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MAINSTREAMING OF ECO-DRR TO IMPLEMENT INTEGRATED WATER RESOURCES MANAGEMENT IN INDONESIA

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ABSTRACT

Science to policy of ecosystem based adaptation to manage disaster risk reduction in the context of IWRM is very important in sustainability science concept. It will explain how the science and evidence-base of ecosystem based disaster risk reduction (DRR) and climate change adaptation (CCA) could more effectively inform and influence development decisions. Sustainability Science can be defined as understanding the fundamental character of interactions between nature and society. In brief definition, a sustainable development as the 'ability to make development sustainable—to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs'. Understanding core concept related to ecosystems, disaster risk reduction, climate change adaptation, resilience and sustainable development is very important, because: it linkages between ecosystems, disaster risk reduction, and resilience; (2) it linkages between climate change, disasters and ecosystem-based adaptation; (3) ecosystem management approaches/tools in reducing disaster risk and adapting to climate change impact; and (4) mainstreaming Eco-DRR/CCA into development policy, plans and strategies. The paper was also to remind us that ecosystem-based DRR/CCA is often under valued and under-appreciated as part of a comprehensive approach to risk reduction.

Keywords: Eco-system based, Disaster risk reduction, Integrated water resources management.

INTRODUCTION

Science to policy of ecosystem based adaptation to manage disaster risk reduction in the context of Integrated Water Resources Management is very important in sustainability science concept. It will explain how the science and evidence- base of ecosystem based disaster risk reduction (DRR) and climate change adaptation (CCA) could more effectively inform and influence development decisions.

Climate change has already affected all our life, such as: (1) The Earth's climate is warming human activities are primarily responsible -- further climate change is inevitable without actions to reduce GHG emissions; (2) Most socio- economic sectors, ecological systems and human health will be adversely affected by climate change, with developing countries being the most vulnerable; (3) Technologies are available to reduce greenhouse gas emissions but policies and measures are needed to realize the technological potential. Moreover, concentrations of CO_2 during the 21st century are projected two to four times the pre-industrial level. Levels of atmospheric CO_2 during the next 100 years would be higher than at anytime in the last 440,000 yrs. Temperatures During the 21st Century Are Significantly Higher Than at Any Time During the Last 1000 Years (Watson, 2007).

Climate change is not just an environmental issue, but a development issue. Global and regional changes have been observed in the chemical composition of the atmosphere, earth's surface temperature, precipitation, extreme climatic events, sea level. These have caused changes in biological, physical and socio-economic systems. Most of the observed warming of the past 50 years is attributable to human activities. Our challenge are how to meet a sustainable energy, forestry, fisheries, food and water security, use & conservation of biodiversity.

In the short statement we can mention our problems that climate change is not just an environmental issue, but a development issue. Global and regional changes have been observed in the chemical composition of the atmosphere, earth's surface temperature, precipitation, extreme climatic events, sea level. These have caused changes in biological, physical and socio-economic systems. Most of the observed warming of the past 50 years is attributable to human activities.

We reaffirm that climate change is one of the greatest challenges of our time, and we express profound alarm that emissions of greenhouse gases continue to rise globally. We are deeply concerned that all countries, particularly developing countries, are vulnerable to the adverse impacts of climate change, and are already experiencing increased impacts, including persistent drought and extreme weather events, sea- level rise, coastal erosion and ocean acidification, further threatening food security and efforts to eradicate poverty and achieve sustainable development. In this regard we emphasize that adaptation to climate change represents an immediate and urgent global priority. (UNCSD, 2012: Giupponi, 2012).

In the last half of the twentieth century, four key themes emerged from the collective concerns and aspirations of the world's peoples: peace, freedom, development, and environment. The World Commission on Environment and Development was initiated by the General Assembly of the United Nations in 1982, and its report, Our Common Future, was published in 1987.

The Brundtland Commission's brief definition of sustainable development as the ability to make development sustainable—to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs' is surely the standard definition when judged by its widespread use and frequency of citation. The use of this definition has led many to see sustainable development as having a major focus on Although reinterpreted over time, peace, freedom, development, and the environment remain prominent issues and aspirations.

Thus, the concept maintains a creative tension between a few core principles and an openness to reinterpretation and adaptation to different social and ecological contexts. Sustainable development thus requires the participation of diverse stakeholders and perspectives, with the ideal of reconciling different and sometimes opposing values and goals toward a new synthesis and subsequent coordination of mutual action to achieve multiple values simultaneously and even synergistically. Sustainability Science is also can be defined as

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understand the fundamental character of interactions between nature and society. Sustainability Science is started with outcomes to be avoided and work backward to identify relatively safe corridors for a sustainability transition (Gomes *et al.,* 1987; Kates *et al.,* 2001; Kates *et al.,* 2005; Komiyama & Takeuchi, 2006; Jager, 2009).

Water resources in Indonesia are very severe and scarce, and a very rapid population increase is apparent in recent years. This rapid population increase causes not only increase of water demand but also affect the land use change, resulting land degradation, soil erosion and change in hydrologic regimes.

Indonesia continues to face natural disasters in early 2014. Floods occurred in six provinces, i.e. DKI Jakarta, Banten, West Java, Yogyakarta, Central Java, and South Sulawesi, while Mount Sinabung continues to experience increasing volcanic activities as it is building the lava dome at its crater.

Jakarta Floods: As of 21 January 2014, approximately 134,662 persons or 38,672 households in 100 urban villages are directly affected by floods, with 12 casualties. At least 62,819 persons are displaced and staying in 253 displacement centers. Goverment of Indonesia has indicated the emergency readiness phase for 30 days starting from 13 January 2014 until 12 February 2014. National response has been mobilized. GoI indicated that it has the capacity to respond to both short and longer term needs created by the floods. GoI also welcomes technical assistance from the international community in the country, particularly for relief aid logistic management (Ocha, 2014).

For the last two weeks, Jakarta and outlying areas have experienced continued rains causing river overflows and inundation since 12 January 2014. Fourteen sluice gates including Katulampa in Bogor, upstream of Jakarta, are being closely monitored for flood management. Thousands of houses, buildings, roads have been flooded. The Provincial Agency for Disaster Management (BPBD) DKI Jakarta reported that as of 21 January 2014, approximately 134,662 persons or 38,672 households in 100 urban villages are directly affected by current floods. Twelve casualties have been recorded. At least 62,819 persons are displaced who are sheltered in 253 displacement centers. Telephone lines and electricity networks are generally functioning. Floodwaters have blocked some major roads. Flood water levels were vary from 0.2 m up to 1.2 m and around 2 m at the river bank. The percentage of IDPs in each municipality is ranging from 0.1 to 0.5% of the total population. GoI has indicated the emergency readiness phase for 30 days starting from 13 January until 12 February 2014 (Ocha, 2014).

Ciliwung and Citarum are very important rivers which have socio economic and environment role to the people who live in the watershed and middle area, and support fresh water to Jakarta. Eventhough, their condition recently are very critical, concerning to degradation, run-off, erosion, pollution, flood and drought.

To overcome those water crises, it is necessary to develop an integrated water resources management, from the upstream, river bank and downstream area. IWRM covers various issues and aspects (bio-physical, technical, economical, social, cultural, and environmental) that should be considered in integrated management. Attempt to deal with bio-physical, technical, social and cultural, economic and environmental issues need efforts which have to be supported by a proper capacity related management including human capacity, financial capacity, instrument capacity and management capacity. These efforts are being more critical when it is deals with critical watershed in the humid tropical regions.

Aims of the paper is to share core concept related to ecosystems, disaster risk reduction, climate change adaptation, resilience and sustainable development, and how to implement it in Integrated Water Resources Management in Indonesia. It is also to remind us that ecosystem-based DRR/CCA is often under valued and under-appreciated as part of a comprehensive approach to risk reduction.

METHODS

In 2013, the United Nations Environmental Programme (UNEP) and Center for Natural Resources and Development (CNRD) based at the Cologne University for Applied Sciences (CUAS), Germany jointly developed a master's module "Disasters, Ecosystems and Risk Reduction", which is currently being implemented in a number of universities around the world. The current format of the course is designed for masters students enrolled in a regular university and provides lecturers with the necessary teaching materials and a sophisticated didactic concept.

The module was designed to be modular and comprises 50 hours of materials for in-class teaching including PowerPoint slides with explanations for lecturers, plus further readings, case studies from different countries, and learning games. Fields surveys and assignments are the responsibility of the participating universities. The course is structured in four main blocks: (1) it linkages between ecosystems, disaster risk reduction, and resilience; (2) it linkages between climate change, disasters and ecosystem-based adaptation; (3) ecosystem management approaches/tools in reducing disaster risk and adapting to climate change impact; and (4) mainstreaming Eco-DRR/CCA into development policy, plans and strategies.

To continue this programme, PEDRR/CNRD/LIPI/UNORCID International Science-Policy Workshop was conducted in Bogor, Indonesia, at 16-18 June 2014 (Fabrice G. Renaud, United Nations University Institute for Environment and Human Security), and Global Training of Instructors Ecosystem-based Disaster Risk Reduction and Climate Change Adaptation (Eco-DRR/CCA) 19-21 June, 2014, at the same venue (Dr. Karen Sudmeier-Rieux, United Nations Environment Programme, Geneva). The course module, Teaching module, and Case study and exercise had already been prepared (Nehren *et al.* 2013; Nehren *et al.* 2014a and 2014b). A brief description of the course and content will be shared in this paper.

RESULTS AND DISCUSSION

Disasters, Risk Reduction and Climate Change

1. *My do we think Eco DRR is so important?* Disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources." (UNISDR, 2009; Renaud *et al.,* 2013; Sudmeier- Rieux and Ash, 2009; Sudmeier-Rieux *et al.,* 2013).

According to the official database on disasters, EM-Dat, the International Disaster Database (http://www.emdat.be/), it must meet one of four criteria: Ten (10) or more people reported killed; Hundred (100) or more people reported affected; Declaration of a state of emergency; and Call for international assistance.

In other words, hazard events, such as landslides, cyclones, floods, avalanches, etc., become disasters if they exceed the capacity of a community or society to cope using its own resources. So whether a hazard event becomes a disaster depends largely on the magnitude of an event but also on how well society is prepared to cope with such an event.

Disasters continue to increase globally although the number of people killed is declining — economic damages continue to increase, often severely impacting development in the poorest countries. And the fact is that most disasters are actually preventable. As students, practitioners and decision makers in this field we need to know how disasters of various types may be preventable and what actions we need to undertake to reduce the occurrence of preventable disasters.

Hazards can be classified in several ways but are usually broken down into geophysical (landslides, earthquakes, volcano eruptions) or hydrometeorological (flooding, cyclones, droughts, wind storms, avalanches) which could also include climatological hazards. Landslides can be considered both geophysical and hydrometerological depending on if they are triggered by earthquakes or rainfall. Disasters can also be classified in different ways although the first distinction is between man-made disasters (chemical accidents, oil spills, industrial pollution) as caused by technological hazards versus natural hazards.

Figure 1. Types of Hazards (UNEP, CNRD, 2013

2. Tal *is disaster risk reduction?:* Disaster risk has become shorthand for the risk of a disaster occurring. It refers to the potential disaster losses — in lives, assets, livelihoods, etc. which could occur to a particular community or society over some specified future time period. The term disaster risk is used to distinguish with other types of risk, such as financial risk. Risk refers to the probability of future losses. Disaster risk is the potential disaster losses in lives, assets, livelihoods, etc. which could occur to a particular community or society over some specified future time period" (UNISDR, 2009).

Risk is often expressed in terms of three factors, which are sometimes expressed as the disaster risk equation:

Risk= Hazard * Vulnerability * Exposure

It is important to distinguish between these three factors as they require different sets of actions and policies in order to reduce disaster risk.

Definition Risk Component, are:

- Hazard: A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage
- Exposure: People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.
- Vulnerability: The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard (UNISDR, 2009).

3. *What are the main actions undertaken to reduce disaster risks?:* We oflen divide disaster risk reduction actions into two main categories: We usually consider two types of measures, physical construction to reduce or avoid possible impacts of hazards or non-structural measures which relate to knowledge, policies, laws, public awareness raising, training and education for disaster prevention and preparedness.

Examples of non- structural measures: (1) Emergency drills, early warning and monitoring, training search and rescue teams, stocking up on emergency supplies; (2) Land use planning to reduce exposure, developing guidelines on what to do during an emergency, including safety, safeguarding water and other key environmental resources.

Examples of structural measures: (1) Building seawalls, dykes, dams and raising houses to avoid flooding; (2) Ecological engineering by restoring wetlands, forests on slopes, coastal vegetation could be considered having components of structural measures.

4. *What are the links between climate change, climate change adaptation and disaster risk reduction?* "Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased' (IPCC, 2013 SPM-3).

Here is a summary of main findings: (1) In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans; (2) In many regions, changing precipitation or melting snow and ice are altering hydrological systems, affecting water resources in terms of quantity and quality *{medium confidence)',* (3) Many terrestrial, freshwater, and marine species have shifted their geographic ranges, seasonal activities, migration patterns, abundances, and species interactions in response to ongoing climate change *(high confidence),* (4) Based on many studies covering a wide range of regions and crops, negative impacts of climate change on crop yields have been more common than positive impacts *(high confidence),* (5) At present the world- wide burden of human ill-health from climate change is relatively small compared with effects of other stressors and is not well quantified; (6) Differences in vulnerability and exposure arise from non-climatic factors and from multidimensional inequalities often produced by uneven development processes *{very high confidence).* These differences shape differential risks from climate change. Impacts from recent climate-related extremes, such as heat waves, droughts, floods, cyclones, and wildfires, reveal significant vulnerability and exposure of some ecosystems and many human systems to current climate variability *(very high confidence)',* (7) Climate-related hazards exacerbate other stressors, often with negative outcomes for livelihoods, especially for people living in poverty *(high confidence)',* (8) Violent conflict increases vulnerability to climate change *{medium evidence, high agreement)* (IPCC, 2014).

Ecosystem based disaster risk reduction and adaptation.

1. *What do we mean by ecosystem-based disaster risk reduction (Eco-DRR) ?:* Ecosystem-based disaster risk reduction (Eco-DRR) is the sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim to achieve sustainable and resilient development (Estrella and Saalismaa, 2013). Well-managed ecosystems, such as wetlands, forests and coastal systems, act as natural infrastructure, reducing physical exposure to many azards and increasing socio-economic resilience of people and communities by sustaining local livelihoods and providing essential natural resources such as food, water and building materials (Sudmeier- Rieux and Ash, 2009, Nehren *et al.,* 2014). Ecosystem management not only offers an opportunity to strengthen natural infrastructure and human resilience against hazard impacts, but also generates a range of other social, economic and environmental benefits for multiple stakeholders, which in turn feed back into reduced risk. Table 1. outlines fundamental hazard mitigation functions of ecosystems. "Ecosystem-based disaster risk reduction (Eco-DRR) is the sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim to achieve sustainable and resilient development" (Estrella and Saalismaa, 2013).

Table 1. Outlines fundamental hazard mitigation functions of ecosystems

Ecosystem	Hazard Mitigation Function
Mountain forests, vegetation on hillsides	. Protect erosion . Reduction risk of landslides, rockfall, avalanches, . Reduction risk floods and drought
Wetlands, riverine ecosystem	. Flood control: Water storage and slow release, reducing spped and volume of runoff . Coastal wetlands, tidal flats, deltas and estuaries reduce the height and spped of storm surges and tidal wave
Coastal ecosystems (mangrove, saltmarches, coral reefs, sanddunes)	. Natural buffer againts tropical cyclones, storm surges, flooding, tsunamis and other coastal hazards . Coastal wetland bufer against saltwater instrusion and adapt to (slow) sea-level rise
Dryland ecosystems	. Reducing risk of drought and disertification, as trees, grasses and shrubs conserve soil and retain moisture . Shelterbelts, greenbelts and other types of living fences act as berrier againts wind erosion and sand storm

2. *What are the core elements of ecosystem-based disaster risk reduction?.* The following five principles constitute the core elements of ecosystem-based disaster risk reduction and guidance to better understanding the role of ecosystems in disaster risk reduction. Core elements of ecosystem-based disaster risk redaction, are: (1). Ecosystems provide multiple functions and services, including protection from hazard events, (2) Ecosystem-based disaster risk reduction is anchored in sustainable livelihoods and development, (3) Sound environmental management is critical to addressing the risks associated with climate change and hazard events, (4) Integrating environmental approaches into disaster risk management requires multi-sectoral and multi-disciplinary collaboration, while involving local stakeholders in decision- making, (5) Existing instruments and tools in ecosystems management can enhance the range of options for disaster risk reduction, but also have limitations.

3. *How does Eco-DRR differ from ecosystem-based adaptation (EbA)?:* There are many more similarities than differences Many ecosystem-based activities (both EbA and Eco-DRR) and general community-based DRR programmes include the same type of measures, such as forest management, mangrove or wetland restoration, sustainable agriculture and sustainable land management forms that contribute to resilient societies and human security (while also acknowledging that effective climate adaptation measures should be based on scientific projections and local climate change data). Eco-DRR measures will be more focused on reducing immediate risks from hazard events and may be combined with early warning systems, hybrid approaches including engineered structures, while EbA will focus more on long term effects brought about by climate change, such as more drough resistant plants or food crops and water management. The IPCC Fifth assessment reports does not distinguish between EbA and Eco-DRR and considers adaptation to be a broaden set of measures including disaster risk reduction and ecosystem based measures.
4. *What are some oj! the challenges and gaps in implementing Eco-DRR?.* Within the last years the ecosystem-based approach has received much attention in the disaster risk and climate change communities, but there are still many needs in research, education, and practice. The MOOC is one step toward filling this gap by providing professionals and students with theoretical concepts and practical tools in understanding environment and disaster linkages and applications of ecosystem-based disaster risk management.

Ecosystem-based tools for disaster risk reduction and adaptation

In this section, we will explore how ecosystem-based disaster risk and adaptation (Eco-DRR) is applied and operationalized throughout the disaster management cycle.

1. *How can ecosystem management contribute to reducing disaster risks both*

pre- and po.st-disaster?. We start by questioning the dominant view of disaster management (see Figure 1) where the hazard event is the trigger for the post-disaster emergency responses, the recovery and reconstruction phase, mitigation and finally pre-impact preparation activities.

In this predominant situation, the accent and most budgets are placed in the post-disaster phase and on pre-disaster preparedness activities such as early warning systems or emergency preparedness. This is how disasters have most commonly been managed, while in the past decade this notion has been Background Reading for Global Training of Instructors, June 19-21, 2014 challenged by NGOs, development- and UN agencies such as UNISDR which is advocating for a paradigm shift toward disaster prevention through long-term planning and investments in reducing underlying risk factors in order to reduce hazard impacts (See Figure I DRR spiral to the right). Here the emphasis is on reducing disaster risks through investments in sustainable development, rather than just managing risks as in the old paradigm. Ecosystem-based activities can be implemented at all stages of the DRR spiral from the early stages after a hazard event, through reconstruction, mitigation and especially in the prevention phases. This session will take us through the different phases of the DRR spiral and explore different options for including ecosystem-based activities as part of a more comprehensive DRR portfolio of activities alongside more “classical” DRR activities.

Incorporating Eco-DRR into all phases of the disaster risk reduction spiral is highly recommendable and requires: (l) A long-term perspective conducted in an emergency Planning BEFORE a disaster occurs, (2) Collaboration between humanitarian & environmental authorities to establish environmental, (3) standards, (4) Planning for debris management, sanitation, disposal of hazardous substances, water management, and proper land-use, (5) Proper location of settlements and related infrastructures.

The planning and management approaches for Eco-DRR presented above are not new and have been the mainstay of natural resources management for decades. What is emerging in parallel to the paradigm shift toward better prevention rather than disaster management is a greater emphasis on combining risk reduction and climate change adaptation with natural resources management and further integrating ecosystem-based components in the existing instruments. Many ecosystem-based approaches, combined with more classical disaster risk reduction actions such as preparedness, risk and hazard mapping are proving more effective and sustainable in terms of reducing risks and contributing to long term adaptation to a changing climate (IPCC, 2012; IPCC, 2014; UNISDR, 2013).

Mainstreaming Eco-DRR/CCA into development policy, plans and strategies

The application of disaster risk reduction have saved millions of lives and helped communities globally. But, the ecosystems on which communities depend up on for their protection, economic well-being and recovery have, until now, been largely ignored in disaster risk reduction. Incorporating ecosystems into disaster risk reduction can save lives, aid recovery and help build a more resilient and secure planet for all. This timely policy makers, scientists, economists, sociologists and practitioners on why and how to integrate ecosystems into disaster risk reduction. Scientific studies have repeatedly confirmed the role of healthy ecosystems in providing resilience against disasters. And they have demonstrated how environmental degradation contributes to more severe disasters including drought, floods, and storm surges. A key challenge is how to integrate this knowledge into policy and planning. Multidisciplinary approaches that combine ecology and economics have to be implemented (Deborah Brosman, Environment and Policy Scientist, University of California, Davis, One Health Instimte, *in.* Fabrice, 2013).

The Role of Ecosystems in Disaster Risk Reduction brings together the world's experts on how the natural environment has evolved tools to buffer again natural hazards in real, sustainable and cost effective ways. From coastal ecosystems that buffer large waves while providing valuable services to Indian Ocean Communities to protective services that forests provide in Swiss Alps, they showing how environmentally and economically sustainable solutions can provide real benefits to exposed populations and resources' (Brian G. AcAdoo. College Rector, Professor of Science, Yale-NUS College, *in.* Fabrice, 2013).

Sustainable livelihoods are at the core of ecosystem-based DRR. Ecosystem management contributes to an integrated, cross sectoral approach to DRR and Climate change Adaptation. Ecosystem-based and engineered measures may be combined as a hybrid solutions. Involving local communities in decision-making is key. Ecosystem-based DRR is not panacea.

Eco-DRR implemention to Ciliwung and Citarum IWRM

1. *Ciliwung River Basin.* Ciliwung River is one of the rivers that flows into a densely populated area in Jakarta. The catchment area is around 337 km2 with 110 km length of river. The average annual rainfall is 2,500 mm. The condition of topography and land use between upper part and lower part are different. The upper part is dominated by steep slope and area of sub urban, cultivation, and forest while the lower part is dominated by mild slope and urban area. Current development in Ciliwung River Basin has significantly increased the flood discharge and has caused over capacity on river cross section (Farid *et al.,* 2010; Subagiono and Tanaka, 2010). The combination between the decrease of Ciliwung River capacity and the increase of runoff leads to more frequent and intense flood in Jakarta (Hadihardaja *et al.,* 2013).

2. *Citarum River Basin.* Citarum River Basin is the largest and longest river in West Java Province. The catchment area is around 12,000 km2. This river basin has many functions. For energy, it generates 1 .400 MW of electricity. It also serves almost 420,000 ha of irrigation area and supplies drinking water to 80% population of Jakarta for 16 m3/s (Citarum River Basin Organization, Balai Besar Wilayah Sungai Citarum).

3. *Ciliwung and Citarum Environment Hazards.'* The rivers are heavily polluted. Informal settlements or slums flourished on the banks, increasing the amount of waste and reducing the surface area of the river. Some canals were completely blocked by slums and people created informal gardens inside by drying the canal. Water maintenance and ecological awareness is minimal. Flooding is a problem of the rivers. With many of the original forest converted into settlements around watershed area, the flooding got worsen each year.

Flood disaster is a natural hazard influenced by many factors including anthropogenic, change in climate, and socio economic development. Flood resilience as a part of mitigation in disaster management is important to reduce risk to people and property from flood and its effects. Ciliwung and Citarum are two examples of main river basins in Indonesia which experience ecosystem degradation problems. Eco-DRR have to be implemented to Ciliwung and Citarum IWRM.

CONCLUSION

The effectiveness of Eco-DRR and CC adaptation in Integrated Water Resources Management in Indonesia depends on their integration and mainstreaming into development planning and decisions of national and local governments. An understanding of linkages between environment and disasters risk reduction are very important to integrate Eco-DRR intoexacerbate disasters and disasters can aggravate environmental degradation. Our challenge is how to implement Disaster Risk Reduction based on Ecosystem as a fundamental development issue, mainly in land-use planning and ecosystem investments in the dimension of time, space and scale. Our problems, are: economics gap, such as valuing ecosystem services for DRR; bridging the policy and institutional gap; developing capacities for ecosystem-based DRR, and in scientific knowledge gaps, such as the need for more research, monitoring and evaluating ecosystem-based DRR.

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