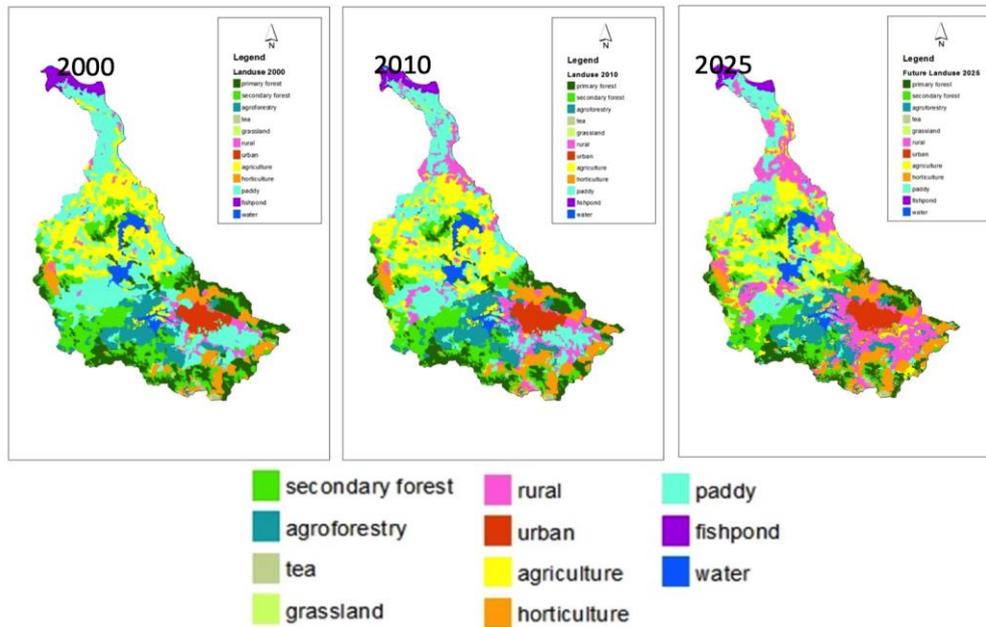
to the past about long terms phenomenon related to climate change or natural changes. It is expected that communication and advisory services will encourage dialogue and cooperative among the stakeholders to take proper adaptation and mitigation actions.

The used of mixed media for communicating information or message on climate change that fit community needed will enhance knowledge and understanding of the climate change. Further, the actions taken to reduce climate risks will be more effective to address the issue. Communication for change (2) involves developing three techniques as follows, (i) evaluate unproductive communication that prevent from thinking of change, (ii) develop ideas and narratives that intersect economic, political, and environmental problems, and (iii) design communication processes to be able to organize and engage diverse publics to demand more effective solutions (2).

Communication on climate changes requires understanding the issues, causes and effects of climate changes, symbol used to communication, socio-cultural and psychological aspects. Lack of personal experience, lack of public discussion, and the view that climate change are not the issue of occurring in nearby of the community are among the barriers in communicating climate changes (3). Better understanding the barriers may increase climate change engagement. The needs for communication and advisory services to increase knowledge is apparent. Communication on climate changes should make the information accessible to communities. Research by (4) in two urban cities, namely Tomakamai City and Fukuoka City, Japan shows that the two government cities and related associations support in climate changes risk communications. Information has been communicated through public spaces, in the form charts, posters and maps. The citizens of the cities can contact the agencies to seek data and information needed as the basis to take decision.

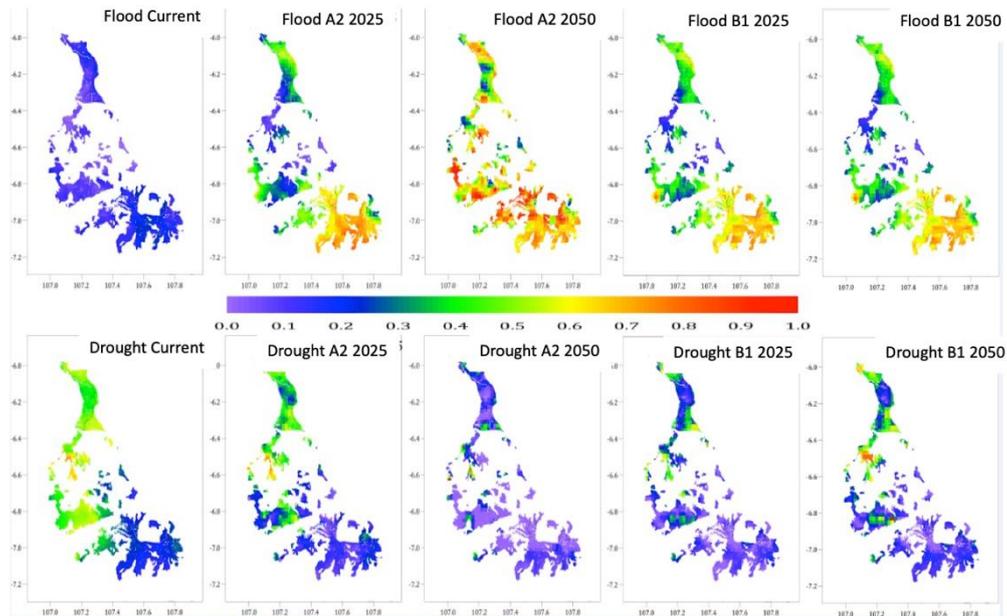
Climate changes advisory services is a growing need due to the increase effects of anthropogenic climate change. Advisory service is also known as extension, and extension should not be viewed as one way communication (linier model of extension) (5). Climate change extension should develop into the increase of understanding and focus on risk. It is urgent to ensure (6) that advisory service is not just an 'implementing partner.' Communication and advisory service can bring together those connected to climate change issues in negotiating through facilitation and brokerage activities.

In relation to Citarum River Basin (CRB), Presidential Decree Number 12 year 2012 on River Basin Territories declares that CRB is a multi-provincial river basin whose management is carried out with respect to meet the raw water need of Jakarta, the Capital City of the Republic of Indonesia (7). The CRB is one of the most critical basins in Indonesia with 269 km long, covering 11 districts with 6614 km<sup>2</sup> watershed area (7). The river produces 1,400MW electricity output and irrigates approximately 420,000 hectares rice paddy field. Land use change and conversion increase to fulfil the needs for food, housing, and other purposes. Figure 1 shows land-use change in 2000 to 2010 and prediction for 2025.



**Fig. 1.** Land Use in 2000 and 2010 in CRB and Land use projection 2025. Source: (8)

Three decade ago, the river was a clean and tranquil place with abundant aquaculture or fish farming, supported the needs of the people near its banks (8). High tension to CRB because of human population growth has affected the area. West Java Statistical Agency as cited by open data Jawa Barat (10) reports that population in West Java has increased 1.11 percent from 2010 to 2020, from 43.05 to 48.27 million. In 2011, population of CRB upstream area reached 8.7 million and total population in CRB area plus Jakarta was 25 million (10). With 1.11 growth in ten years, the population in upstream of CRB will reach 9.6 million in 2021. The effect of climate change to the community in CRB is apparent. This includes increase in temperature about 0.03 °C per annum (11), anomaly in rainfall, and extreme climate. The community has experienced failure in paddy rice harvesting because of flood and drought. Figure 2 presents change patterns in flood and drought in CRB areas and prediction of the disasters in 2025 and 2050. In some areas of CRB, flood and drought are predicted will be likely to increase in 2025 and 2050 if there is no actions taken (Model A). If climate actions implemented (Model B), possibility for the disasters to occur will decrease.



**Fig. 2.** Current and the prediction of flood and drought in rice paddy field due to climate change without land use change in 2012, 2025, and 2050. Source: (8)

Data from household survey on vulnerability assessment to climate change (8) shows that more than 50 percent of respondents perceived “climate change is as the same as environmental change.” In average, 60 percent out of 625 households have already known about the issues of climate change, but still do not know how to deal with the effects of climate change. Few people have good knowledge and understanding about how to deal with climate changes issues. On the other side, there have been various organizations and institutions involved in running environmental actions around CRB, but required further advisory services approaches. Effective climate change communication among stakeholders (12) may increase community engagement in adaptation.

The terms “climate change” and “environmental change” are sometimes used interchangeably, but “environmental change” is only one aspect of climate change. According to IPCC (13), Climate change is a scientifically proven phenomenon that includes “any change in the climate, whether due to its natural variability or as a result of human activity.” It refers to “the broader range of changes that are happening to our planet. These include rising sea levels; shrinking mountain glaciers; accelerating ice melt in Greenland, Antarctica and the Arctic; and shifts in flower/plant blooming times.” Those are all consequences of activities such as burning fossil fuels, deforestation, the increase of gases into the air, bad waste management and other unaware or irresponsible human actions to the nature. Climate change is not just about temperature, it is “bringing multiple different changes in different regions which will all increase with further warming. These include changes to wetness and dryness, to winds, snow and ice, coastal areas, and oceans.

A number of initiatives in CRB have been undertaken to improve CRB for example, community based biogas in Suntenjaya (14), agroforestry in Pangalengen (15), river care in Bandung District (16), and also ecovillage program (17). In addition to the initiatives, the West Java Governor launched Citarum Bestari Program in 2014 to improve environmental quality of CRB (17). The tagline “nature protect us, we protect nature” or in Indonesian language: “alam jaga kita, kita jaga alam” has been widely used by various community groups in implementing “Ecovillage” (18). West Java Government has focused the ecovillage program inviting community in local site to engage actively using socio-cultural approaches to improve quality of environment through following aspects: planting tree, water conservation, waste management and commitment from the village government to support community actions. Up to date, the ecovillage initiatives have been adopted in other river basins. The initiatives and actions will be extend faster to the wider community when communication and advisory services managed well and continuously.

## 1.2 Objectives

Based on the importance aspect of communication and advisory services to induce change, this article aims are twofold. First is to discuss the effect of the communication and advisory services to community knowledge of climate change, and the second is to analyze community initiatives or actions in caring environment as a response to climate change issue in CRB.

## 2 Methods

This study used mixed research methods to reach the objectives. A quantitative method using rapid assessment procedure was used to analyze the effects of communication method to community knowledge of climate change. Qualitative method using multi stakeholders dialogues, group discussions and in-depth interviews were employed to learn perceptions of various actors to the future of CRB relations to climate change.

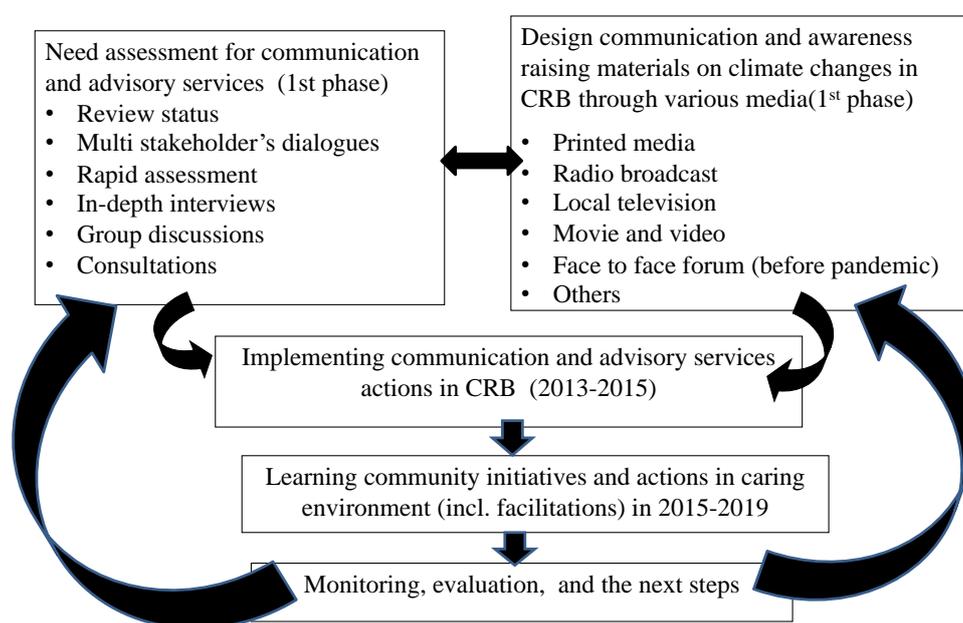
The study was divided into two phases, the first was from 2012-2014 and the second was from 2015-2019. The first phase concentrated in communication and advisory services for enhancing community knowledge and related stakeholders to climate change. The second phase focused on assessing community initiatives and actions caring environment. The study covered the area of CRB that were upstream area (Bandung District, Bandung City, Bandung Barat District, Cimahi), middle stream (Purwakarta District, Karawang, Bekasi District, and Bekasi City. Data about community knowledge to climate change was gathered report on household survey of vulnerability assessment<sup>1</sup> in 20 villages from five districts (Bandung Distirct, Bandung Citu, Bandung Barat, Puwakarta, Bekasi District) with 625 respondents.

Primary data about various views from stakeholders to climate change in CRB were collected from serial of multi stakeholder dialogues, focused group discussions (FGD), individual in-depth interviews and group interviews. Data about effect of communication and advisory

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<sup>1</sup> Household vulnerability assessment survey by CCROM SEAP IPB, Ministry of Environment, and ADB (Technical Assistance ADB 7189-INO Package E).

services to the knowledge and attitude towards climate change actions was gathered through rapid appraisal using questionnaire and interview. Data about on community initiatives and actions from 2015-2019 was collected through field assessment and document review. Informants for the stakeholder dialogues were representatives from Environmental Management Agency (EMA) in CRB, representatives from eight districts/cities, change agents and extension workers, community leaders, farmers, female farmers and civil society organizations. Figure 3 shows the research methods and activities conducted to gather data, designing the media and contents of the communication, implementation and learning the change in knowledge, initiatives and actions taken as an output of communication and advisory services.



**Fig. 3.** Research methods and activities

Need assessment was done to ensure the information or the message shared and exchanged in the communication and advisory services met the needs of multi stakeholders in CRB. Several content of communication materials made during 2012 – 2015 (19) were introduction to climate change, posters on climate adaptation and mitigation actions, booklet on climate change, movie entitled *I love Citarum*, and radio – television broadcast what is climate change and what should be done, adaptation and mitigation to climate change, movie entitled *I love Citarum*, scheduled program on climate changes through radio broadcast, talk shows in television, journalist workshop and field days. The talk shows programmed were as follows: The first episode on introduction of climate risks and opportunity management, contextual issues in CRB, and the needs for institutional strengthening, and example of action from BPLHD and *Kelompok Jaga Citarum*<sup>2</sup>; the second episode was about the role of *Kelompok Jaga Citarum* in CRB. The dialogue presented representatives from *Kelompok Jaga Citarum* talk about their activities,

<sup>2</sup> Community based Citarum Watched

challenges and expectation, comments from representatives of policy makers, and representatives of climate experts; The third talk show presented representative from business sectors operated in CRB, representative from the government, and the experts on water management and climate change. The third also discussed the future of Citarum and the role of 'kelompok jaga' towards better CRB; and last episode presented a feature of climate adaptation and mitigation activities in CRB to reduce climate risks.

The next phase in the study were recommendation to the government to develop policy or program that will encourage community initiatives to undertake actions. The community initiatives implemented in 2013-2014 by the community groups was called climate village initiatives (CVI). During 2013-2014, the instrument for CVI assessment was formulated and disseminated to the districts and cities of CRB via Agency for Environmental Management, civil society organization, and change agents. *Proklam*<sup>3</sup> indicators from Ministry of Environment (2012) were modified for CVI assessment considering the characteristics of CRB.

Prior to assessment of the climate village initiatives, coordination meetings were conducted to ensure that the community groups understand the aims of the assessment and the process of field visit by the reviewer of the initiatives. The criteria for assessing CVI were: (i) type of natural resources and environment in the sites, (ii) level of knowledge and awareness of the community group on climate change issues, (iii) initiatives and concrete actions of the community in caring the environment and its continual actions for improvement, and (iv) connectivity, networking, and partnership.

Data about response of the community (readers) to the leaflet produced during the study was gathered from 30 respondents. The readers were selected randomly from those who received the media, and they agreed to answer the questions after reading the printed media. They were interviewed using a questionnaire to gather information on how the readers assessed the leaflet in terms of the message clarity, understanding to the information, design of the leaflet, and the usefulness of the leaflet to broaden knowledge of the reader to climate change. Data from the media survey was analyzed quantitatively using Chi Square ( $X^2$ ) test. Data during formulation of the CVI instrument, socialization of CVI, and CVI assessment were analyzed qualitatively to learn understanding of the community to climate change, community capacity in managing climate adaptation or mitigation, and factors related to the success of the actions taken.

### **3 Results and Discussions**

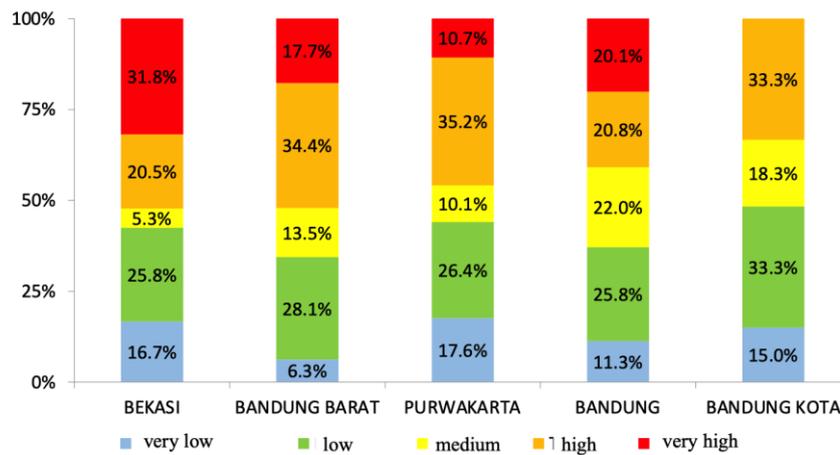
#### **3.1 Knowledge and understanding of climate change**

The purpose of communication and advisory services is to help community to increase knowledge, understanding and to take concert action in responding to climate change. Household vulnerability assessment report (8), shows that households in Bekasi District were categorized as the very high vulnerable. Purwakarta District has the lowest households that

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<sup>3</sup> Abbreviation of Pro Iklim A program launched by Ministry of Environment (now, Ministry of Environment and Forestry) to acknowledge village or community group innovation and actions that support climate change actions

categorized as having very high vulnerable (Figure 4). Compared to Bekasi, Bandung Barat, Bandung District, and Bandung City which that are over populated, Purwakarta District provides more catchment areas and green places (forest) managed under Perum Perhutani (State owned Forestry Corporation) (20). To reduce the climate risks in Bekasi District (downstream), the messages on mangrove planting and other messages should be designed following the issue found in coastal areas, followed by alternative adaptation actions that can be done by the fishers.



**Fig. 4.** Percentage of the household vulnerability to climate change in five districts/cities of CRB. Source: (9)

We live in the era of information technology in which the media have become more convergent. In communicating climate change, mass methods of communication can be applied using a wide selection of media to deliver the message for wide target audiences. Also, using audio-visual media such as television, film projector, radio, and other media can be more attractive than using printed media. However, printed media is much more manageable for the people because no need to open gadget to read it. The survey to 625 household-survey on climate vulnerability assessment in 20 villages of CRB shows that 60 percent respondents have heard the terms of climate change. Television broadcast, followed by radio, and paper are the main source of climate change information. The results of the audience responses to the printed media delivered during the outreach activities show that education is associated with a willingness to share information to others, including climate change information. The higher education, the more likely she or he share the climate information accessed from the media (Table 1).

**Table 1.** Actions taken by the readers of climate change information using printed media according to education of the readers

Level of education	Action taken after reading the climate media									
	None		Save the media		Share information		Others		Total	
	n	%	n	%	n	%	n	%	n	%
Low (elementary school)	7	23.3	5	16.7	1	3.3	0	0	13	43.3
Medium (junior and senior high school)	1	3.3	3	10.0	3	10.3	0	0	7	23.3
High (university)	0	0	2	6.7	7	23.3	1	3.3	10	33.3
Total	8	26.7	10	33.3	11	36.7	1	3.3	30	100.0

Chi Square=14.619; P-value=0.023

People living in the areas where there is no disaster have implemented climate adaptation actions (Table 2). Adaptation actions can enhance capacity of the household to cope with the effect of climate changes. People living in vulnerable areas (in upstream and downstream of CRB) are more exposed to the hazard such as eroded land, flood, drought, in up and downstream of CRB and rob in coastal areas. Chi square test shows that there is a significant correlation between area where there is not climate disaster and availability adaptation activities.

**Table 2.** Initiatives and actions taken by the community according to the climate risks in CRB

Status of the area	Climate actions in CRB									
	None		Campaign		Adaptation activities		Others		Total	
	n	%	n	%	n	%	n	%	n	%
No climate related disaster	3	10.0	0	0	17	56.7	2	6.7	22	73.3
Flood/Drought	0	0	1	3.3	0	0	1	3.3	2	6.7
Others	0	0	0	0	2	6.7	4	13.3	6	20.0
Total	3	10.0	1	3.3	19	63.3	7	23.3	30	100.0

Chi Square=25.236; P-value=0.000

It can be perceived that the community that have implemented adaptation activities such as agroforestry practices, farmers adjust planting schedule following planting calendar, and rain harvesting will be likely to experience no climate disaster. In relation to this finding, (21) suggest that joint implementation of technologies including adaptation is necessary to reduce the climate change risk.

Table 3 shows that dairy farmers respondents in upstream of CRB implement several environmental care activities including biogas, managing sewage, organizing community groups in climate adaptation and mitigation actions. The principle of reuse, reduce and recycle (3 R) and *bank sampah* (sewage bank) are applied in the area even though majority of dairy farmers' education are elementary school. The farmers are very responsive to training on agricultural technology that can improve productivity and income. On the other hand, respondent with high education (university) are more interested in 3R. There is significant correlation between education and caring environmental activities in upstream of CRB.

**Table 3.** Dairy farmers activities in caring environment according to level of education

Level of education	Caring Environment Activities									
	Biogas		Managing Sewage		Waste management		Community groups		Total	
	n	%	n	%	n	%	n	%	n	%
Low (elementary school)	7	23.3	5	16.7	1	3.3	0	0	13	43.3
Medium (yuniior and senior high school)	1	3.3	3	10.0	3	10.3	0	0	7	23.3
High (university)	0	0	2	6.7	7	23.3	1	3.3	10	33.3
Total	8	26.7	10	33.3	11	36.7	1	3.3	30	100.0

Chi Square=14.619; P-value=0.023

Syurga Air Tani Group in Lembang in upstream area of the river basins were supported by Company Aetra Air Jakarta successfully change marginal land to be fertile land. The farmer group change the crops planted from cash crops to annual crops including coffee. This is an example adaptation action managed by the community group.

From the results, it is apparent to strengthen knowledge and understanding of the community to climate change, there are three aspects to be integrated in communication: (i) the knowledge gap about climate change in the community and relevant advisory service including learning approaches needed, (ii) innovation that can be developed to better manage the actions, (iii) sustainability of the actions to improve CRB quality.

### 3.2 Assessing climate village initiatives (CVI) in CRB

Involving community in managing actions to care environment is a key element in strengthening resilient to climate change. A serial of multi stakeholders dialogues contribute valuable support to community to undertake adaptation actions needed (19). As a small step to practice knowledge in climate actions, CVI is a prototype for community-driven climate actions in the future. To appreciate the initiatives, assessment to CVI was aimed to evaluate the performance of the actions. The CVI assessment was based on the role of community driven movement in caring environment, as well as developing institution to manage the actions. The community may have productive activity that would contribute additional income for the group members. The principle of communication for sustainable development initiatives (22) inspires process of promoting CVI. The CVI Instrument has been formulated consisting of four aspects (19):

- (i) Capacity in managing natural resources and environment in the village is assessed on the ability of communities to plan, implement, and maintain the sustainability of natural resources and the environment (social, economic, and environmental aspect). This aspect is measured by whether the community group has a clear planning of the initiatives, implementation strategy, participatory monitoring and evaluation, and innovation to manage the natural resources and environment in the site.
- (ii) Level of awareness and public knowledge about climate-related issues are assessed on the level of knowledge of the community group leaders and members to the climate change or environmental issues, and the efforts to minimize climate risks and minimizing climate-related disasters.

- (iii) Community initiatives and concrete action in environmental management can be done by the community itself, or jointly with other parties in managing natural resources (land, forests, water) and the environment (such as waste management, irrigation, and other), so the environment becomes cleaner, safer, more beautiful, comfortable, and sustainable. It can even be a source of livelihood through income-generating businesses, based on natural resources and the environment. This aspect is assessed by evaluating the appropriateness of the initiatives or actions with aspects of climate change initiatives, the level of community involvement of various groups (including women, youth, and character), and the sustainability of the action.
- (iv) Level of connectivity and networking relates to the connection or interlink between the community and other parties, both internal and external of the group or village, and network or cooperation with other parties such as cooperation with civil society organization or business sectors or the government. This aspect is measured through the type of connectivity, the number of environmental issues try to be solved, the benefit from the partnership for the community and environment, and sustainability of the relationship and cooperation.

After selection for the community groups that matched the CVI criteria, six community group are to be assessed, two groups from Bandung District, two groups from Purwakarta and two groups from Karawang District. The CVI group assessment results are summarized in Table 4.

**Table 4.** Community groups of CVI and results of assessment in 2015

Community group	Location	Focus of initiatives and actions	Assessment
KPL Alam lestari (Kelompok Peduli Lingkungan Desa Pulosari/P3T (Environment Care Community Group)	Pulosari Village, Pangalengan, Bandung District	Institutional development	The actions have been done in group members and needs to disseminate to the wider community (level: medium)
Kelompok Gabungan Pengguna Air (Farmers Association for Water Use)	Lamajang, Pangalengan, Bandung District	Waste management, composting for agriculture	Already implemented water management to the members and governance have been developed (level: high)
Program Kampung Iklim Kelompok masyarakat "Arjuna Putra Cilangkap"- Climate Village Community Group	Cadas sari, Tegal Waru, Purwakarta	Citarum empowerment	The actions are innovative and managed by youths (level: medium)
Pokmas Mitra Tani (Farmers Partner Group)	Galumpit, Tegalwaru, Purwakarta	Climate village program	The actions managed by the farmers group (level: high)
Kampung Hijau Sauyunan Kampung Sauyunan (Kp. Bubulak Sauyunan RT 04,05,08) Green Village Sauyunan	Tanjungpura Karawang Barat	Composting, biopori, and mitigating disaster campaign kompos,	The initiatives are inspiring and the institution needs to be strengthened (level: medium)
Sahabat lingkungan (Eco-Friend)	Sukaluyu, Teluk jambe,	Apotek hidup (living pharmacy), greening	The actions vary and involve people from different

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Karawang	village, cleaning the drainage channels, biopori	background (level: high)
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Source: adapted from (9)

There was a gap in capacity of the groups to manage the environment and increasing community awareness to caring environment. Based on the assessment, it was recommended to Environmental Management Agency to develop further program that includes capacity building for the members of the group in environmental or climate actions programs prioritized.

The findings of the CVI assessment show that overall the community groups have good spirit in caring environment. However, the groups need to strengthen initiatives in terms of encouraging and mobilizing the wider community to take actions in caring the environment. Based on the criteria assessment used, the winners in each location of the CRB: Upstream: Farmers Association for Water Use (Gabungan Kelompok Pengguna Air) - Pangalengen; Middle stream: Farmers Partner Group (Pokmas Mitra Tani) - Purwakarta; and Downstream: Eco-Friend (Sahabat Lingkungan) – Karawang (9).

All CVI contestants were invited to the field day in Pangalengen. The field day was also attended by journalists (19). All of the participating groups were awarded with certificates and gifts in forms of biodigester for the first winners in each location and biopori tools for the second winners. Comment given by one of the winners Mr. DK: *“saya senang bisa punya kesempatan ikut kegiatan ini, jadi bisa tahu apa itu perubahan iklim dan manfaat gerakan cinta lingkungan, saya ingin melanjutkan hal ini di masyarakat lebih baik lagi.”* (I am very happy to get an opportunity to take part in this activity, I can learn what climate change is and the benefit of our program for the environment and our lives. I want to continue this and promote it to the wider community.” Another participant that did not win the award still had the spirit to continue the initiatives, as YS said: *“Saya tetap akan melanjutkan gerakan cinta lingkungan dan memberdayakan masyarakat untuk keberlanjutan”* (I commit to continue our initiatives in caring the environment, empowering community for sustainability).

Related to the spirit of CVI and the need to develop a sustainability in West Java, West Java Province Agency of Environmental Management has implemented an eco-village program in West Java. In 2014, there were 56 villages targeted to be to be eco-village and in 2015, 65 villages were targeted to be eco village. The approach to assess eco-village adopted the strategy used in CVI assessment. Up to 2020, there were 287 villages from 12 districts/cities implemented ecovillage. Community in CRB have developed understanding on how to better manage of the environment with intensive communication by West Java Environmental Management Agency together with civil society organization, community groups such as Kelompok Peduli Sungai, Kelompok Peduli Ciliwung, Sahabat Lingkungan and ecovillage Citarum (17)(23). The use of communication and advisory service approach has increased community engagement in eco-village. This is a prove that the messages that have been delivered through different medium have increased knowledge of the community to climate risk.

## 4 Conclusion and Recommendation

1. Communication and advisory services in CRB context has increased knowledge of the people about climate change. With the rapid development of communication and information technology, digital platform of communication can be used in addition to conventional approach of communication depending on community preferences. Printed materials may be needed for specific audiences and to be used where appropriate.
2. Even though most of the actors aware the effects of climate change, communication between the government, business sector and community need to be enhanced via a clearer platform. The platform can use existing forum to redefine the objectives, structure, tasks, and scheduled meetings for dialoguing urgent issues that need to resolve. Advisory services in climate change can be provided by government, community leaders and private organization.
3. Support from the government and civil society organizations, community leaders, partnership with private sectors and cooperated with journalist have positive impact to enhance community initiatives and actions in caring environment including ecovillage. Further research to develop communication and advisory services strategy and actions for CRB after 2030.

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