AMBIO (2011) 40:351–360
DOI 10.1007/s13280-010-0097-1

REVIEW PAPER

Integrated Approaches to Natural Resources Management in Practice: The Catalyzing Role of National Adaptation Programmes for Action

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Received: 1 April 2010 / Accepted: 27 September 2010 / Published online: 15 October 2010

Abstract The relationship of forests in water quantity and quality has been debated during the past years. At the same time, focus on climate change has increased interest in ecosystem restoration as a means for adaptation. Climate change might become one of the key drivers pushing integrated approaches for natural resources management into practice. The National Adaptation Programme of Action (NAPA) is an initiative agreed under the UN Framework Convention on Climate Change. An analysis was done to find out how widely ecosystem restoration and integrated approaches have been incorporated into NAPA priority adaptation projects. The data show that that the NAPAs can be seen as potentially important channel for operationalizing various integrated concepts. Key challenge is to implement the NAPA projects. The amount needed to implement the NAPA projects aiming at ecosystem restoration using integrated approaches presents only 0.7% of the money pledged in Copenhagen for climate change adaptation.

Keywords Forests · Water · Integrated approaches for natural resources management · Climate change adaptation · Post-Copenhagen

INTRODUCTION

What is the role of forests in flood control? Does logging cause more and bigger floods in the developing world? What is the role of population density in damage caused by floods or reporting of them in the media? The exchange of views and argumentation between international organizations and researchers on the role of forests in flood protection has been often in the agenda during the past few years. Researchers' opinions vary still considerably. This segregated forest–water debate has been surprising in the light of the widely promoted and supported concepts of various integrated approaches for natural resources management.

Such approaches date long back in history. As stated by Varis et al. (2008), the philosophy of Integrated Water Resources Management (IWRM) has been around for several decades. The Dublin Principles initiated at the International Conference on Water and Environment in 1992, have been considered as the heart of the IWRM concept. Another widely used integrated natural resources management-related concept is the Ecosystem Approach, which was formally accepted at the Earth Summit in Rio in 1992. The same conference put another concept, the Integrated Coastal Zone Management (ICZM), high in the agenda (Pernetta and Elder 1993). Douthwaite et al. (2004) anchor the birth of Integrated Natural Resources Management (INRM) to 1996, when agricultural scientists, and predominantly the International Agricultural Research constituency, started increasingly to promote the concept (Twomlow et al. 2008). The international forest community is familiar with the Forest Landscape Restoration (FLR) approach, which has been heavily promoted for the past 10–15 years (Wenger et al. 2005). Apart from differences in wording, the underlying philosophy of all these approaches is very similar. They promote the need to consider natural resources in the context of the broader landscape level and acknowledge the fact that humans are part of the landscape and that they need to be involved in management and planning processes in an equitable way.

Climate change has become the highest profile environmental issue during the last decade. Forests and water are directly linked with climate change adaptation through the ecosystem services they provide. Ecosystems services related to forests and water can make the impacts of

changes in climate less severe because of the "natural infrastructure" they provide. This can be in a form of storage, buffering, regulatory, and protection characteristics of forest and wetland ecosystems. When the "natural infrastructure" of these ecosystems is not in place, people and economies are often vulnerable to the more frequent flooding, drought, and coastal inundation expected under future climates. This is especially the case in the developing world where population pressure is high, and people are forced to live where natural hazards are more prevalent, such as flood plains. Lately, ecosystem restoration has been increasingly promoted as a way to adapt to climate change. For example, a recent study on The Economics of Ecosystems and Biodiversity (TEEB 2009) concluded that upfront investment costs in maintenance and conservation of nature are almost always cheaper than those needed in trying to restore damaged ecosystems.

The National Adaptation Programmes of Action (NAPA) is a policy process for the developing countries to address their urgent adaptation needs. The NAPA process is an initiative agreed under the UN Framework Convention on Climate Change (UNFCCC). It is an internationally initiated and driven process with agreed process format. Key aspects include national ownership, participatory assessment of vulnerability to climate change, stakeholder consultation, and establishment of priorities for adaptation (Björklund et al. 2010).

AIM

This article is inspired by the perceived "duel" between forests and water on the one hand, and the long history of integrated approaches on the other. The underlying hypothesis is that, an external factor, such as climate change, is needed to push theoretical concepts into practice.

The *objective* of the article is to demonstrate how the emerging priority given to climate change adaptation is gradually catalyzing a shift from a focus on policy to practical applications of integrated approaches. Based on the findings, recommendations on setting the priorities for new flows of adaptation financing expected post-Copenhagen are provided.

THEORY

Setting the Scene: The Forest–Water Debate

The forest–water debate of the past few years followed partly from the release and subsequent reporting by the media of reports issued by well-recognized international organizations including Center for International Forestry Research (CIFOR) and the Food and Agricultural Organization (FAO) (FAO–CIFOR 2005)). The report questioned some of the widely accepted concepts on the water–forest relationships, such as the sponge theory, which claims that forests store water during rain and release it gradually when the season is dry. Although the report did not give such a black-and-white picture of the forest–water relationships, the results ended up being reported by the international media in a relatively one-sided way (BBC 2005; The Economist 2005). Around the same time, the Department for International Development of the U.K. (DfID) funded a study that criticized foresters' views on the unique role of forests in the hydrological cycle (Hayward 2005). Further, a number of well-respected international researchers wanted to raise attention on the overstated role of forests in water resources management (Calder 2006). The juxtaposition was ready.

Some researchers and international organizations realized that the debate between forests and water suffered partly from overstated opinions and subsequent reporting by the media. Numerous side-events, articles, and speeches were presented in international conferences and meetings (International Congress on Cultivated Forests 2006; World Water Forum 2006). Common to these was the emphasis on the importance of integrated and holistic approach; water resource managers talked about IWRM, ecologists about the Ecosystem Approach, marine professionals about Integrated Coastal Zone Management, agricultural scientists about Integrated Natural Resources Management, and foresters about Forest Landscape Restoration.

The debate was picked up when the journal *Global Change Biology* published an article by Bradshaw et al. (2007). The article revealed results of a global research project, which claimed the role of forests in flood protection as unquestionable. Bradshaw and his team collected and analyzed national data of forest cover and the occurrence of floods. According to the article, the loss of natural forest cover by 10% can increase the occurrence of floods by 4–28%. In Nature, Laurence (2007) reported the results of Bradshaw et al. as a "breakthrough." Immediately after the release of the report of Bradshaw et al. and subsequent essay in the Nature by Laurence, a group of internationally recognized researchers (Bruijnzeel 2007) questioned the results of Bradshaw and his team. Bruijnzeel and his colleagues claimed that the conclusions of Bradshaw were wrong since they did not take into account population size and density in the regions included in the research. Bruijnzeel et al. claim that flood occurrence in these countries is mostly influenced by land-use practices after the forest has been cleared. This in turn is strongly influenced by the number of people competing for that particular piece of land to exercise their ways of livelihoods.

After the release of the report by Bradshaw et al., the debate has shifted to the wide recognition that forests are needed for much more than flood protection, such as contributing to an area's biodiversity, water quality, providing non-timber-forest-products, recreation, and providing means for livelihoods.

Lately, scientists have conducted "non-narrative" systematic reviews with meta-analyses on forest–water–soil relationships. Ilstedt et al. (2007) showed that the infiltration capacity increased after afforestation or planting trees in agricultural fields. Locatelli and Vignola (2007) found out significantly lower total flows or base flows under planted forests than under non-forest land uses.

Planting trees for carbon sequestration has increased in importance during the past years. Yet, scientists call for caution. Malmer et al. (2010) point out to the current gaps between development policies and research. The article stresses the need to better understand the effects of different rainfall, soil, and tree species combinations. The authors also demand more prudence in the use of forest management definitions by practitioners from different fields.

The lack of scientific experiments on the forest–water–soil interlinkages especially in the tropics has been stated as a real concern (Ilstedt et al. 2007; Locatelli and Vignola 2007). As long as this is the case, the debate between researchers on forest–water linkages is bound to continue. Yet, at the same time, climate change adaptation policies are being developed, and there is the prospect of large amounts of money being pledged for their implementation.

Climate Change: A Driver for Integration?

Under the current climate change projections, major changes are expected in ecosystem structure and function. Some examples of such changes include an estimation that drought-affected areas will increase, water availability in regions that are supplied by meltwater will decrease, flood risk will increase, and forest productivity will decrease in places such as Central and Eastern Europe (IPCC 2007). Incorporation of maintenance and restoration of ecosystems into adaptation strategies thus needs to accommodate these predicted changes and methods of managing associated risks.

Countries need to urgently find solutions on how to respond to the challenge of climate change. This is the case especially for vulnerable developing countries. Formal policy-related processes, such as the development of the NAPA is one way for the Least Developed Countries (LCDs) to identify and prioritize their urgent adaptation needs.

METHODS AND APPROACH

to analyze whether the forest–water juxtaposition is reflected in the proposed climate change adaptation practices in the developing countries, an analysis of the NAPA project profiles was carried out.

By the time of writing this article, i.e., early 2010, 40 NAPA documents existed.[1] An analysis was carried out to find out how widely ecosystem restoration and different integrated approaches have been incorporated into these LCDs' priority adaptation activities and projects. The total number of activities and projects in existing NAPAs is 436, which are clustered under 12 sectors.[2]

We analyzed the NAPA projects for two aspects: (i) number of projects using ecosystem restoration as an adaptation method, and (ii) number of projects following the philosophy of the different integrated approaches. A summary of the integrated approaches included in this analysis is presented in Table 1.

The NAPA project profiles were analyzed using the following logic:

(a) Based on the *Justification/description* in the NAPA project profile,[3] the project was classified according as either following or not following one of the five integrated approaches categories as presented in Table 1: Ecosystem Approach, FLR, ICZM, INRM, and IWRM. The decision was driven by the high-level definition of each of these concepts using a selection of key words as triggers in the classification process. Keywords used for each of the concept are presented in Table 2. The NAPA profiles provided only a high level summary of the proposed projects, and therefore, using the high-level definition of the different integrated approaches was deemed as an appropriate approach for the purposes of this analysis. Hence, the analysis in this article gives a rough indication of the approaches in the different NAPA project profiles. A detailed analysis would require access to detailed project descriptions.

[1] NAPA documents exist for the following countries: Bangladesh, Benin, Bhutan, Burkina Faso, Burundi, Cambodia, Cape Verde, Central Africa Republic, Comoros, Democratic Republic of Congo, Dibouti, Eritrea, Ethiopia, Gambia, Guinea, Guinea-Bissau, Haiti, Kiribati, Lesotho, Liberia, Madagascar, Malawi, Maldives, Mali, Mauritania, Mozambique, Niger, Rwanda, Samoa, Sao Tome E Principe, Senegal, Sierra Leone, Solomon Islands, Sudan, Tanzania, Uganda, Vanuatu, Yemen, and Zambia.

[2] Coastal Zones and Marine Ecosystems, Cross-sectoral Projects, Early Warning, Education and Capacity Building, Energy, Food Security, Health, Infrastructure, Insurance, Terrestrial Ecosystems, Tourism, and Water Resources.

[3] Project profiles for Lesotho and Vanuatu were not available. For these countries, the analysis was done based on the project title only.

Table 1 Comparison between a sample of integrated natural resources approaches

Concept	Year	Invented by	Definition	Supporters	Spatial scale
Integrated Water Resources Management	1926 (early forms) Varis et al. (2008) Since the 1977—various international conferences	Probably Spain, by adopting the concept of *confederaciones hidrograficas*. Other similar—and even older—examples exist in the literature. Varis et al. (2008)	A process which promotes the coordinated development and management of water, land, and related resources, to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. Global Water Partnership, 2003	Water resources professionals, international bodies, such as the Global Water Partnership, UNESCO, World Water Forum. Donor agencies	Basin (river, lake, groundwater)
	1992. The Dublin Principles	The Dublin Principles were the result of the International Conference on Water and Environment			
Ecosystem Approach	1992	Earth Summit in Rio	A strategy for the integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way. Convention on Biological Diversity (1995)	Ecologists, international bodies, such as the Convention on Biological Diversity. International organisations. Increasingly the private sector	Within the limits of ecosystems functioning
Integrated Coastal Zone Management (ICZM)	1992	Earth Summit in Rio (Agenda 21 Chapter 17)	The process of combining all aspects of the human, physical, and biological aspects of the coastal zone within a single management framework. Pernetta and Elder (1993)	Marine scientists	All coastal and upland areas, the uses of which can affect coastal waters and the resources therein, and extends seaward to include that part of the coastal ocean that can affect the land of the coastal zone Cicin-Sain et al. (1995)
Integrated Natural Resources Management	1996. Douthwaite et al. (2004)	Consultative Group on International Agricultural Research (CGIAR) system	Responsible and broad-based management of the land, water, forest, and biological resources base—including genes—needed to sustain agricultural productivity and avert degradation of potential productivity. ICARDA (2004)	Agricultural scientists, The Consultative Group on International Agricultural Research (CGIAR) community. Twomlow et al. (2008)	Landscape
Forest Landscape Restoration	2000. Wenger et al. (2005)	International Union for Conservation of Nature, IUCN and World Wildlife Fund, WWF	A process that aims to regain ecological integrity and enhance human well-being in deforested or degraded forest landscapes. Wenger et al. (2005)	Foresters, international bodies, such as the Global Partnership on Forest Landscape Restoration	Landscape

Table 2 Keywords used in analyzing the NAPA project profiles

Concept	Keywords used in analysis
Ecosystem Approach	Integrated, water, land, living resources, conservation, sustainable, ecosystems, equitable
Forest Landscape Restoration	Ecological integrity, human well-being, forest landscape
Integrated Coastal Zone Management	Human, physical, biological, coastal zone, single management framework
Integrated Natural Resources Management	Land, water, forest, biological resources, agricultural productivity, landscape
Integrated Water Resources Management	Integrated, water, land, economic, social, equitable, basin

(b) Based on the *Objectives/activities* of the NAPA project profile, a decision on whether the project was directly aiming at ecosystem restoration was made. By "direct," we mean that the project's activities physically and within the project's time frame improve the condition of the ecosystem. Hence, projects aiming at, for example, alternative livelihood methods to eventually reduce the pressure on the natural resource, did not fulfill the "ecosystem restoration" criteria used in this analysis.

The main data source for this study was the existing literature. Literature review was done to set the objective and to provide background information on the debate between forests and water, and on different integrated approaches.

Qualitative data analysis was done on NAPAs for the LDCs. The NAPA database is available on the public domain on the United Nations Framework Convention on Climate Change (UNFCCC) website.

MAIN RESULTS

General Results

From the qualitative data analysis, the following observations on the practical applicability of the different integrated concepts were made:

- *Concepts*. Out of the five concepts, "Ecosystem Approach" is the most vaguely defined and had the least differentiating characteristics in comparison with the other four concepts: IWRM's key differentiating feature is the "basin," INRM's "agricultural," FLR's "forest landscape" and "ecological integrity," and ICZM's the "coastal zone." "Ecosystem Approach" can be considered more as an overarching philosophy whereas the rest of the integrated concepts are more precise and therefore might be more useful for practical implementation purposes.
- *Buzzwords*. Terms INRM and IWRM were used even if the project profile did not meet the official definition of these. This suggests tendency of these concepts being used as "buzzwords" without necessarily following the philosophy of the concepts as described in their official definition.
- *INRM and FLR closely linked*. The differentiation between the classifications of INRM and FLR was often difficult to make. Often the approach described in a project profile met both the INRM and FLR criteria.
- *Water needs to be more integrated*. IWRM tended to be more of a single topic, or "water only" issue. This suggests the need for IWRM to be more closely integrated with the "terrestrial" approaches (FLR, INRM).
- *Scale*. Spatial scale, which is central to each of the integrated approaches, was missing. In many cases, a project profile followed the principles of integrating among land, water, and people, but the scale of the proposed intervention was not at the landscape, ecosystem functionality, or basin level. This indicates the need either to further clarify the importance of the broader scale, or to accept the fact that integrated approaches often need to be started at a small scale.
- *More restoration than integration*. The proportion of projects aiming at ecosystem restoration as a means for adaptation was higher than the proportion of projects using integrated approaches.
- *Little emphasis on institutions*. There was a strong lack of project profiles aiming at institutional strengthening or development. The problems related to institutional capacity has been identified as one of the key constraints in the success of IWRM (Stucki 2010; GWP–INBO 2009). This finding suggest the need for an urgent intervention with regards to the NAPA project implementation: careful attention should be paid on institutions and their strengthening.
- *Two truly integrated projects*. Out of 436 project profiles, two fulfilled the criteria of all of the five integrated approaches, and hence can be considered as excellent examples of true integration. These were: Comoros: "Reconstitution of basin slopes," and Eritrea: "Groundwater recharge for irrigation wells." Closer analysis of these two project profiles reveal that both project proposals were driven by already observed, drastic changes in climate with subsequent consequences on

species, habitats, and people's livelihoods. The proposed adaptation approach in both proposals addressed the root cause of the problem with an understanding on the effects of the root cause on the ecosystems at the landscape level. Surrounding communities were key players in the proposed intervention action. The institutional arrangements included players from multiple sectors and ranged from local to national scale.

Results by Sector

The first NAPA was developed in 2004 and by the time of this research, i.e., early 2010, a total of 40 NAPAs were in place. Nine NAPAs are in preparation or draft formats. Figure 1 presents the evolution in the proportion of projects with ecosystem restoration activities and with at least one of the integrated approaches over this period. There has been an increase in project profiles following both ecosystem restoration and integrated approaches categories between 2004 and 2009 despite the fact that the proportions decreased between 2006 and 2008.

Out of the total of 436 NAPA projects, 122 (28%) included ecosystem restoration-related activities in their objectives. Projects that followed the basic principles of at least one of the integrated approaches amounted to 101 (23%). The number of projects that met both criteria was 68 (16%). The principles of INRM were followed by the largest number of project profiles: 38 in total.

The sector with the highest proportional amount of projects aiming at ecosystem restoration was Terrestrial Ecosystems (79%). The Coastal Zones and Marine Ecosystems sector had the highest proportion of projects (47%) using at least one of the integrated approaches. The highest proportion of projects meeting the two criteria was the Coastal Zones and Marine Ecosystems sector (44%).

For the water sector, 41% of the projects followed integrated approach, but only 15% of projects aimed at ecosystem restoration. This is an interesting finding in the light of the forest versus water debate presented earlier, which revealed the juxtaposition between the two disciplines. The data suggest that the tendency for single-sector approach is still somewhat prevalent in the water sector. Björklund et al. (2010) give detailed analysis on water in NAPAs.

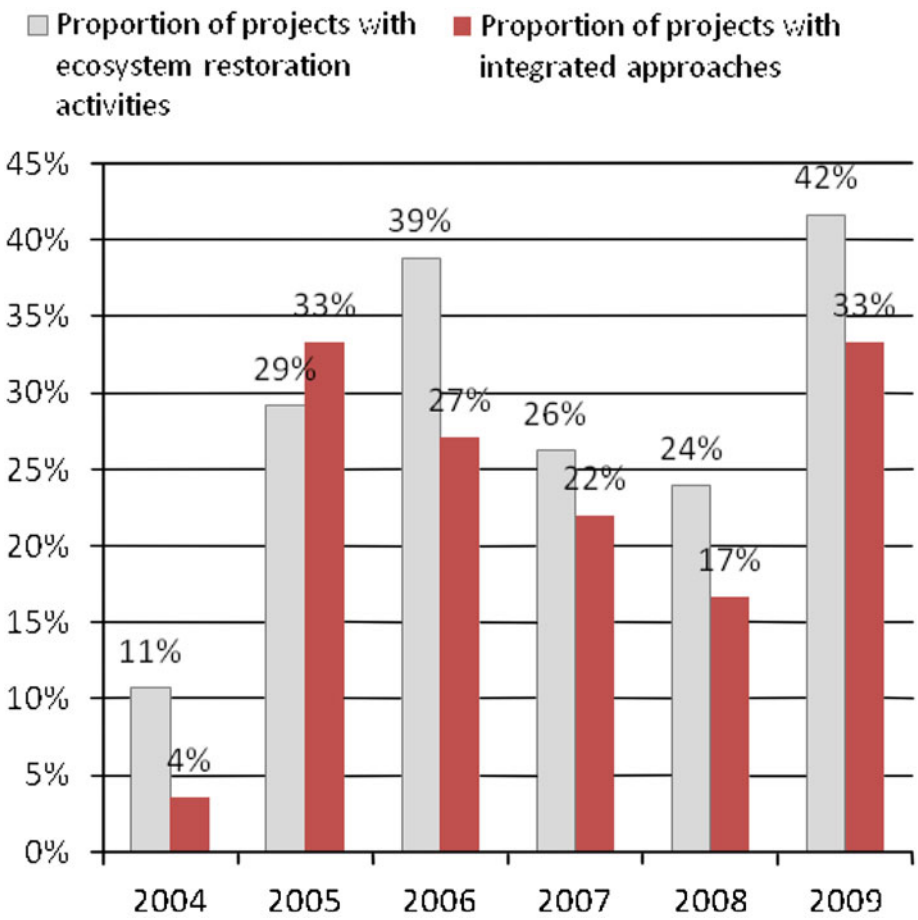

Fig. 1 Evolution of NAPA project profiles over the years. Data source: UNFCCC (2009b)

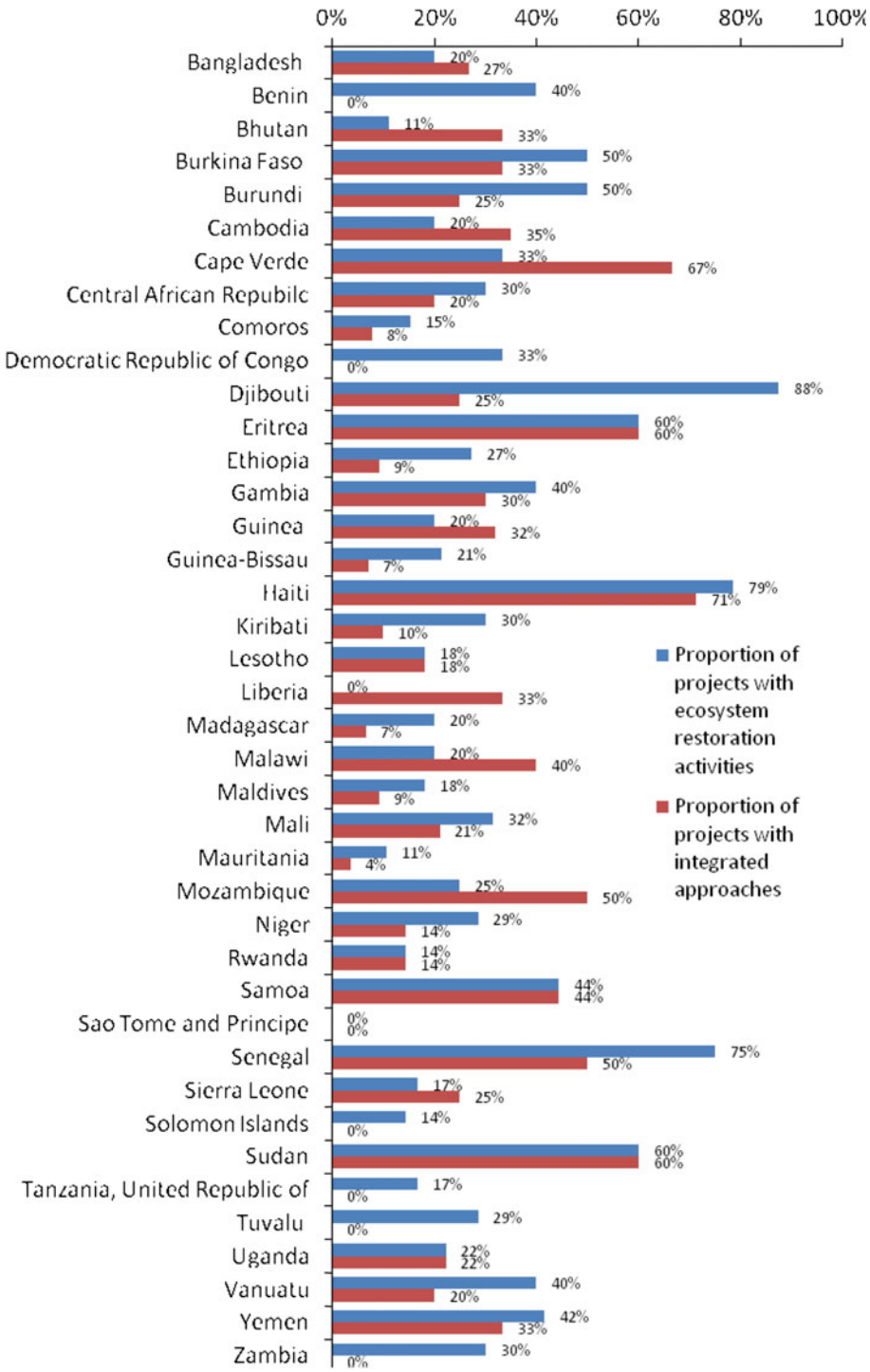

Fig. 2 NAPA priority project data by countries. Data source: UNFCCC (2009b)

Results by Budget

The Total Indicative Project Cost including all NAPA projects was USD 934 million.[4] Out of that, the cost for projects aiming at ecosystem restoration was USD 282 million (30% of the total budget), and costs for projects with at least one of the integrated approaches was USD 314 million (34% of the total budget).

The proportional Total Indicative Project Costs per sector followed closely the order of the number of projects. Terrestrial Ecosystems had the highest proportional amount earmarked for ecosystem restoration (30%), while Coastal Zones and Marine Ecosystems had the largest

[4] Budget data for Niger's NAPA project profiles was not available.

Table 3 NAPA priority project data by sectors

NAPA priority project sectors	Total no. of projects	No. of projects aiming at ecosystem restoration	%	No. of projects with integrated approaches	%	No. of projects aiming at ecosystem restoration using integrated approaches	%	Total indicative project cost	Total indicative project cost for ecosystem restoration	%	Total indicative project cost for integrated approaches	%	Total indicative project cost for ecosystem restoration using integrated approaches	%
Coastal Zones and Marine Ecosystems	36	27	75	17	47	16	44	168,425,167	101,635,167	60	142,985,905	85	82,985,905	49
Cross-sectoral Projects	33	7	21	10	30	6	18	57,420,225	5,181,200	9	9,671,200	17	5,446,200	9
Early Warning and Disaster Management	31	0	0	0	0	0	0	59,713,180	0	0	0	0	0	0
Education and Capacity Building	32	4	13	3	9	1	3	39,253,338	12,800,000	33	5,830,000	15	5,050,000	13
Energy	18	1	6	0	0	0	0	26,307,520	150,000	1	0	0	0	0
Food Security	91	16	18	11	12	9	10	163,603,933	46,757,924	29	48,640,000	30	41,640,000	25
Health	30	0	0	0	0	0	0	32,493,000	0	0	0	0	0	0
Infrastructure	10	1	10	2	20	1	10	58,870,000	2,500,000	4	6,500,000	11	2,500,000	4
Insurance	18	0	0	1	6	0	0	23,156,631	0	0	250,000	1	0	0
Terrestrial Ecosystems	72	57	79	32	44	28	39	121,210,796	94,264,207	78	55,205,839	46	48,763,409	40
Tourism	4	0	0	0	0	0	0	1,750,000	0	0	0	0	0	0
Water Resources	61	9	15	25	41	7	11	181,757,686	19,081,000	10	45,321,000	25	20,291,000	11
	436	122	28	101	23	68	16	933,961,477	282,369,498	30	314,403,944	34	206,676,514	22

Data source: UNFCCC (2009b)

money earmarked for projects with at least one of the integrated approaches (85%).

The Total Indicative Project Cost for NAPA projects that fulfill both ecosystem restoration and at least one of the integrated approaches criteria is estimated at USD 207 million. In December 2009, the developed countries collectively committed approximately USD 30,000 million new and additional resources for enhanced implementation of the United Nations Framework Convention on Climate Change for the period of 2010–2012 (UNFCCC 2009a). A proportion of this money is aimed at adaptation activities, and prioritized for the most vulnerable developing countries. The amount needed to implement the NAPA projects aiming at ecosystem restoration using integrated approaches presents only 0.7% of the money pledged in Copenhagen.

Figure 2 and Table 3 provide detailed findings of the data analysis.

DISCUSSION

Uncertainties remain about relationships between forest cover and river basin hydrology. As a result, there is considerable debate about whether either upstream or downstream communities are best served by land-use and water management policies that promote forest retention and, more especially, afforestation (FAO–CIFOR 2005; Calder 2006; Bruijnzeel 2007; The Economist 2005). Maintaining ecosystem services that create resilience is important especially in the developing world. There is a need to shift the debate from where and to what extent forest cover is hydrologically optimal to what are the best ways to meet requirements for ecosystem services. This requires an integrating perspective that spans the multiple and interacting ways that people use and depend on landscapes and watersheds. The integrated approaches referred to in this article, among others, all provide frameworks for doing this.

Although the NAPA process can be seen as a step closer to practical implementation of integrated approaches, the key challenge is yet ahead: implementation. This is especially relevant since the NAPA guidelines clearly state that the focus of the NAPA itself is in the political, participatory process, rather than in implementation (UNFCCC 2009c).

In many of the NAPA project profiles, lack of capacity was listed as one of the risks or barriers in implementing the NAPA. The NAPA process could take advantage from the lessons learned of integrated processes with a longer history, such as the IWRM and INRM.

Financing was listed as another potential barrier for the NAPA implementation. Putting into practice currently identified NAPA projects aiming at ecosystem restoration with integrated approaches would require less than 1% of the amount pledged for climate change mitigation and adaptation at the Copenhagen Climate Conference. Research results on the high Internal Rates of Return from investing in natural ecosystems (e.g. TEEB 2009) are increasing. Building the investment case for mobilizing financing for practical implementation of natural resources management using integrated approaches could be a way for international and local organizations to advance the sustainable development agenda.

CONCLUSIONS

The data show that the NAPA process has pushed forward the ecosystem restoration and integrated approaches a step closer to their practical applications. An increasing number of countries are seeing ecosystem restoration as an important option for adaptation. In 2009, 42% of all the NAPA project profiles included ecosystem restoration as a means for adaptation. The proportion in 2004 was 11%. The proportion of project profiles using at least one of the integrated approaches was 33% in 2009 in comparison to 4% in 2004.

The water sector should integrate more with other sectors. The data revealed that significantly less NAPA projects under the Water Resources category aimed at ecosystem restoration than in Terrestrial Ecosystems and Coastal Zones and Marine Ecosystems. Further, the number of water-sector project profiles using integrated approaches was almost three times higher than the number of projects aiming at ecosystem restoration.

The challenge ahead is to ensure that the restoration is undertaken using integrated approaches. A particularly important aspect is the broad, landscape-level scale. All of the integrated approaches referred to in this article emphasize the importance of landscape, basin, or ecosystem scale. Yet, this aspect was missing in most of the NAPA project profiles.

Acknowledgments The authors would like to thank Prof. Olli Varis and Prof. Steven De Bie for constructive comments and advice during the drafting stage of this article. Scholarship received from Maa- ja Vesitekniikan Tuki r.y. helped tremendously in allowing for the finalization of this article. The two independent reviewers provided valuable comments during the revision process.

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