Volume 19 . Number 1. March 2017 • ISSN: 1466-0466

Journal of the
National Association of Environmental Professionals

Environmental Practice

Taylor & Francis
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ENVIRONMENTAL PRACTICE

Journal of the National Association of Environmental Professionals

Environmental Practice (ISSN 1466-0466) is a quarterly journal published by Taylor & Francis for the National Association of Environmental Professionals. Information for contributors appears in this issue and on the journal's Web site at http://www.tandfonline.com/uevp.

Environmental Practice is the successor to *The Environmental Professional*, which appeared from 1979 to 1997. *Environmental Practice* honors the fine traditions established by *The Environmental Professional* while simultaneously opening new avenues of discussion on environmental issues. For more information about the NAEP, please visit www.naep.org.

Subscription Information: *Environmental Practice* is published quarterly in March, June, September, and December. Annual subscription rates for Volume 19 (2017): Annual institutional subscription rates (electronic): $488, £305, €407.

Publishing and Advertising Offices: **USA/North America**: Taylor & Francis Group, LLC, 530 Walnut Street, Suite 850, Philadelphia, PA 19106. Tel: 215-625-8900; Fax: 215-207-0050. **UK/Europe**: Taylor & Francis Customer Service, Sheepen Place, Colchester, Essex, Co3 3LP, UK. Tel: +44 (0)20-7017-5544; Fax: +44(0) 20-7017-5198. Production Editor: Amanda Grisafi. For a complete guide to Taylor & Francis Group's journal and book publishing programs, please visit our website: **www.taylorandfrancis.com**

Postmaster: Please send address changes to *Environmental Practice*, Taylor & Francis Group, LLC, 530 Walnut Street, Suite 850, Philadelphia, PA 19106.

Instructions for authors can be found at www.tandfonline.com/uevp.

March 2017

ENVIRONMENTAL PRACTICE
2017, VOL. 19, NO. 1, 1
http://dx.doi.org/10.1080/14660466.2017.1278997

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PRESIDENT'S MESSAGE

Thank you NAEP

As you know, my term as President will be ending in March 2017 and this will be my last President's message within the journal. I hope that during my term I have been able to make a positive impact on both the current and future NAEP. Thank you for the opportunity to lead and for your patience as I grew in my position. This is definitely one experience I will never forget!

My journey in leading the Association wasn't done alone. I was accompanied by a team of dynamic individuals, both elected and not, who shared in our successes and learned from our challenges. So, I would like to take this opportunity to thank a number of people for their hard work and dedication, without whom running the Association would not have been possible.

In particular, I'd like to thank past President Ron Deverman for his support and encouragement during my term as President and over the past eight years on the Board of Directors, as well as all the members of the Executive Committee and the Board of Directors for their dedication in serving with me.

I would be remiss if I did not recognize the true champions of this past two years, our dedicated Strategic Plan Pillar leaders, committee chairs, and their volunteer members. There are not enough words to express the thanks and appreciation I feel toward these great leaders for their time and friendship over the past several years. Without their passion and undying commitment to devote hundreds of hours of volunteer service, we would not have begun this journey of transformation or achieved any of our strategic plan goals these last two years. Embracing change is difficult and these volunteers never lost sight of the Association's strategic direction even when our road to success got bumpy or was detoured.

In addition, I extend my sincerest thanks to our headquarters team, and specifically their leader, Tim Bower, for his mentoring, guidance, friendship, and dedication to NAEP as well as his tireless work since 2008 managing our operations and taking care of our members and chapters. I am certain that we can count on his valuable support of the Association this year.

But, most importantly, my thanks go out to you, the Members and our Associated Chapters, for all your support of NAEP and the strategic plan initiatives and changes these past two years. Without you, the Association would not exist. It has been my pleasure to serve you.

In closing, I do have one final request. I ask that each of you pledge your continued support to NAEP and help our future Association leaders continue our journey to deliver the success our Association deserves.

Sincerely,
Brock Hoegh, CEP, NAEP President

ENVIRONMENTAL PRACTICE
2017, VOL. 19, NO. 1, 2–3
http://dx.doi.org/10.1080/14660466.2017.1275730

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Letter from the Editorial Office

As the managing editor for *Environmental Practice*, I work with the NAEP Publications Pillar and our readers to identify topics and issues that we feel are of interest to the journal's readership. Some volumes have a theme, which is usually suggested to us by our readers. This approach has been effective in bringing in new perspectives and topics on environmental issues, and maintains the NAEP mission by providing quality articles that balance the interests of both the practitioner and the scholar in the environmental professions.

Please send us your ideas for interesting and relevant thematic topics in the field of environmental practice. Also, if you are particularly passionate about a topic, then consider signing on as a guest editor. Contact me at ruth.gaulke@gmail.com if you are interested.

Deadlines for content

- September 2017: 03/6/17
- December 2017: 05/29/17

Manuscript categories

Peer-reviewed

- Research Articles
- Environmental Reviews and Case Studies

Non-peer-reviewed

- Perspectives from the Field
- Reviews
- Dialogue

Counterpoint

For our Counterpoint category, we will look for discussion-generating articles. When we receive an interesting, provocative submittal, we plan to recruit authors to write a response piece to initial piece. An initial article or a response manuscript would be similar in length to a Perspectives from the Field piece, in the range of 1,000–1,500 words. However, the goal of a Counterpoint piece would be to respond to a cited, peer-reviewed article and, as a result, each manuscript would need to be grounded in literature citations, unlike a Perspectives from the Field piece, which does not. These manuscripts would not be peer-reviewed.

Working group

In this category, we will give the NAEP working groups an outlet to report their findings. These manuscripts will vary in length, according to the specific projects being reported on by the working group, but will be similar in length to our peer-reviewed manuscripts (roughly 5,000–6,000 words). These manuscripts would be peer-reviewed.

Student perspective

Students are the future of NAEP. As such, we will work with the NAEP student chapters to provide students with an outlet for writing their first peer-reviewed publication. These manuscripts would be written in the same format as our usual peer-reviewed manuscripts, but would be identified as a student work. Ideally, the student series will highlight the work of up-and-coming student practitioners, aiding them in their future careers, and will also

identify the NAEP as a beneficial organization for student practitioners.

Career development

This manuscript category would act as a topic-focused version of our Perspectives from the Field section. The NAEP has members who work in a wide variety of fields, all of whom can provide particular insights into the future of careers in their industry. We would like to recruit these professionals to write short opinion pieces, in the range of 1,000–1,500 words, on career development, with advice for other working professionals. These manuscripts would not be peer reviewed.

If you have ideas for other categories, please let us know!

Ruth Gaulke

ENVIRONMENTAL PRACTICE
2017, VOL. 19, NO. 1, 4–15
http://dx.doi.org/10.1080/14660466.2017.1275658

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RESEARCH ARTICLE

No walk in the park: Transboundary cooperation in the Angolan war-torn Okavango

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ABSTRACT
The Okavango region is currently part of a transboundary project extending to three neighboring countries—Angola, Namibia, and Botswana. This article discusses the unequal trajectory and present conditions for such cross-border cooperation, with a particular focus on Angola. Angola's disadvantageous position is above all due to the lasting effects of war that adversely hindered the development of structures and resources to engage in such joint programs. The central argument is that the inequalities pose particular challenges to the country to accompany the pace of the neighboring countries. The article looks at the fragilities focusing on institutional resources, Angolan policy background, existing dedicated institutions, and human resources, as they are major concerns for post-war reconstruction. On the other hand, it poses questions regarding resilience effects on local level livelihoods and on the future environmental management of the Okavango. This article is based on a literature and documental review and on data from fieldwork where local communities have to rely more heavily on the available natural resources in absence of others.

ARTICLE HISTORY
Received 30 August 2016
Accepted 27 October 2016

KEYWORDS
Angola Okavango; post-war resilience; transboundary cooperation

The call for joint initiatives focusing on sustainable development has never before been as strong as it is now. Environmental concerns are today a matter recognizably dependent of agreements between nations (Agyeman and Evans, 2003). These, however, require finer adjustments between the partners as departing conditions are enormously varied, even regionally. There are wide differences between countries in their capacity to participate in, and contribute to transboundary projects (Cumming, 2011). Cross-border engagements involving the society, governments, and ecosystems have never been easy to address (Green, Cosens, and Garmestani, 2013, p. 1), namely due to the differences between the countries, including different legislative approaches and national priorities. The Angola-Namibia-Botswana partnership in the Okavango region is one of such examples. Several environmentally focused joint initiatives in the area, particularly in the last two decades, unravelled the uneven terms upon which such partnerships are built and projects are implemented on the ground. Angola is by far a disadvantaged partner in the context of the joint management of the Okavango Basin if compared to the two neighbors, despite its geographical advantage, controlling over 90% of the water sources of the Delta. This article deals with the Angolan condition within the partnership, describing the main areas of its fragility. The most obvious cause for this disadvantaged position is the civil war (1975–2002) that affected not only the Angolan Okavango region directly but also the national institutions as a whole for three decades. The civil war also contributed to the absence of development policies and practices in all provinces, including in the Cuando Cubango province—an area known in Angola as "end of the world land"—and even more significantly affected the areas of environmental policies and practices, for decades overlooked. Additionally, the Okavango Basin provides support to rural communities, the majority returning from displacement elsewhere that now have their livelihoods dependent on subsistence rainfed agriculture, flood-recession agriculture, and on a wide range of natural resources. Due to the war, people living in the basin area are in general poorer, less healthy, and less well educated than nationals from other parts of Angola (OKACOM, 2011), which poses further challenges to local sustainability.

This article analyzes two crucial areas for the joint management of the Okavango. First, it addresses

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the institutional background and the systems and mechanisms of the Angolan state—especially in the environmental area—and of the partnership, that directly or indirectly affect the Angolan part of the Okavango. Second, the article examines local strategies and alternatives available to the people who live in the Angolan part of the Okavango, with special reference to the recent trends of local development and welfare.

Although the natural relationships are old and the riparian areas of the three countries of the Okavango form an ecosystem and landscape setting, the institutional linkages are as young as mentioned, notably since the independence of the countries. The establishment of the colonial borders after the Berlin conference in 1885 and the territorial disputes it entangled was followed by the impossibility of a joint management of the region with the effective participation of the Angolan counterparts as the country submerged into civil war right after independence in 1975. This resulted in decades of more informal and "natural" transboundary relationships than in formal planned collaborations, with war producing several other negative impacts in the region. An Okavango River Basin Transboundary Diagnostic Analysis concluded in 2009 (Barnes et al., 2009) indicated that the basin is far from being affected by development.

Nonetheless, both national and bilateral agreements and projects as well as initiatives clearly or potentially across borders, devoted to environmental issues, have been developed here and there since the 1990s, leading to diverse evolutions on the ground but certainly to accumulated knowledge about the region. The abundance of projects, agreements, or policies, at the national, regional, bilateral, and transboundary levels, ultimately shows the desire and intentions of protecting together such an important part of the planet and consolidating inter-country and regional initiatives focused on the environment. Results, however, proved to be diversified. In Angola, they have revealed the inequality regarding the conditions to participate in such partnerships, namely in terms of human resources and of institutional capacities and background. They have also highlighted the specificities of the impacts of the long-lasting war and the conditions for the resilience of livelihoods in the Angolan part, which poses further interrogations to the future of the transboundary project and the desired pace of implementation.

The main discussion in this article, concerning the inequality of the partners and the uneven starting conditions the war background created at the local level, aims at showing that notwithstanding the efforts and collaborative intentions foreseen by the environmental plans and projects, the differences remain markedly evident and condition the development of the region, at least in the short term. The particularity of the Angolan case brings to the fore institutional and managerial constraints caused by war but also other specific local features affecting the region. For instance, while the war kept the population away from the exploitation and use of natural resources related to subsistence—which to a certain point may have spared environmental consequences—on the other hand allowed for intensive and long lasting exploitation of ivory, valuable timber, or bush meat by the guerrilla militaries who were based in this region. Beyond the most evident differences in terms of historical background, language, or culture, the uneven conditions of the partner countries within the cross-border projects are objectively recognizable in the differing infrastructures, institutional development, available and qualified human resources and, most importantly, in terms of the socioeconomic conditions of the local population. Identified constraints to conservation and environmental development successes in Transfrontier Conservation Areas (TFCAs) point to some general aspects (Cumming, 2011), such as these, which require from all partners involved capacity to deal with them.

The research in this article is based on the analysis of institutional information, produced in the countries integrated in the conservational transboundary areas and within joint research projects of national and international agencies, organizations, and the academy. At the local level, as a case study, the analysis is grounded on information collected through a multiparty and multidisciplinary academic research

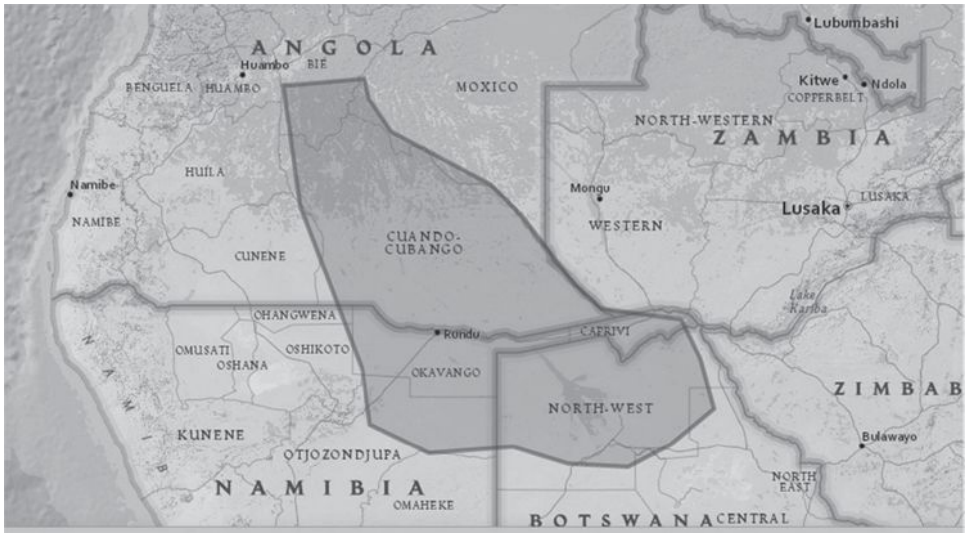

Figure 1. National Geographic map showing the five KAZA countries and the Okavango region. Map created using MapMaker (http://mapmaker.nationalgeographic.org/) and published with permission of National Geographic.

project also conducted in Angola, in Chitembo, a town in the Bié province, the area of the upper catchment of the Cubango (Kavango) river (see Figure 1). The project *The Future Okavango* was coordinated by the University of Hamburg and funded by the German Federal Ministry of Education and Research (http://www.future-okavango.org/). Given the Angolan perspective of this analysis, the literature examined and the survey information are important sources as there is not much data and information about the Okavango part of Angola, especially if compared to the neighboring countries. Part 3, about local population and livelihoods' resilience, is substantially based on a survey to 237 households and qualitative research conducted in the Chitembo region within the project. However, it should be stressed again that the changes taking place in the transboundary area and between the transboundary stakeholders are relatively recent, with much information still being produced and many local strategies still being readapted to the new conditions of peace.

The inequalities

The institutional, legal, and human capital background in a context of war

The discussion of the ongoing partnerships is particularly important today as the end of the 30 years of civil war in Angola in 2002 gave a new impetus to the early 1990s plans to develop a transboundary environmental project of the Okavango Basin and Delta. In Angola, the Okavango occupies an area of approximately 700,000 km^2 in the Cuando Cubango province, with the main water sources covering 120,000 km^2 (Figure 1). The tri-country transboundary area under the management and cooperation agreement on the Okavango, the OKACOM of 1994, was later on, in 2003, integrated into a five-country Transfrontier Conservation Area (TFCA) within a project linking the Kavango and the Zambezi, the Kavango - Zambezi Transfrontier Conservation Area (KAZA), supported by the SADC, adding Zambia and Zimbabwe to this larger project. There are 14 TFCAs currently being developed in southern Africa (Cumming, 2011) and these regional and bilateral agreements foresee the common management of the defined areas.

Together, the National (and Regional) Parks and Reservations in Angola cover 123,302 km^2, 9.9% of the surface of the country: nine national parks (Quiçama, Cangandala, Bicuar, Iona, Cameia, Mupa, Luengue-Luiana, Mavinga, Mayombe), 1 regional natural park (Parque Natural Regional of Chimalavera), and 4 natural reserves (Luando, Ilhéu dos Pássaros, Búfalo, Namibe). Additionally, the 18 forest reservations (*Reservas Florestais*) and the several game reserves cover 106,650 km^2 more. In Angola, the region within the KAZA covers only 2 of the 14 national environmental protection areas

(*Áreas de Protecção Ambiental*). The national parks and game reserves within the KAZA are five in Zambia, three in Namibia, four in Botswana, and four in Zimbabwe.

The initial negotiations for agreements regarding the regional natural resources and specific initiatives leading to the current Okavango partnership took place in the beginning of the 1990s. By then, Angola was a country amidst serious internal confrontations and coming out of a regional conflict involving South Africa and Namibia, with no structured approach to the environmental issues, both nationally and within its regional context. However, even when previous agreements and discussions were taking place, in the mid-1970s, Angola was at war for independence, meaning it had no available personnel, capacities in this area, or political interest (Msukwa, 2010). After independence in 1975, the region was occupied by the guerrilla opposition of National Union for the Total Independence of Angola (UNITA), fought by the MPLA government (Popular Movement for the Liberation of Angola) and the Namibian liberation war was also being played out in the southern regions of Angola for some years. The Angolan partners of the Okavango project started to emerge from the colonial setting in the 1990s and as war ended in Namibia they were both able to proceed with the development of their institutions and of their local mechanisms to manage the Okavango, while Angola submerged into an even more destructive civil war.

At the national levels of the three countries involved, several national plans, policies, and other sectoral orientations were produced along the years, some more general related to the environment, conservation, or water resources and others more specific (Table 1).

For Angola, the major challenges identified by the National Strategy for the Environment in 2006 are still valid today. In the political and socioeconomic area, Angola is still dealing with reconstruction and addressing the basic needs of the population. On the other hand, province- and municipal-level administrative fragilities remain and the foreseen decentralization is still incipient. In general, the level of environmental awareness is low while poverty and dependency on natural resources is high. Finally, the loss of local and indigenous knowledge because of the war is still producing effects.

One of the few areas relevant to the environmental development that has evolved significantly in the recent years was demining. In the area of research and environmental education, programs, and national policies missing are still the main constraint, together with the lack of human and financial resources. Regarding environmental protection, the absence of specific plans, programs, and functioning systems for the area continues to constitute the main areas of constraint, along with the shortages of qualified human resources to deal with them. Within the legal and institutional framework, there are still also constraints regarding law enforcement, lack of specialized legislation, few programs for legal awareness in the area of the environment. Additionally, national policies lack coordination, which has proved to produce better results in the neighboring countries, according to the available reports. The development of institutions and mechanisms to manage the Okavango comprises an important combination of work in Namibia and Botswana between the ministries of Environment and Tourism, and this is extensive to the KAZA partners as well. In Angola, the Okavango project is managed by the Ministry of Tourism, with less interaction from the Ministry of Environment, although more recently there has been some increased direct engagement.

Law and enforcement of law

In general, legislation regarding the diverse relevant areas involved is still incipient in Angola, as well as the structures to actually enforce the legal compliance to the existing rules. With the establishment in 2011 of two national parks in the Cuando Cubango province, there has been increased law enforcement in the province through the establishment of rangers' posts and training of wildlife rangers. They are, however, recognizably insufficient to cover the Okavango territory. In Namibia and Botswana, laws and regulations, as well as the structures and mechanisms to address incompliance, are quite developed in the various relevant areas, as referred by several sources. While

Table 1. Regional, international, and national frameworks.

Year	Regional initiatives
1994	OKACOM Agreement
1995	SADC Protocol on Shared Watercourse Systems
1997	UN Convention on the law of the non-navigational uses of international watercourses
2002–2012	SADC Expanded OUZIT Project – Okavango Upper Zambezi International Tourism Spatial Development Initiative
1995–2000	Transboundary Diagnostic Analysis (OKACOM, 1998), Integrated Management Plan (IMP) and an Environmental Assessment (EA) (under the OKACOM)
2001–2010	Project on Environmental Protection and Sustainable Management of the Okavango River Basin (EPSMO)
2010	Cubango Okavango River Basin Water Audit Project (CORBWA) (by FAO)
2010	Protocol on Hydrological Data Sharing for the Okavango River Basin
International agencies' projects	
1995–2010	UNDP: Trans-boundary Diagnostic Analysis (TDA) and Strategic Action programme (SAP)
2004–2007	Swedish SIDA: Every River Has Its People (ERHP) project*
2005–2009	USAID: Integrated River Basin Management Project (IRBM)
2010–2015	USAID: Southern African Regional Environmental Programme (SAREP)
National framework	
2008	Okavango Delta Management Plan (ODMP), Botswana
2005	Okavango Delta Information System (ODIS) (Harry Oppenheimer Okavango Research Centre (HOORC), University of Botswana), Botswana
2008	Kavango Basin Management Committee: National Integrated Water Resources Management plan, Namibia
2011	Okavango Basin Tourist Hub and respective Management Office, Angola
2011	National Action Plan for the Environmental Protection and Sustainable Management of Okavango River Basin, Angola

* Implemented by the Kalahari Conservation Society (KCS) in Botswana, the Namibia Nature Foundation (NNF) in Namibia and the Association for Environment Conservation and Integrated Rural Development (ACADIR) in Angola.

Botswana and Namibia—and within the KAZA area, Zimbabwe and Zambia—have produced along the last decades several laws and regulations specifically addressing environmental and conservation issues, Angola has slowly been recovering the pace since the end of the war in 2002 and most of the protected areas' legislation is still from the colonial times (Russo, 2005). So far, the main laws (Morais, 2009), approved very recently, have been focusing on general aspects of the environment and conservation. Several international protocols were also signed, providing a general transboundary background for future projects and activities in the Okavango and in the KAZA area. Compliance with all the items of these protocols is, however, not regularly monitored.

Moreover, important international background instruments, like the Ramsar Convention on Wetlands of 1971, have only been signed by Angola in April 2013. Angola ratified the UN Convention on Biological Diversity in 1998 and several national documents are now regulated by these international guidelines including the National Biodiversity and Action Plan (Government of Angola, 2006). The 2010 Constitution itself has several articles referring the environmental concerns. So far, Angola has published the Environmental Framework Law, the Law of Territory and Urban Development, a Decree on Environmental Impact Assessment, and a Decree on Biological Aquatic Resources. Several other norms and legislation are also partially interconnected, by specific areas, to the activity and environment in the transboundary area (Morais, 2009). At the regional level, Angola signed important protocols within the SADC, directly focusing on areas such as the Okavango or the KAZA: the Protocol on Fisheries (2001) and the Water Protocol on Shared Watersourses (2000).

However, while Namibia and Botswana produce monitoring reports regularly—about the environment, hydrological, flood reports, etc.—in Angola the information is scarce and irregularly collected until now. At the local level, national regulations are often ineffective and local strategies prevail, for instance in the area of land regulations or regarding over-exploitation and illegal smuggling of natural resources like timber (Röder et al., 2015).

Human capital

The human resources necessary to sustain a project, particularly one with the transboundary approach of the Okavango, are very limited in Angola, mainly as a result of the war but also due to the inability to quickly address these

limitations after the end of the war. Although a number of people are being trained in different institutions in relevant areas—including higher education institutions—the quality of the teaching in Angola is yet to be satisfactory and there are few courses specifically focused on environmental issues. The staffs of state services and departments are generally not well capacitated in areas devoted to the environment, international relations or research and development policy. Universities and research structures generally lack the human resources and funding to pursue national and/or multi-institutional international research, and are not equipped with the informational tools and resources necessary to engage into relevant research. Very scarce research is therefore conducted and the results of this and of the few research projects are seldom publicly available. Finally, at the local level, non-government and civil society organizations, particularly those working about sustainable development in the Okavango, are very limited, numerically and in terms of the activities they are capable of developing within the transboundary area.

According to the reports and documentation examined, a set of key stakeholders, beyond the local inhabitants, still needs to be involved in the analysis of the recovery of the transboundary parks. These include policy makers, particularly those of the different ministries implicated; the authorities in charge of the management of parks and conservation areas; the administrative authorities at central and local level, including the traditional authorities; specialists of correlated and relevant areas like the academics and research instances; specialized services like demining companies and national institutions; authorities and private stakeholders related to tourism. Moreover, in the Cuando Cubango, even the level of development and implantation of civil society organizations is lower than the Angolan average. The number of Non-Governmental Organizations (NGO) and Civil Society Organizations (CSO) in the cross-border area as a whole is so large that it would be "impossible to profile each of them" (Msukwa, 2010, p. 46). However, these are practically only located in Namibia and Botswana. The references to Angolan NGO working in the area are just one, Associação de Conservação do Ambiente e Desenvolvimento Rural Integrado (ACADIR), and even this one is not totally dedicated to environmental issues at all times.

While in collaborative research projects, relevant partners from the academy in Namibia include the University of Namibia, the Polytechnic of Namibia, or the Desert Research Foundation of Namibia, in Angola only the University Agostinho Neto—and the ISCED institute of the same university—the University Privada of Angola in Lubango and a Polytechnic School in Menongue have been capable to assign some of its staff to projects dedicated to the Okavango region. References in Portuguese language and/or published by Angolans about the Okavango are very rare, if not practically inexistent, despite the remarkable efforts of the OKACOM and the involvement of Angolan researchers in the OKACOM's programs. Some few reports are developed by government institutions but are rarely made public. Scholars then approach the Okavango essentially from the Namibian and Botswana sides, as structures such as universities and research centers are functioning there and developing quite substantial work on the subjects relevant to the management and protection of the region. All these institutions play an important role in the conception and operationallity of the transboundary nature of the project, in the day-to-day monitoring and integrated management of the activities and projects conducted and, at the same time, contribute to progressively strengthen local capacity.

Local population and livelihoods' resilience

Another area of analysis of this paper regarding the uneven background of the partner countries focuses on the local aspects and on how they integrate the ongoing and foreseen transboundary dynamics. Two main ideas are important to retain in this area: firstly, the extreme impacts and effects of war in the region, in terms of population displacements, hindered access to education or training, limited access to basic health care and sanitation or, particularly, the underdevelopment of local activities and provision of infrastructure.

On the other hand, the coping strategies of the population after the end of the war, in such conditions, have to rely heavily on the existing natural resources, which adds to the disruption of agriculture skills and the rural exodus caused by war. Reliance on natural resources and the use local population make of them has been extensively discussed, including for the case of Angola within the mentioned TFO research (Pröpper and Haupts, 2014; Schnegg, Rieprich and Pröpper, 2014). The post-war context in Angola, along with major social and economic changes, has exacerbated the dependency of the rural population on natural resources. Additionally, livelihoods are increasingly connected to processes of urban growth or growing consumerism (Pröpper et al., 2013), which anticipate direct and indirect effects on the natural setting. The Angolan background of war and displacement has intentionally been contradicted recently by development policies, which, however, have not been able to reverse generalized precarity. Poverty, poor institutional environmental regulation, and a need for development are today by extension common to the three countries of the Okavango (Pröpper and Haupts, 2014) but more critical in Angola. The Development Plan approved by the government for the Cuando Cubango province in 2013 was prepared to deal with these issues by improving access to the construction of approximately 4,000 km of roads, fostering agriculture, education, and health as well as some industrial activities related to the mining industry. The challenge will be to turn the proposed activities into real actions that will enable poverty alleviation to the rural communities and, expectedly, a lower degree of dependency on natural resources.

Effects of war on livelihoods, then and now

As already suggested, the most striking unequal departing condition for Angola is then related to the disruptive situation in terms of economy, society and even the natural setting left by three decades of civil conflict. The Cuando Cubango province, where the largest portion of the transboundary area of the Okavango is located, was one of the most affected by the conflict, where the belligerent parties often collided and where tons of landmines were deposited along the years and the wildlife killed or chased away almost up to exhaustion, particularly elephants to feed the ivory market. Physically, war had severe impacts on circulation and accesses, leaving the region isolated in one hand and militarily controlled on the other. More acutely, the conflict disrupted the local economies and was responsible for massive displacement, and forced immobility of both the militaries and the captive population. Currently, the continued inadequate control of the borders has led to new illegal exploitation of natural resources, border crossings and trade with neighboring countries, principally Namibia and Zambia.

With massive displacements of the population, the region witnessed the abandonment for several years of practically all agricultural activities as well as of others based on natural resources' exploitation. Moreover, it also opened space for several traffics of natural resources that persisted during the war decades. Controversially, war spared the exploitation of natural resources but added negative impacts. Analysis of recent war affected areas of the world shows that the protection of wildlife and habitats through the limitations of human incursions and settlement imposed by warfare is contradicted by the negative effects of munitions, landmines, and chemical agents used in the conflicts as well as over exploitation of natural resources (Dudley et al., 2002). In Angola, an unknown but substantial part of the wildlife was hunted for years to feed the armies on the ground and a large number of landmines deposited.

The survey conducted in Chitembo showed that women are the heads of a relatively high percentage of households (29%), a clear consequence of war imposing changes in local family structures and attributing more responsibilities to women. On the other hand, the majority (50%) of the households is headed by an adult between 30 and 49 years old, which may indicate that the effects of war on adult male mortality are only beginning to fade away. Other long-term impacts of war and lack of infrastructure locally are visible in the very low levels of education of the household heads

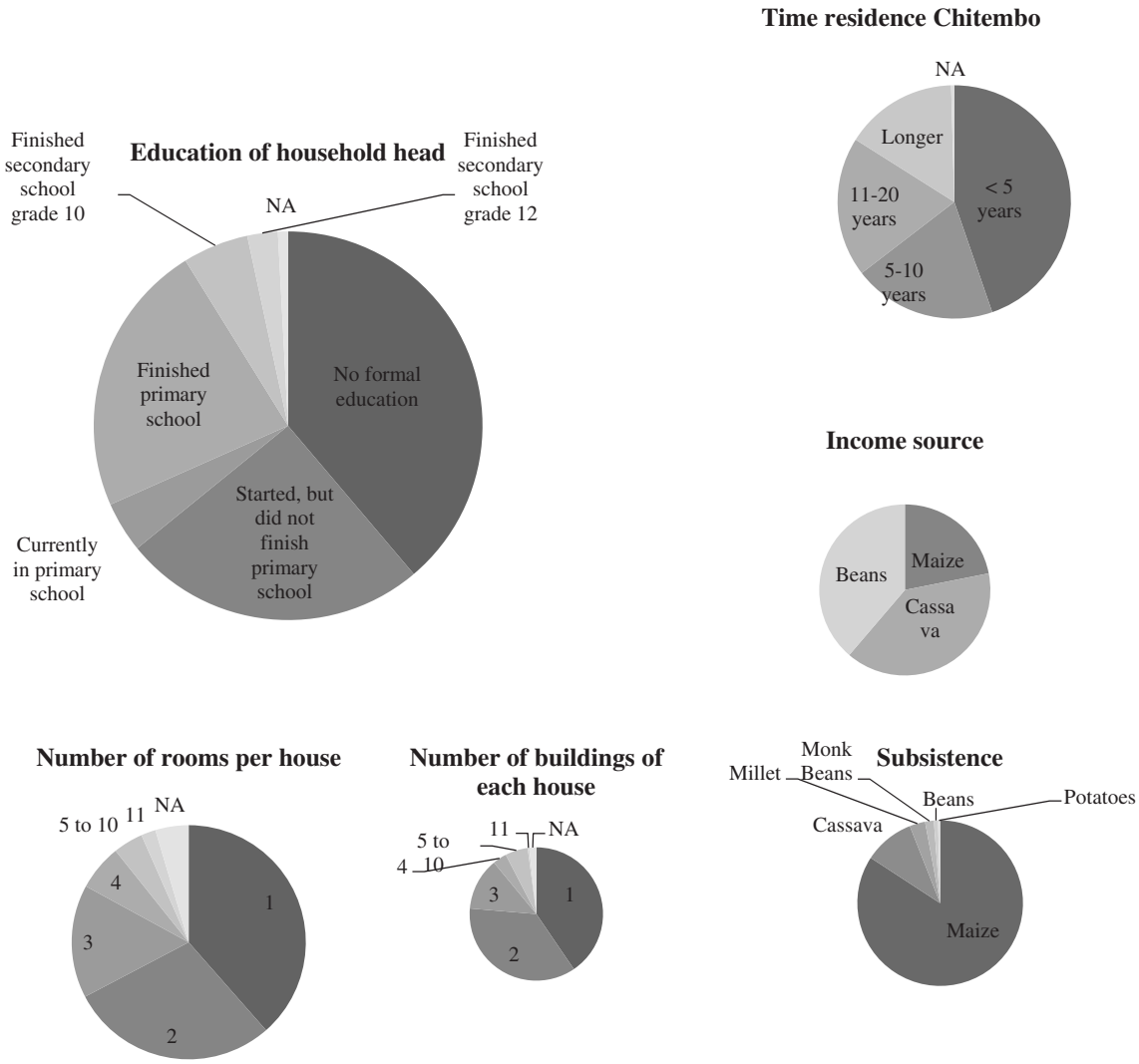

Figure 2. Characteristics of households.

(Figure 2), who have in their majority either never been to school or did not complete primary school.

Other noteworthy consequences of war in the region are related not just to the destruction of the few existing infrastructure—although the region was not properly addressed by the colonial settlement and administrative efforts until the beginning of the 20th century—but also with the halting of any new project during the war, may it be roads, facilities of any kind —either touristic or administrative—commercial or industrial investments. Still today, communication by road is very problematic, which is also one of the difficulties found in the joint management of the area and within the management of international projects.

Resilience, available opportunities, and burden on natural resources

The resettlement of population in Angola after the end of the war emphasized the fragilities of subsistence in such scenery of destruction at several extents. The prolonged displacement, particularly in urban locations or refugee cross-border sites, caused the loss of agriculture skills, of knowledge about the management of local natural resources and services, and disrupted the productive chains. On the other hand, the end of the war did not translate into massive return of population to their areas of origin, particularly the youth. Relocations in the province focused more on the search for better economic means—at roadsides, on former villages—while the disruption of the local economic

activities and circuits and the introduction of economic activities with shorter-term returns pushed even more others to seek for solutions for resettlement and resilience in nature, in the absence of other opportunities. Also, animal population that was either killed or chased away to neighboring countries during the war is starting to return and increasing rapidly in number, like elephants (Chase and Griffin, 2011), causing additional constraints to the environment and rural subsistence as often stated as people are not able to deal with this.

The local population, returning to their areas of origin or settling in new locations closer to the roads or the more fertile land fields had to start almost from scratch. The majority of households arrived in the surveyed region—and in other regions of the Okavango—relatively recently, practically after the end of the war in 2002 (see Figure 2). While return to villages like Chitembo and others in the Okavango region is notorious by the growth of housing and settlement, the development of economic activities is not yet visible, although predicted and desired, particularly by the national instances. Potentially, touristic projects will be materialized but in the meantime, the population either returning or settling has not many available possibilities to generate income. Practically, all surveyed families are engaged in agriculture—only 2 of the 237 surveyed do not resort to this type of activity. More than a half of the households cultivates in forest areas (54%) or near the river (34%). Only 8% do agriculture on dry grassland. The average size of cultivated fields is 1.7 hectares: only 6 households have fields smaller than one hectare and only 25 out of 236 have fields larger than 4 hectares. The predominance of farming is, however, strategical combined with other activities in order to cope with subsistence. Employments, livestock raising, businesses, and trading of natural resources—and particularly charcoal—constitute the other available possibilities in the region. Depending on the success of the diversification, households are increasingly diverse in terms of wealth and welfare too. Three main wealth categories were identified in the studied villages of the region—the better-off, intermediate, and the poor—with sub-categories related to the type and amounts of income families can generate (Domptail et al., 2013). The more exclusively dependent on agriculture, the less wealthy the household is (Mendelsohn and Obeid, 2004, p. 138), which points to a generalized context of poverty and precarity. In the Angolan part of the Okavango, however, the situation might even be more acute in terms of its replication as most of these households, while in displacement locations, have lost partial or total access to land and with it knowledge and skills to perform it efficiently. Returning to the villages implies some efforts in terms of recovering these capacities but in the meanwhile the majority of the population, in their recuperation from war, lives in precarious or poor conditions. The majority of the houses have few buildings or rooms, showing that reconstruction is still ongoing and living conditions still vulnerable (see Figure 2).

Agriculture, however, is not solely dedicated to subsistence, which shows that accumulated capacities to integrate in markets and local economic networks are being developed and becoming dynamic. Maize is cultivated by a large majority of the households and 73% of them raise cattle, which shows that the traditional activities and subsistence have been rapidly readopted (see Figure 2). Charcoal production, however, is the most evident consequence of the dependence of the population on natural resources and on the consequences of accelerated demand as part of the survival strategies in a context of precarity and lack of economic and energy alternatives.

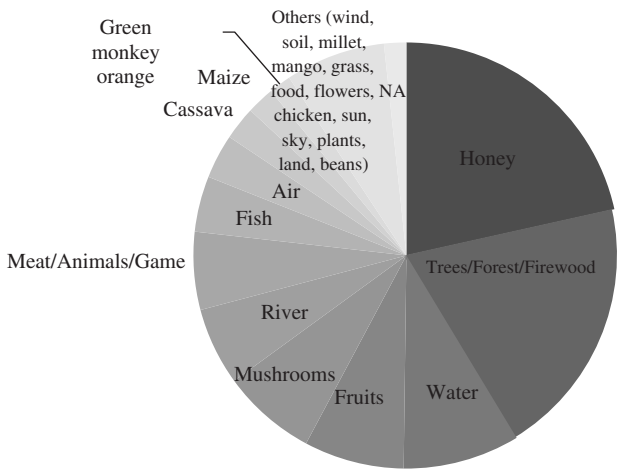

Figure 3. Most important things in nature.

This activity, which is not "traditional" as it was only residually carried out before the war, has increased rapidly in the last years, providing fast and significant income to the local population but producing serious impacts in terms of the environment. For this reason, the surveyed household heads mention the importance of forests, firewood, and trees among the five most important natural things in the region (Figure 3). Families depend on these resources daily and will use them in face of no other alternatives for their livelihoods.

Of the most important resources for subsistence of families, firewood and timber then appear in first place for 49% of the surveyed households (Figure 3). Data conclusively shows that dependency on natural resources and ecological services is quite high, particularly in such post-war context where other alternatives are not available. Moreover, the need to quickly generate income among a population previously residing in urban areas or in villages and locations connected to the trading networks—near half the surveyed households—has initiated important pressure on wood resources, necessary for charcoal production. This situation is not predominant in the Namibian and Botswana areas of the Okavango, as shown in the existing literature, which makes the Angolan case once again distinctive.

Conclusion

The legacies of war, that affected particularly the countryside and forced populations to displacement, were both physical and functional regarding the Angolan part of the Okavango. Therefore, Angola will have namely to seriously address infrastructural, institutional and human resources; the devastation caused by war; sustainable tourism and alternative economic policies and infrastructure for the local populations. Also, actual active cross-border activities in several areas are still needed, like anti-poaching, ecotourism, or community conservation programmes (Chase and Griffin, 2011). This calls for more robust policies and practices environmentally directed addressing cross-border issues. Despite the training programmes being implemented in Angola for, for instance, game rangers, some of them integrating ex-combatants, there are still difficulties in managing joint projects as the overall qualifications and capacities of the few staff involved in conservation and environmental activities are insufficient and comparably lower than those of the neighboring partners. The latter were able to develop, along the years, systems, and institutions capable of managing the Okavango areas, along with professional staff and policies aiming at local development and sustainable activities, namely in the area of tourism.

Other local functions and mechanisms have also been heavily affected by war particularly the local capacities and knowledge of the population. As expectable, the Angolan government did not channel any investments to the region during the war as it was mostly occupied by the guerrillas (Mendelsohn and Obeid, 2004). With the end of the war, the region is like others in the country experiencing resettlements of population (Msukwa, 2010) that either fled the war and became urban or was living at military locations in the Cuando Cubango. As they arrive into an area for decades left almost abandoned, where there are no industries or other income generating activities, the dependency of natural resources and ecological services is higher. The urgency of coping with livelihoods leads to short-term fast income generating activities, such as the production of charcoal, with environmental impacts. In a context of globalization and developing markets, and particularly due to post-war significant investments in reconstruction in Angola, increasing pressure on resources and land is expected (Röder et al., 2015), particularly around the major villages (Mendelsohn and Obeid, 2004). Urbanization, particularly at border points like Santa Clara-Oshikango (Udelsmann Rodrigues, 2010) or at Rundu-Calai (Röder et al., 2015) demonstrate not only the transformation of local residential features but also of economic activities, with commercial developments on both sides of the border. The increasing weight of income cash economies and consumerism in all three Okavango countries not only leads to accelerated social recompositions (Pröpper et al., 2013; Herold, 2013) but also to new relations between

the population and the natural environment, which are insufficiently addressed so far in Angola.

There are expectations regarding the development of activities able to provide earnings to the local population, like those of hydro-electricity generation and irrigation (Msukwa, 2010; Pinheiro et al., 2013), possibly absorbing some local labor force but the capacities to deal with their environmental and local impacts are scarce in Angola. Projects aiming the development of tourism, similar to those on the Namibian and Botswana side, are already in motion, facing the same challenges. With less tools and experience to manage such entrepreneurial activities in terms of the environmental, economic and sociological implications, the Angolan authorities and other stakeholders may shortly have to face the same kind of questions their neighbors did some years ago, like the many effects these projects have on traditional livelihoods activities, including hunting and gathering, crop and livestock farming (Mbaiwa, 2011). Reports from Botswana since the introduction of touristic projects show that farming and fishing—the predominant activities—declined, and the negative effects are related to the "foreign domination of the tourism industry, the poor jobs citizens have access to, the weak linkages of tourism to other economic sectors" (idem, p. 1051). The positive effects anticipated are that the population may gain access to income and employment opportunities and infrastructures that are being developed, such as roads and telecommunication (idem). Moreover, these processes introduce new lifestyles, added risks like animal diseases or the spread of HIV; impose new delimitations for land access and use and consequently access to natural resources (Mbaiwa et al., 2008). The examples of zonation in Botswana where the area of the Okavango became a livestock free zone where fences were erected and hunting became prohibited (Mbaiwa, 2011), has already shown the impacts the new projects have on local populations and on their strategies and livelihoods. In these additional areas, Angola is also in a disadvantageous position. Sustainable development in the Okavango area, conducted in a collaborative fashion will then require Angola not only trying to catch up with the investments in terms of human resources and institutional systems and mechanisms addressing specifically environmental aspects but also absorbing the lessons from the neighboring and regional experiences in terms of management of natural resources and local populations. There are also concerns about the level of possible investments for the Okavango giving the fact that this is the most unpopulated region of the country. The pace of such combination of capacity building, including of the local populations to deal with management and conservation of natural resources, will set the conditions for the local livelihoods and for the recovery and resilience of the local economies. Elsewhere in the context of national parks in Africa, the available possibilities for the local populations are significantly higher (Baird et al., 2013) as these conditionalities have been partially or substantially addressed. Balancing between institutional investment and local level development is, consequently, the sought after result of an integrated approach of the diversity of challenges.

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ENVIRONMENTAL PRACTICE
2017, VOL. 19, NO. 1, 16–25
http://dx.doi.org/10.1080/14660466.2017.1275680

Taylor & Francis
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RESEARCH ARTICLE

Exploring residential characteristics as determinants of environmental sanitation behavior in Ibadan, Nigeria

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ABSTRACT
This study investigated residential characteristics as determinants of environmental sanitation behavior in Ibadan, Nigeria. The municipality was stratified into three residential zones (core, transition, and suburb). Three political wards were selected in each of the residential zones for questionnaire administration. Using systematic sampling technique, every 20th residential building was selected in the selected wards. Questionnaire was administered in 1,082 residential buildings with a success rate of 84.8% comprising 436 in the core, 351 in the transition, and 295 in the suburb based on the building density in the zones. Focus was on residents with minimum age of 18 years. Findings revealed that environmental sanitation behavior is influenced by residential characteristics such as place of residence, gender, educational attainment, length of residence, household size, and house tenure in Ibadan. All these together can enhance environmental sanitation behavior and preserve sanitary urban environment.

ARTICLE HISTORY
Received 13 September 2016
Accepted 17 November 2016

KEYWORDS
Determinants; environmental behavior; environmental sanitation; Ibadan; Nigeria; residential characteristics

Environmental sanitation is rooted in pro-environmental behavior (Blaikie and Brookfield, 1987; Hueting, 1980). It refers to efforts or activities aimed at maintaining a clean, safe, and pleasant physical environment and ensuring the safety of the environment in all human settlements towards the promotion of social, economic and physical well-being of all sections of the population (Acheampong, 2010; Daramola, 2015, 2016; Dwivedi and Sharma, 2007; Franceys et al., 1992; IRC, 2006a, 2006b; Ojewale, 2009; WHO and UNDP, 1997; WHO and UNICEF, 2000). Therefore, as opined by Daramola (2016), environmental sanitation connotes the habit of living where every second, minute, hour and day counts in order to make the home environment sanitary and aesthetic.

In achieving this liveable environment, environment sanitation can be primarily assessed based on two dimensions which work together to form a hygienic environment: change in behavior and availability of facilities (Mmom and Mmom, 2003; World Bank, 2002). In the light of these dimensions, environmental sanitation comprises certain components. These include provision and maintenance of sanitary facilities and services (water supply; toilet; and management of wastewater, storm water, and solid waste), public education, legislation, and individual and community actions (Federal Government of Nigeria, 2005; IRC, 2006a). This implies that environmental sanitation is a behavioral issue and it strongly depends on human behavioral patterns.

In this study, environmental sanitation behavior refers to the activities of the residents in the provision, utilization and maintenance of environmental sanitation facilities and services and adherence to environmental sanitation legislation both in their homes and neighborhoods (Daramola, 2016). This implies that despite the fact that availability of infrastructure contributes towards residents' promotion of sanitary environmental condition, the sustainability of these conditions should be based on the characteristics of the people. This is because environmental quality strongly depends on human traits (Steg and Vlek, 2009). Thus, the importance of studying environmental sanitation behavior is based on the intrinsic link between environmental sanitation and other sustainable development issues such as poverty, hunger, health,

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education, gender inequality, ecosystems integrity, climate change, and disasters (Bernhardt, 2015; UNESCO International Hydrological Programme, 2014). In actual fact, Bernhardt (2015) pointed out that some components of environmental sanitation are seen as fulcrum for Sustainable Development Goals (SDGs).

Issues pertaining to environmental sanitation have been explored by many studies (Acheampong, 2010; Afon, 2005; Daramola, 2011; Mmom and Mmom, 2011; Narayan, 1995; Olawuni, 2007; WHO and UNICEF, 2000). Nevertheless, the major limitation of these studies is that they focused mainly on contextual aspect of environmental sanitation which has to do with provision of facilities and services such as water supply, sanitation, solid waste management, and wastewater disposal. A particular recourse to the motivational (intra-personal) aspect (habits and the factors affecting them) has not well documented, especially in African setting. Thus, it is expedient to investigate the personal and social factors of environmental sanitation as the complement of the contextual aspect.

In the study of environmental behavior, several factors that have implication for environmental sanitation have been identified. They are both personal factors and social factors (Kollmuss and Agyeman, 2002). These include age (Buttel and Taylor, 1999; Howell and Laska, 1992; Kalantari et al., 2007; Nord et al., 1998), gender (Arcury, 2000; Caiazza and Barrett, 2003; Dietz et al., 2002; Hunter et al., 2004; Stern, 1998; Tarrant and Cordel, 1997), education (Daramola, 2012, 2015; EORG, 2002; Kalantari et al., 2007), and income (AWDR, 2006). Other identified factors include place of residence and household size (Arcury, 2000; Daramola, 2015; Dunlap, 1998; Kalantari et al., 2007; Poortinga et al., 2004). All these factors are termed residential characteristics that are capable of influencing residents' environmental sanitation behavior.

Residential characteristics connote the factors about the environmental surroundings as well as the social milieu that promote the socio-economic well-being of people residing in a community (Bilgel, Sam, and Bayram, 2012). These factors include gender, age, marital status, income, education, household size, house tenure, length of residence, and place of residence (Ojewale, 2014). These characteristics have been found relevant, both in the distant past and recent past, in promotion environmental sanitation behavior by being factors influencing individual and household activities in provision, utilization, and maintenance of environmental sanitation facilities and services and adherence to environmental sanitation legislation both in their homes and neighbourhoods (Daramola, 2015; Kasarda and Janowitz, 1974; Ojewale, 2014). Therefore, this article is concerned with the effects of these residential characteristics on environmental sanitation behavior of residents in Ibadan. This study was a novel attempt in this respect because there is hardly any empirical study of environmental sanitation behavior in Ibadan in relation to residential characteristics. Also, the major components of the study (residential characteristics and environmental sanitation) are central in achieving Sustainable Development Goals (SDGs). They have the goals directly related to them (SDGs 6 and 12) and have implication on several others (SDGs 1–5, 9, and 13).

The thrust of this study was to investigate residential characteristics as determinants of environmental sanitation behavior in Ibadan. In achieving this, the study attempted to provide answers to the following questions: What is the profile of residents across the residential zones if Ibadan? Is there any significant statistical difference in environmental sanitation behavior based on residential characteristics? What residential characteristics can predict environmental sanitation behavior in Ibadan? The study sought answers to these questions in order to reveal the need for policy makers to consider residential characteristics in addressing issues and challenges associated with environmental sanitation.

Methods

The study area is Ibadan, one of the largest indigenous urban centres in sub-Saharan Africa. Characterized with cosmopolitan nature, Ibadan can be seen as a metropolis comprising the municipality (main city) and its suburbs (less city). The focus of this study is on the municipality. Politically and administratively, the municipality was under one local government area, Ibadan Municipal Government, before it was split into

five distinct local government areas (LGA) in 1991. These are Ibadan North, Ibadan North East, Ibadan North West, Ibadan South East, and Ibadan South West. As at the year 2006 when the last population census was held in Nigeria, the total population of these five LGAs comprising Ibadan municipality was 1,343,147 people.

As a traditional city in Nigeria, the city reveals three contrasting residential zones linked to three historical periods (Onibokun, 1985) with their nature and characteristics determined by social, economic, and physical patterns. These are: the pre-colonial residential development which is the core or traditional zone; the colonial/pre-independence residential development referred to as the intermediate or transition zone; and the post-independence residential development, also called the suburban. Among the typical Nigerian cities where these zones have been identified are: Ilorin (Akorede, 1975), Benin City (Onakerhoraye, 1977), and Ogbomoso (Afon, 2005; Okewole, 1977).

The sampling procedure for this study started with stratification of the municipality into three residential zones (core, transition, and suburb). This stratification cut across all the five LGAs in the municipality. Following the stratification was random selection of three local government areas out of the five LGAs. Each of the selected LGAs was divided into the existing different political wards, as recognized by Independence National Electoral Commission (INEC) in the conduct of electoral polls. For questionnaire administration, one ward in each residential zone of all the selected local government areas was sampled randomly. Through this method, residents from nine wards cutting across the three different residential zones were surveyed. Using systematic sampling technique, every 20th residential building was selected in the residential zones. Questionnaire was successfully administered in 1,082 residential buildings with a success rate of 84.8% comprising 436 in the core, 351 in the transition, and 295 in suburb. Focus was on residents with minimum age of 18 years. This is because, in Nigeria, 18 years is the minimum age of franchise and responsibility (when somebody is no more a minor).

The questionnaire addressed issues on their residential characteristics. Also, data were collected on components of environmental sanitation behavior such as provision of environmental sanitation facilities and services, environmental sanitation awareness, and compliance with environmental sanitation legislation. To measure these components, five Likert-type scales were used with each containing some items as parameters for measurement. The ordinal data collected were scored and thus transformed to interval data. Thus, it was possible to use parametric tests such Analysis of Variance (ANOVA), correlation analysis, and regression analysis apart from other analytical methods such as cross tabulation.

Results and discussion

This section discusses the profile of the respondents, tests of difference in environmental sanitation behavior based on residential characteristics and the determinants of environmental sanitation behavior in the study area.

Profile of the respondents

This profile the respondents discussed here are gender, age, educational attainment, marital status, income, household size, house tenure, and length of residence, all these in relation to the residential zones (places of residence) of the respondents. These identified factors of environmental behavior in literature, and by extension, environmental sanitation behavior are discussed and are presented in Table 1 to provide descriptive information on the personal and social aspects of the respondents. Findings from this study revealed representation of the two categories of gender across the residential zones. In all, 50.1% of the respondents were male while 49.9% were female. This representation of both genders will help in ascertaining what studies such as gender Stern (1998), Arcury (2000), and Caiazza and Barrett (2003).

Age is expected to play a significant role as maturity could affect level of environmental awareness. According to Eagles and Demare (1999), the reasoning level of matured adults with respect to environmental attitude and behavior is expected to be high. This implies that older residents are expected to be more environmentally conscious than the younger

Table 1. Profile of the respondents across residential zones.

Parameters	Residential zone			Total
	Core	Transition	Older suburb	
Gender				
Male	241 (55.3)	157 (44.7)	144 (48.8)	542 (50.1)
Female	195 (44.7)	194 (55.3)	151 (51.2)	540 (49.9)
Total	436 (100.0)	351 (100.0)	295 (100.0)	1082 (100.0)
Age (in years)				
<20	-	4 (1.1)	8 (2.7)	12 (1.1)
20–39	146 (33.5)	208 (59.3)	205 (69.5)	559 (51.7)
40–59	224 (51.4)	117 (33.3)	77 (26.1)	418 (38.6)
≥60	66 (15.1)	22 (6.3)	5 (1.7)	93 (8.6)
Total	436 (100.0)	351 (100.0)	295 (100.0)	1082 (100.0)
Educational qualification				
Primary	178 (40.8)	21 (6.0)	17 (5.8)	216 (19.9)
Secondary	40 (9.2)	38 (10.8)	71 (24.1)	149 (13.8)
Tertiary	218 (50.0)	292 (83.2)	207 (70.2)	717 (66.3)
Total	436 (100.0)	351 (100.0)	295 (100.0)	1082 (100.0)
Marital status				
Single	41 (9.4)	95 (27.1)	93 (31.5)	229 (21.2)
Married	376 (86.2)	245 (69.8)	199 (67.5)	820 (75.8)
Have been married	19 (4.4)	11 (3.1)	3 (1.0)	33 (3.0)<
Total	436 (100.0)	351 (100.0)	295 (100.0)	1082 (100.0)
Average monthly income (in Naira)				
Low	370 (84.9)	197 (56.1)	128 (43.4)	695 (64.2)
Medium	36 (8.3)	95 (27.1)	111 (37.6)	242 (22.4)
High	30 (6.8)	59 (16.8)	56 (19.0)	145 (13.4)
Total	436 (100.0)	351 (100.0)	295 (100.0)	1082 (100.0)
Household size				
Small	70 (16.1)	144 (41.0)	189 (64.1)	403 (37.3)
Medium	233 (53.4)	181 (51.6)	96 (32.5)	510 (47.1)
Large	133 (30.5)	26 (7.4)	10 (3.4)	169 (15.6)
Total	436 (100.0)	351 (100.0)	295 (100.0)	1082 (100.0)
House tenure				
Owner-occupied	268 (61.5)	239 (68.1)	187 (63.4)	694 (64.1)
Rented	168 (38.5)	112 (31.9)	108 (36.6)	388 (35.9)
Total	436 (100.0)	351 (100.0)	295 (100.0)	1082 (100.0)
Length of residence (in years)				
1–5	224 (51.4)	96 (27.4)	143 (48.5)	463 (42.8)
6–10	113 (25.9)	91 (25.9)	75 (25.4)	279 (25.8)
Above 20	99 (22.7)	164 (46.7)	77 (26.1)	340 (31.4)
Total	436 (100.0)	351 (100.0)	295 (100.0)	1082 (100.0)

ones. The age of the respondents was grouped into four categories: teenagers (those with less than 20 years and specifically of age 18 and 19 years); young adults (20–39 years); elderly adults (40–59 years); and old people 60 years and above). Majority of the residents (90.3%) were adults (20–59 years), 1.1% were teenagers and 8.6% were old people (60 years and above). Across the residential zone, majority of the respondents were in adult category. However, in the core area, no teenager was sampled while the proportion of the old people sampled in the core area is higher than the proportion of that category for the other residential zones. This is further revealed in the mean age across the residential zones: 46 years in the core, 39 in the transition, and 34 in suburb, while the overall mean age was 40 years. The ANOVA results ($F = 125.713$; $\rho < 0.001$) indicated that age distribution of the residents varied significantly with residential zones.

Findings were also made on the marital status of the residents. This was based on the proposition that marital responsibility affects household environmental sanitation behavior. Marital status was also categorized into three categories: single, married, and those that have been married but no longer are (widowed or divorced). Findings revealed that 75.8% of the respondents were married; 21.2% were single and others comprised 3% of the respondents. Thus, it can be inferred that the respondents were in position of marital responsibility that may affect their household environmental sanitation behavior. On

educational attainment, it was discovered that all the respondents acquired formal education. In the core area, half of the respondents (50%) had tertiary education. This increased in the transition and peripheral zones to 83.2% and 70.2%, respectively. This proportion is followed with secondary education, apart from the core area in which 40.8% of the residents had primary education. Overall, 19.9% of the residents had primary, 13.8% had secondary while 66.3% had tertiary education. This residents' level of educational attainment across the residential zones could serve as the basis for assessment of their environmental sanitation behavior.

Monthly income of the respondents was grouped into three categories: low, medium, and high. Based on these categories, 64.2% of the respondents were low income earners (less than N50,000); 22.4% were of medium income (N50,000–N99,999); and 13.4% were of high income (N100,000 and above) in the city. Across the residential zone, however, there was variation in the categories of the income of the residents. Also, calculation of mean income revealed variation across the residential zones with average income of N38,394.50; N62,569.80; and N80,261.02 in the core, transition and suburb, respectively, while the overall mean income was N7,651.57. These findings revealed that on an average, the respondents in the core residential zone were of low income while those in other zones were in medium income with varying degrees. The ANOVA results ($F = 54.332$; $\rho < 0.001$) indicated that income distribution varied significantly with residential zones.

A household was defined as a person or group of people with shared cooking and living arrangements. Thus, household size was measured by the number of people living together with common eating arrangement. Based on this, the household size of the residents was categorized into three. The household sizes of one to five members were categorized as small, those with 6–10 members as medium while those with more than ten members was categorized as large. Findings revealed that, in general, 37.3% had small household size with maximum of five members, 47.1% had medium household size of 6–10 members while 15.6% had large household size, with above 10 members. Across the residential zones, it was also revealed that household size varied with residential zones. There were average of nine household members in the core, seven in the transition, and six in the suburb. The results revealed that household size reduced with increase in distance from the core of the city to the suburb. The ANOVA results ($F = 148.125$; $\rho < 0.001$) also indicated that household size varied significantly with residential zones.

House tenure of the residents was also considered relevant to this study. This is because it is a factor in provision and maintenance of environmental sanitation facilities for households (Daramola, 2015). House tenure in the study area is of two categories: owner-occupied and rented. Findings revealed that in the study area, 64.1% of the residents sampled lived in their houses while the remaining 35.9% lived in rented apartments. The distribution of house tenure across the residential zones revolved around these overall proportions.

Length of residence refers to the number of year(s) a household has been in the study area and it is considered relevant to this study. This is based on the postulation that environmental concern is a function of length of residence (Kasarda and Janowitz, 1974). This is because the longer the period people live in an area; the more they are likely to understand the problems associated with environmental sanitation in such area. In the study, the length of residence is divided into 3 categories of 1–5 years, 6–10 years, and above 10 years. Findings revealed that almost a third of the residents (31.4%) had lived for more than 10 years in their residential areas; a quarter (25.8%) had spent 6–10 years while 42.8% of the residents had lived for maximum of 5 years in their residential areas. Across the residential zones, it was also discovered that, in the least, almost half of the total number of the residents in each zone had lived in their residential areas. This was as high as 72.6% in the transition zone, followed with 51.5% in the periphery and 48.6% in the core residential zone. From this analysis, it could be deduced that the residents were familiar with their environment and their length of residence could be a factor of their environmental sanitation behavior.

Table 2. Difference in environmental sanitation behavior by residential characteristics.

		Sum of squares	Df	Mean square	F	Sig.
Place of residence	Between groups	1766.308	2	883.154	7.049	.001
	Within groups	135187.991	1079	125.290		
	Total	136954.299	1081			
Gender	Between groups	1146.395	1	1146.395	9.117	.003
	Within groups	135807.905	1080	125.748		
	Total	136954.299	1081			
Age	Between groups	2132.680	3	710.893	5.684	.101
	Within groups	134821.620	1078	125.066		
	Total	136954.299	1081			
Marital status	Between groups	24.028	2	12.014	.095	.910
	Within groups	136930.272	1079	126.905		
	Total	136954.299	1081			
Educational attainment	Between groups	2809.197	2	1404.598	11.298	.000
	Within groups	134145.103	1079	124.324		
	Total	136954.299	1081			
Income	Between groups	331.131	3	110.377	.871	.456
	Within groups	136623.168	1078	126.738		
	Total	136954.299	1081			
Length of residence	Between groups	6462.780	2	3231.390	26.720	.000
	Within groups	130491.519	1079	120.937		
	Total	136954.299	1081			
Household size	Between groups	777.406	2	388.703	3.080	.046
	Within groups	136176.893	1079	126.207		
	Total	136954.299	1081			
House tenure	Between groups	1799.988	2	899.994	7.185	.001
	Within groups	135154.311	1079	125.259		
	Total	136954.299	1081			

Difference in environmental sanitation behavior based on residential characteristics

One of the research questions raised in this study was centred on assessment of statistical significant difference in environmental sanitation behavior based on residential characteristics. To provide answer to this question, tests of statistically significant difference in environmental sanitation behavior by residential characteristics were conducted using one-way Analysis of Variance (ANOVA). The results of these tests are presented in Table 2. The included factor variables in the tests are gender, age, place of residence, educational attainment, income, length of residence, household size, and house tenure.

The results of the ANOVA tests revealed that there were statistically significant differences in residents' environmental sanitation behavior based on their place of residence, gender, educational attainment, length of residence, household size, and house tenure. The analyses were further subjected to post hoc tests for multiple comparison analysis for those with more than two categories using Bonferroni. Findings revealed that significant difference existed within and between the groups in residents' environmental sanitation behavior. For instance, significant statistical differences were found between each of the place of residences, and between categories of educational attainment, length of residence and household size in terms of environmental sanitation behavior of residents.

Nevertheless, there are no statistically significant differences in environmental sanitation behavior based on age, marital status, and income in the study area. The implication of these findings is that while residential characteristics such as place of residence, gender, educational attainment, length of residence, household size, and house tenure can be used to explain environmental sanitation behavior in Ibadan, reverse is the case for others such as age, marital status, and income in the city.

Determinants of environmental sanitation behavior

In this part of the study, environmental sanitation behavior was the dependent variable while the independent variables or predictors were the identified residential characteristics. The dependent variable

was determined by making the residents indicate, via a five-point Likert scale, the effectiveness of some notable residents' environmental actions. Responses ranged from "not at all effective" (coded as 1) to "very effective" (coded as 5). The scores for each item were summed to create a composite measure of environmental sanitation behavior. Thus, by transforming the categorical responses into interval data, suitable variables for parametric tests were generated (Daramola, 2015; Kalantari et al., 2007).

The predictors of environmental sanitation behavior comprised the residents' basic characteristics such as gender, age, marital status, education, income, household size, place of residence, house tenure, and length of residence. Data collected on these variables were of various classes. Continuous data were collected for quantitative variables such as age, income, household size, and length of residence. The categorical variables were transformed into interval data to make them suitable for parametric tests. The binary categorical variables (gender and house tenure) among these were coded as "0" and "1" while those with more than two categories were dummied with consideration for reference category.

In order to examine the influence of the residential characteristics on environmental sanitation behavior, a multiple regression analysis was conducted. The interest was to determine whether the identified residential characteristics can predict a significant amount of the variance in environmental sanitation behavior of Ibadan residents. The regression model summarizes these factors in relation to environmental sanitation behavior. Presented in Table 3 are results of the combined effects and the relative contributions of each independent variable on environmental sanitation behavior.

Table 3. Environmental sanitation behavior regressed on residential characteristics.

	B	Std. error	Beta	t	Sig.
Constant	34.948	2.844		12.286	.000
Gender	-2.899	.664	-.129	-4.368	.000
Age	.012	.037	.013	.324	.746
Marital status	.400	.947	.016	.423	.673
Educational attainment	2.509	.523	.145	4.797	.000
Income	-8.252E-006	.000	-.041	-1.286	.199
Household size	-.096	.126	-.026	-.765	.444
Type of house tenure	-1.355	.353	-.113	-3.834	.000
Years of living	-.359	.046	-.229	-7.810	.000
Place of residence	1.435	.514	.103	2.791	.005

R = 0.323; R Square = 0.104.

The composite correlation coefficient of the relationship between residential characteristics and environmental sanitation behavior is 0.323. This value provides a good estimate of the overall fit of the regression model. The regression value (R^2), which provides a good gauge of the substantive size of the relationship, is 0.104 for this model. This implies that 10.4% of the variance in environmental sanitation behavior is accounted for by the predictor variables. Furthermore, presented in the table is the relative contribution of each predictor variable to the variance in environmental sanitation behavior. Length of residence has the highest beta value (-.223), followed by educational attainment (0.147), gender (-.126), house tenure (-.120), place of residence (.103), and household size (-.066). As shown in Table 2, with the exception of age, marital status, and income the predictor variables have significant effect on environmental sanitation behavior.

As shown in Table 3, these findings indicate that a statistically significant relationship exists between environmental sanitation behavior and residential characteristics such as length of residence, educational attainment, gender, house tenure, and household size but not with age, marital status and income in the study area. These findings are consistent with the results of some earlier studies (Arcury, 2000; Caiazza and Barrett, 2003; Daramola, 2012, 2015; Dietz et al., 2002; Dunlap, 1998; EORG, 2002; Hunter et al., 2004; Kalantari et al., 2007; Poortinga et al., 2004; Stern, 1998; Tarrant and Cordel, 1997) which have indicated that there is a significant statistical association between characteristics such as gender, education, household size, and place of residence and residents environmental behavior. Thus, they serve as predictors of environmental sanitation behavior in the study area. On the other hand, the analyses also revealed findings that are not in tandem with findings of some other studies (AWDR, 2006; Buttel and Taylor, 1999; Howell and Laska, 1992; Kalantari et al., 2007; Nord et al., 1998) which have identified age and income as strong predictors of environmental behavior. The rationale for the

difference in the findings of this study from the findings of the identified previous studies might be due to the empirical nature of this study and the peculiarity of the study area.

Conclusion

This study assessed residential characteristics and difference in residents' environmental sanitation behavior in Ibadan based on their residential characteristics. Also, the study assessed residential characteristics as determinants of environmental sanitation behavior in Ibadan. Based on the findings from the study, it is concluded that residential characteristics such as place of residence, gender, educational attainment, length of residence, household size, and house tenure can be used to explain variance in residents' environmental sanitation behavior. They are among the various factors determining environmental sanitation behavior in Ibadan. Therefore, the influence of residential characteristics on environmental sanitation behavior can enhance environmental sanitation behavior and ensure sanitary urban environment.

These results on environmental sanitation in Ibadan have policy implications for sustainable development both in Nigeria and countries of similar urban settings. According to WHO and UNICEF (2015), components of environmental sanitation such as water supply; sanitation and management of wastewater, storm water, and solid waste are fundamental human needs that are vital for the dignity and health of all people. For instance, the failure of Nigeria to achieve the Millennium Development Goals (MDGs) and the prospects to achieve the Sustainable Development Goals (SDGs) hinge on issues of environmental sanitation. This is because issues in environmental sanitation are intrinsically linked to other sustainable development issues such as poverty, hunger, health, education, gender inequality, ecosystems integrity, climate change, and disasters (UNESCO International Hydrological Programme, 2014; Bernhardt, 2015). The focus of SDG 6 is on environmental sanitation and that of SDG 11 on the city are related to other topics in the 2030 Agenda. These include poverty eradication [SDG 1), better nutrition [SDG 2], healthy lives [SDG 3], education [SDG 4], gender equality [SDG 5], climate change [SDG 13], and infrastructure [SDG 9]. Therefore, the need for policy makers to consider residential characteristics in addressing issues and challenges associated with environmental sanitation is germane. This is because the contributions of residential characteristics in promotion of the environmental sanitation behavior will go a long way in liberating and enhance some personal and social characteristics of residents such as gender, education, income, and place of residence.

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ENVIRONMENTAL PRACTICE
2017, VOL. 19, NO. 1, 26–37
http://dx.doi.org/10.1080/14660466.2017.1275692

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RESEARCH ARTICLE

In the eye of the storm: Exploring how Montana and Ohio are framing the debate about the Clean Power Plan rule

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ABSTRACT
Rulemaking is an integral component of environmental policy at both the federal and state level; however, the role states play in implementing federal rules is often overlooked. States frequently have to devise their own plans for implementation—subject of course to federal oversight—and this is the case with the new Clean Power Plan rule proposed in 2014 and finalized in 2015. This exploratory research examines the newspaper coverage of proposed Clean Power Plan rule in Montana and Ohio in an effort to surmise how these two states will proceed with implementation. To investigate these responses to the proposed rule, we utilize Nisbet's (2010) framework for science-policy debates in the media to conduct a content analysis and identify the driving frames from the ten leading newspapers in each state. Our analysis concludes that although the leading frame in both states is economic development and competitiveness, Montana seeks a pathway forward, while Ohio wants a two-year freeze on renewable energy efforts. These findings suggest the rich potential for careful study of the importance of administrative processes at the state level and beyond.

ARTICLE HISTORY
Received 10 October 2016
Accepted 13 December 2016

KEYWORDS
Clean Power Plan rule; climate change; framing; Montana; Ohio; rulemaking

The U.S. Environmental Protection Agency (EPA), under the direction of President Barack Obama, has begun issuing regulations that will alter the future operations for both new and existing coal burning power plants in an effort to combat climate change. In particular, the EPA proposed the Clean Power Plan Rule in June 2014, and finalized the rule in August 2015 following public comment. This rule calls for states to devise their own implementation plans. Given the flexibility afforded states within the rulemaking process, investigating state responses to federal rulemaking is an important area of study (c.f. Rinfret et al., 2014; Yackee, 2015). Much of the scholarship to date, however, primarily focuses on federal rulemaking (Kerwin and Furlong, 2011; West, 2005, 2009) and how interest groups influence this process at different stages (Cook and Rinfret, 2013; Golden, 1998; Naughton et al., 2009; Rinfret, 2011). Although existing federal research is noteworthy, our understanding of state-level rulemaking is lacking (Renfrow and Houston, 1987; Rinfret et al., 2014; Woods, 2009; Yackee, 2015), despite its importance.

In this study, we investigate how two states, Montana and Ohio, responded to the EPA's 2014 proposed rule that provides emissions guidelines for existing fossil fuel fired electric generating units (e.g., coal or natural gas fired power plants).[1] Although the final rule was published August 2015, we focus on the proposed rule for several reasons. First, the proposed rule (and ultimately the final rule) requires states to submit their own plans to achieve specific targets that are reflective of state approaches and their primary sources of energy. Second, and unsurprisingly, the proposed rule garnered extensive media coverage and that reporting varied at the national and state level. Therefore, to understand how the states will devise their plans under the final rule, it is important to explore how state media coverage initially framed the proposed rule. Accordingly, our focus is on uncovering how the proposed rule was framed in two states, with different internal politics and energy contexts. By understanding these frames, we can draw conclusions about the nature of the

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[1]While the final EPA clean power plant rule was published August 2015, the focus of this article is on the initial media response after the Notice of Proposed Rulemaking was published in the Federal Register. Also, this rule is often referred to as the CPP (Clean Power Rule) or 111d because this is the section of the Clean Air Act by which the EPA is using to regulate coal burning power plants.

debate surrounding state compliance with the final Clean Power Plan rule.

This study examines over 100 major newspaper articles in Montana and Ohio from June–December 2014 when the Notice of Proposed rulemaking (NPRM) was published in the *Federal Register*. We situate the newspaper articles within the theories of issue definition and framing (Baumgartner et al., 2009; Kamieniecki, 2006; Lewicki et al., 2003). Additionally, we employ Nisbet's (2010) typology of frames for science-related policy debates to evaluate why differences exist between Montana and Ohio in their response to the proposed Clean Power Plan rule. This examination demonstrates that Montana and Ohio vary based upon the framing (e.g., governor, state or federal lawmakers, public, interest groups), which will impact their state approach for the rule.

Understanding rulemaking

U.S. federal and state rulemaking can be summarized as a process that entails specific stages. The process often begins with the pre-rule stage when agency discussions with stakeholder groups occur. These conversations allow the agency to investigate concerns or questions, which then facilitate the initial draft of a proposed rule. Once this language is drafted, an agency will publish a Notice of Proposed Rulemaking (NPRM)) in the *Federal Register*. At this juncture, an agency seeks comment from the public about the rule. The public usually has 30–90 days to submit comments to the agency about the rule. Once the comment period closes, an agency begins the third stage of the process, this is when an agency examines the comments and provides responses to commenters. Based upon this feedback, an agency can make revisions to an NPRM, and then issue a final rule in the *Federal Register* (Kerwin and Furlong, 2011). Scholars have extensively studied this aforementioned process to determine if groups can influence the outcome of an agency rule.

To date, many scholars that have examined the federal rulemaking process conclude that business or industry groups dominate the NPRM phase in which participants can submit comments to an agency regarding a particular rule (c.f. Fritschler, 1989; Golden, 1998; Magat et al., 1986; West, 2005). However, more recent scholarship at the federal level has also found that groups can influence the process when discussing the rule during the drafting phase or prior to a rule's publication in the *Federal Register* (Hoefer and Ferguson, 2007; Rinfret, 2011; West, 2009; Yackee, 2012). For example, Rinfret and Cook (2014) posit that this is where the policymaking agenda is set for rulemaking processes because an agency can work with stakeholders off the record and craft the language of the NPRM.

Although the vast majority of research has focused its attention on federal rulemaking processes, this is not to say that scholars have ignored state-level rulemaking. There has been significant research assessing institutional impacts (state legislature, state courts, and the governor's office) on rulemaking (c.f. Gerber, Maestas, and Dometrius, 2005; Poggione and Reenock, 2009; Shapiro and Bornie-Holtz, 2011; Woods, 2009; Woods and Baranowski, 2006). However, the process used by states to respond to federal rules and how stakeholders participate in this process is generally absent from this institutional focus. In particular, Woods (2009) suggests that stakeholder influence could impact how state agencies produce policy, which needs additional study. We contend that understanding framing or issue definition used in state-wide policy debates could help understand the direction a state takes when crafting a plan to comply with the EPA's Clean Power Plan rule standards.

Significance of issue definition

In order to assess how the media has reported the response of policy actors (e.g., interest groups, state-wide organizations, governors, state legislature) regarding the Clean Power Plan rule, this research begins with theories of issue definition/framing. Kamieniecki (2006) argues that theories of issue definition (e.g., agenda setting, agenda building, agenda blocking, framing) are useful for evaluating rulemaking because they offer a conceptual framework

to analyze the involvement of policy actors in environmental policymaking.

Moreover, scholars have used frame analysis to understand environmental policy issues more broadly. Frame analysis is an interpretative process in which scholars consider the social interactions of persons to comprehend societal issues (Lewicki et al., 2003). Or, as Rein and Schon (1993) argued, frame analysis is a way of selecting, organizing, interpreting, and making sense of a complex reality to provide guideposts for knowing, analyzing, persuading, and acting. To examine the aforementioned assertions, Duffy (2003) asserts "[e]nvironmental groups are devoting unprecedented resources and energy framing issues and perceptions of candidates, in the hope that their preferred policies will be adopted" (p. 4). Zavestoski et al. (2004), by a way of comparison, used frame analysis to assess the perceptions of risk by environmental managers to determine how policy actors managed the 1999 dioxin contamination of the Woonasquatucket River in Rhode Island. As a result, these environmental policy examples demonstrate that frame analysis is a useful mechanism to determine how and why issues are "framed" to influence the direction of policymaking.

However, as Lewicki et al. (2003) suggest, "[t]here has been no comprehensive, systematic analysis of differences in frames among all the key parties in major environmental disputes" (p. 20). Therefore, in order to remedy these deficiencies and to incorporate a systematic approach to understanding how the media's portrayal of a federal rule can impact state policymaking decisions, we turn to the work of Nisbet (2010).

Science policy debate frames

Nisbet's (2010) efforts strive to understand the different ways in which science policy debates such as climate change are characterized in policy debates by the news media. His framework concludes that in climate change debates, there are eight frames used: social progress (improving quality of life), economic development/competitiveness (market benefit or risks), morality/ethics (terms of right or wrong), scientific/technical understanding (expert understanding), Pandora's Box/Frankenstein's monster (no turning back mentality), public accountability/governance (use or abuse of science in decision making), middle way/alternative path (possible compromise position), and conflict strategy (battle of personality or groups). Nisbet argues that these frames appear consistently across science-policy debates, so we apply these frames to another science debate in the environmental arena—electric generating units (e.g., coal burning power plants) and their carbon pollution in the U.S.

Clean Power Plan rule background

Before we provide an overview our study, a brief background about the 2014 Clean Power Plan rule and how it pertains to Montana and Ohio is necessary. As noted, the Clean Power Plan is an effort to regulate the carbon emissions of already existing and future electric generating power plants in the U.S. The NPRM was published in the *Federal Register* by the EPA on June 18, 2014 (*Federal Register vol. 79, no. 117, 34830*) and was designed to cut carbon dioxide emissions from power plants by up to 30% by 2030 from 2005 levels. In particular, this rule targets existing and future power plants because they are the largest source of carbon dioxide emissions in the U.S. (38%) (Eiperin and Mufson, 2014). To meet these targets, each state must develop a plan to reach EPA determined targets.

After millions of public comments to the 130-page proposed rule, the EPA finalized the rule on August 3, 2015. Even though the rule was finalized, the focus of our research project is examining how newspapers in two states, Montana and Ohio, covered and responded to the proposed rule. Understanding how the coverage was framed during the NPRM stage of the rulemaking process is useful in our efforts to determine how states might respond to the final rule's requirement for each state to devise their own plan to achieve the emissions reductions and whether or not these states might be party to lawsuits that will invariably follow the finalization of this rule. To organize our investigation into the frames represented in

these two states we use Nisbet's (2010) typology for science-based policy as a framework to investigate how policy actors' responses were reported on in leading state newspapers. Therefore, we will be able to detect patterns across the states and offer plausible approaches that each state might use to reach future compliance targets for the Clean Power Plan rule.

The cases: Montana and Ohio

We analyze the framing used by state newspapers from the announcement of the rule in June–December 2014 in order to advance our understanding of state responses to the EPA's Clean Power Plan rule. And, we focus on newspaper reporting during the NPRM phase in two states, Montana and Ohio. These states were selected for comparison because of their high levels of coal production—Montana ranks seventh in the nation and Ohio tenth—according to the Energy Information Administration (U.S. Energy Information Administration, 2015). Also, both states are controlled by Republican state legislatures. However, there are some important differences. In Ohio, the governor is a Republican and Montana's governor is a Democrat. And each state represents a different geographic region that offers diverse, accompanying interests. Finally, these states were selected due to ease of access given the locations of each author.

Newspaper selection

Leading newspapers[2] in each state were the primary source of data. We analyzed 110 newspaper articles from June–December 2014 in both states. The 110 newspaper articles came from the leading newspapers, in terms of circulation, in each state. Seventeen of those articles were editorials,[3] 69[4] were Associated Press pieces, and the remaining 24 articles were original articles. More specifically, 67 articles came from the following newspapers in Montana: *Great Falls Tribune, Missoulian, Billings Gazette, Bozeman Daily Chronicle*, and the *Independent Record*. Forty-three newspaper articles were from a variety of top Ohio newspapers: *Columbus Dispatch, Akron Beacon Journal, The (Cleveland) Plain Dealer, Cincinnati Enquirer, The Toledo Blade, the Dayton Daily News, The Repository*, and *The Vindicator, the News Herald*. Just over 60% of the articles came from Montana newspapers, indicating that more coverage was given to this proposed rule in Montana than in Ohio. The higher volume of coverage in Montana might be due to the economic implications the rule could have on the Colstrip power plant (the Colstrip power plant is the second largest coal producing power plant west of the Mississippi River).[5]

After the articles were retrieved, we conducted a content analysis using NVivo, a qualitative software program, to examine state responses to the proposed rule. The articles were uploaded as plaintext files into NVivo. Then, we coded the newspaper articles and using Nisbet's (2010) frames. Recall, Nisbet offers eight frames: social progress (improving quality of life), economic development/competitiveness (market benefit of risks), morality/ethics (terms of right or wrong), scientific/technical understanding (expert understanding), Pandora's Box/Frankenstein's monster (no turning back mentality), public accountability/governance (use or abuse of science in decision-making), middle way/alternative path (possible compromise position), and conflict strategy (battle of personality or groups).

Additionally, following a grounded theory approach, we also detected other themes, which resulted in the addition of four more frames to our analysis. These include: for/against rule (if the newspaper article presented arguments that were in favor or against the proposed rule), stakeholder (was a particular organization or interest group framing the debate), significant action (did the newspaper maintain that the proposed rule was a significant government action), and elected official (role of state legislators, governor, or other state-wide elected official). These additions were made to help explain

[2]Leading newspapers refers to the top newspapers in terms of circulation in each state and ones we could access through various library databases.
[3]We opted to keep the editorials in our analysis to capture the driving viewpoints or responses to 111d for Montana and Ohio.
[4]Please note that out of the 69 AP articles, some were repeated (N = 50) and were not double coded in our analysis.
[5]https://www.eia.gov/state/?sid=MT; http://www.montanapbs.org/rundownbethsaboe/101/future-colstrip/

Table 1. Frame/codes and examples.

Frame	Examples
Social progress	"This announcement is a huge win for the health of our families and our environment." *Cincinnati Enquirer* (Lotze, 2014) "The single largest step our country has taken to address the threat of climate change (Environmental Defense Fund)." *Cleveland Plain Dealer* (Eaton, 2014b)
Economic development	"Energy groups and other opponents contend it will have negative economic effects, pointing to a potential cost of billions of dollars to carry out the plan." *Akron Beacon Journal* (Zajac and Drajem, 2014)
	"Mineral fuel (which includes coal and light oils) is the state's second largest export commodity, after wheat." *Bozeman Daily Chronicle* (Kriegel, 2014)
Morality	"It is our moral obligation to take action." (McCarthy quoted) *Cleveland Plain Dealer* (Eaton, 2014b)
	"Other nations will use the results to gauge this country's seriousness – and the extent to which they can find moral cover to delay cuts they should be making." *The Toledo Blade* (Associated Press, 2014a)
Scientific/Technical understanding	"Critics of the study say it relies on discredited data…" *Billings Gazette* (Dennison, 2014a)
	"This proposed rule does little to deal with global carbon emissions…" *The Missoulian* (Dennison, 2014c)
Pandora's box	"Despite fears of a rutted road ahead, the EPA is blithely steering the nation's electricity supply into the dark at a high speed." *Cleveland Plain Dealer* (Eaton, 2014a)
	"These rules make it impossible to build a new coal-fired power plant in America." *Youngstown Vindicator* (Associated Press, 2014b)
Public accountability	"Each state gets to decide." *Billings Gazette* (Dennison, 2014a) "It's too expensive, violates federal law." *Cleveland Plain Dealer* (Eaton, 2014a)
Middle way	"In an effort to find common ground on where energy and environmental issues intersect, the Sierra Club and the United States Steelworkers formed the Blue Green Alliance in 2006." *Billings Gazette* (Howard, 2014)
	"States would have wide latitude in choosing how to meet the administration's goals." *Columbus Dispatch* (Torry, 2014)
Conflict strategy	"The rule carries significant political and legal risks." *Akron Beacon Journal* (Zajac and Drajem, 2014)
	"Montanans are gearing for the latest round in the coal wars, with industry supporters trying to protect jobs while environmentalists seek a shift to renewable energy." *Independent Record* (Olson, 2014)
Against rule*	"The president's directive has us heading in a negative—not positive—direction." *Billings Gazette* (Gazette State Bureau, 2014)
	"Ohio will fight the Obama administration's plan to dramatically reduce the amount of carbon dioxide the state's utilities are pumping into the atmosphere." *Cleveland Plain Dealer* (Funk, 2014)
For rule*	"Building blocks for Montana's energy future." *Billings Gazette* (Gazette State Bureau, 2014)
	"…Ohio's targets should be easy to achieve." *Columbus Dispatch* (2014)
Elected official*	"Daines sponsored bill would block greenhouse gas regulations." *Bozeman Daily Chronicle* (Carter, 2014)
	"Crow leader says Obama plan could hurt tribe." *Billings Gazette* (Brown, 2014)
Significant action*	"Significant regulations." *Independent Record* (Dennison, 2014b)
	"The Clean Power Plan proposal, which for the first time cuts carbon pollution from existing power plants." *Great Falls Tribune* (Puckett, 2014)
Stakeholder*	"The Electric Reliability Coordinating Council, a lobbying group that represents energy companies with major investments in coal-fired power plants, has prepared an analysis that cites a study estimating that a phase-out of coal plants would cost consumers…" *The Missoulian* (Elliott, 2014)
	"The Treasure State Resource Industry Association, which represents mining, oil, agricultural and other business and labor interests, said the rules could lead to "forced closure…" *Independent Record* (McRae, 2014)

* = author additions to Nisbet's frames.

and understand the variation across Montana and Ohio and the potential drivers in shaping future policy directions. Table 1 provides a revised Nisbet framework and demonstrates how we coded information across states and newspapers.

Issues of reliability and validity surround content analyses. To ensure consistency in coding, we, with the help of one political science graduate student, used NVivo to ensure validity in our coding. The NVivo software allows for the researchers and sub-users (e.g., a graduate student)

to directly code raw data through its interface. A pretest detected mismatches or matches between coders. In addition, as the project progressed, the NVivo system tracked codes by user, tracking validity over time.

Examining the coded newspaper articles allows for an investigation into the types of arguments stakeholders use, the relationship between agency officials and interest groups, and the differences across states. Our goal is to evaluate how each state responded to the proposed rule in order to help predict how each state will meet forthcoming compliance deadlines.

Montana and Ohio respond

First, we review the 110 articles before discussing our findings. Table 2 provides an initial look at the newspaper articles from both states combined. More specifically, in the 110 total articles from both states, a total of 488 frames were coded. The top five frames referenced collectively in Montana and Ohio include: (1) economic development and competiveness; (2) conflict or strategy; (3) significant action; (4) public accountability and governance; and (5) middle way/alternative path and each is explained in turn.

As might be expected, the single most common frame noted in the newspaper articles were concerns surrounding economic development and competitiveness. Environmental concerns are often framed as a tradeoff between the health of the environment and the well-being of the economy and, this commonly employed tradeoff conveys the conflict-laden nature of this policy area. In two states where coal is a major component of the states' energy resources, pervasive economic arguments are expected. Additionally, many of the recent actions by the U.S. EPA regarding greenhouse gas emissions, and climate change more generally, have been framed as a federal government "power grab" or an imposition of unreasonable requirements on subnational governments. Therefore, finding the second most common frame in both states related to conflict and strategy makes sense.

Table 2. Frames referenced in Montana and Ohio articles.

Frame	Number of articles
1. Economic development and competiveness	81
2. Conflict strategy	74
3. Significant action	60
4. Public accountability and governance	56
5. Middle way/Alternative path	49
6. Social progress	44
7. Pandora's box	24
8. Against rule	24
9. Stakeholder	23
10. Scientific/Technical understanding	23
11. Elected official mentioned	11
12. For rule	10
13. Morality and ethics	9
	Total: 488

Rounding out the top five frames in both states are significant action, public accountability/governance, and middle way/alternative path. The significant action frame signals that the media coverage in both states has noted that the proposed rule would likely result in significant intervention by the government. Put succinctly, concerns were documented in both states that the proposed rule would impose a burden on states in implementing the rule. In examining the public/accountability governance frame, many of the supporters of the EPA's efforts to impose emissions regulations related to greenhouse gases utilize arguments about the public good that could result from emissions reductions. Additional points of controversy about EPA actions include efforts to ensure states have the flexibility to contend with their own unique needs and still attain compliance with the requirements. Lastly, Montana and Ohio newspapers also frame the proposed rule as a middle way or alternative path to balancing competing arguments on the future of coal burning power plants in the U.S.

However, unlike in other environmental policy debates—notably climate change, as Nisbet (2010) found—the scientific and technical uncertainty surrounding the proposed rule did not feature prominently in this sample of articles. In our sample, the scientific/technical uncertainty ranked as the tenth most used frame across the Montana and Ohio articles. Frequently, opponents to environmental action attack environmental regulations under the guise of scientific and technical uncertainty in an effort to take a seemingly more palatable stance in opposition to government action on the environment (c.f. Ascher, Steeleman, and Healy, 2010).

Table 3. Frames referenced in Montana and Ohio articles.

Frame	Count
1. Economic development and competiveness	(81)
	Ohio = 31
	Montana = 50
2. Conflict or strategy	(74)
	Ohio = 34
	Montana = 40
3. Significant action	(60)
	Ohio = 33
	Montana = 27
4. Public accountability and governance	(56)
	Ohio = 19
	Montana = 37
5. Middle way/Alternative path	(49)
	Ohio = 19
	Montana = 30
6. Social progress	(44)
	Ohio = 22
	Montana = 22
7. Pandora's box	(24)
	Ohio = 11
	Montana = 13
8. Against rule	(24)
	Ohio = 3
	Montana = 21
9. Stakeholder	(23)
	Ohio = 6
	Montana = 17
10. Scientific/Technical uncertainty	(23)
	Ohio = 9
	Montana =14
11. Elected official mentioned	(11)
	Ohio = 0
	Montana = 11
12. For rule	(10)
	Ohio = 3
	Montana = 7
13. Morality and ethics	(9)
	Ohio = 5
	Montana = 4
	Total: 488
	195 total references in Ohio articles
	293 total references in Montana articles

Table 3 breaks down the number of coded frames illustrated in Table 2 by state. As might be expected, a few differences are apparent. Although the overall leading frame referenced across the states was economic development and competiveness (see Table 2), when examined per state, we begin to see variation. For example, Table 3 demonstrates that the leading frame referenced in Ohio was conflict or strategy (N = 34). By way of comparison, Table 3 also presents that the leading frame referenced in Montana was economic development and competiveness (N = 50). Recall, Montana is one of the leading producers of coal in the U.S. and contains Colstrip, the largest coal plant west of the Mississippi River; this may result in greater media coverage.

Although Tables 2 and 3 begin to unpack some of the similarities and differences driving our data here, Table 4 provides additional explanation of the leading frames found in Montana and Ohio. Put differently, Tables 2 and 3 count a frame once if used in a Montana or Ohio article. However, when coding, an article could contain multiple counts of a single frame within one article, or even multiple frames within a single article. We suggest that examining how many times a frame was used within a given article can more accurately portray the driving discourses per frame. Table 4 illustrates the number (count) of times a specific frame was coded across the Montana articles. Stated differently, there might be three references to economic development in one article.

Table 4. Leading frames in Montana.

Frame	Count and percentage
1. Economic development and competiveness	122 (26.2%)
2. Conflict or strategy	64 (13.8%)
3. Public accountability and governance	59 (12.7%)
4. Middle way/Alternative path	40 (8.6%)
5. Social progress	35 (7.5%)
6. Significant action	31 (6.7%)
7. Against rule	29 (6.2%)
8. Stakeholder	22 (4.7%)
9. Pandora's box	16 (3.4%)
10. Scientific/Technical uncertainty	17 (3.7%)
11. Elected official mentioned	17 (36.6%)
12. For rule	9 (1.9%)
13. Morality and ethics	4 (0.9%)
	N = 465

The top three frames coded the most across the Montana articles included: (1) economic development and competiveness; (2) conflict or strategy; and (3) public accountability and governance. We posit that these leading frames are in concert with Montana's political culture. Elazar (1993) argued states like Montana are driven by a moralistic culture because the focus is for citizens or elected officials to serve the community or the best interest of the public good.

Table 5 provides the same additional information for Ohio newspaper articles. In Ohio, the most frequent frames were: (1) economic development and competiveness; (2) conflict/strategy; and (3) significant action.

In Ohio articles, the leading frames repeatedly used such as economic development, conflict/strategy, or significant action are illustrative of the state's political culture. We posit that these leading frames are ultimately driven by Ohio's individualistic culture (e.g., government should be used for utilitarian purposes). As such, Ohioans are focused on limiting government interventions into private activities (Elazar, 1993). As noted before, the Republican controlled state government is particularly keen on framing many issues as the federal government trying to take control.

Table 5. Leading frames in Ohio.

Frame	Count and percentage
1. Economic development and competiveness	73 (24.7%)
2. Conflict or strategy	65 (22%)
3. Significant action	39 (13.2%)
4. Social progress	33 (11.1%)
5. Public accountability and governance	23 (7.8%)
6. Middle way/Alternative path	21 (7.1%)
7. Scientific/Technical uncertainty	13 (4.4%)
8. Pandora's box	11 (3.7%)
9. Stakeholder	6 (2%)
10. Morality and ethics	5 (1.7%)
11. Against rule	4 (1.4%)
12. For rule	3 (1%)
13. Elected official mentioned	0 (0%)
	N = 296

While the aforementioned data present important information regarding how two states framed their responses to the 2014 Clean Power Plan rule, questions still remain. More specifically, based upon the information here, what does the framing articulated by a variety of actors presented in state newspapers reveal about plausible implementation approaches for each state? In order to address this question, we turn to key implications of our research.

Discussion and implications

Even though leading newspapers in Ohio and Montana framed the proposed rule in similar ways, there are noticeable differences. By way of summary, we found that the newspapers collectively in both states focused on economic ramifications along with the conflicts the proposed rule would present—frequently a state vs. national government power battle. However, the differences yield some insight into how each state will address the implementation of the final rule which was published August 2015.

Recall that the leading frames in Montana included: (1) economic development and competiveness; (2) conflict or strategy; and (3) public accountability and governance. However, delving deeper into the Montana data, we argue that the middle way (fourth most common frame used in Montana) frames capture important aspects of the Montana discourse. More specifically, when the proposed rule was published June 2014, Governor Steve Bullock, in conjunction with the Montana Department of Environmental Quality (DEQ) drafted, "Options for Montana's Energy Future: Creating Jobs and Delivering Clean Air

in a Changing Economy"[6] This report provided 5 hypothetical scenarios on how the state could respond to the proposed rule. The five included: (1) existing energy generation plus heavy energy efficiency; (2) existing energy generation plus heavy energy plus Lewis and Clark Plan Co-Fire; (3) existing energy generation plus heavy energy plus Lewis and heat rate improvement; (4) existing energy generation plus heavy renewable energy; and (5) existing energy generation plus heavy energy plus carbon sequestration.

Although the options within this draft Montana plan were not exhaustive, DEQ officials wanted to use the aforementioned scenarios as a means to engender discussion across the state. In having conversations about the rule, the DEQ hoped to have potential options for the state to meet its proposed target to reduce carbon emissions 21% by 2030 (Henrikson et al., 2014). Supporters of this approach suggested that it would allow the state to evaluate a variety of options in order to meet the EPA proposed standards. In particular, Governor Bullock argued, "When Montanans work together, we achieve remarkable results" (Crowe and Wessler, 2015).

However, with the recent finalization of the Clean Power Rule in August 2015, Montana Attorney General, Tim Fox, acting independently of the governor, joined 23 other states to stop implementation of the rule. In response to this approach, Governor Steve Bullock stated, "The rule has been challenged and the courts will sort that out. Ultimately though, Montana faces a choice: we can write our own plan or the federal government will write it for us" (Whitney, 2015). As such, we speculate that a "pathway forward" approach could continue in Montana.

Another important finding within the Montana newspaper coverage is that 100% of the "elected official" frames were found within this state. We suggest that this is due to Governor Bullock's efforts in leading the charge to respond to the rule. For example, Governor Bullock issued an executive order in Fall 2015 to create the Interim Montana Clean Power Plan Advisory Council in order to provide a "path to comply." The advisory council consists of members from coal-fired power plant owners, conservation and environment, hunters and anglers, electric cooperatives, and large industrial electric customers, organized labor, renewable energy, energy efficiency, tribal, coal mining, Public Service Commission, and Montana Consumer Counsel, and Legislature. The goal is to provide a Montana solution for the Clean Power Rule that works for citizens of the state by July 2016 and this work has been put on hold, pending a ruling by the DC Circuit Court of Appeals (Crowe and Wessler, 2015).

In Ohio, there is a great deal of emphasis on how the proposed rule represents a significant action, the conflict it creates, and the economic implications of moving forward with this policy (i.e., negative economic impacts). With Republican control of the legislature and the governor's mansion, much of the rhetoric surrounding the proposed Clean Power Plan rule is framed as a significant action of the federal government that unduly trespasses on the autonomy of Ohio. An extension of this frame is the discussion of the conflict it creates, not only among layers of government, but between industry/the economy and government. Energy companies are a significant component of Ohio's economy, and much of that energy production is based on traditional energy sources. Finally, some opponents of the rule are framing the issue as morally wrong because of the impact it will have on the coal industry.

Of course, it is impossible to draw any causal insights into newspaper coverage and state government action (or inaction), but it is worth noting that Ohio has remained defiant about compliance with carbon mandates. As an example of the state's inclinations on energy and environmental concerns, in June 2014, Governor Kasich signed Senate Bill 310 which puts a two-year freeze on compliance with the state's renewable and energy efficiency portfolio standards established in 2009. Supporters of the bill argued that more study is needed before proceeding with energy mandates while opponents contended the law hurts the state's ability to comply with existing EPA requirements and negatively impacts companies who count

[6]https://governor.mt.gov/Portals/16/docs/111dwhitepaperpathways91914-final.pdf

on energy credits. Chavez (2015) reported, more than a year later, the clean energy sector in Ohio is conveying adverse impacts and may see renewable energy companies leave the state altogether (Chavez, 2015).

Since the final rule has been issued, Ohio has announced its intentions to sue the U.S. EPA. Even the Director of Ohio EPA, Craig Butler, has come out against the rule maintaining that the energy industry is vital to Ohio and that the U.S. EPA's rule is "irresponsible" (Funk, 2015).

Conclusion

This research used Nisbet's (2010) science-policy framework to unpack the framing used in Montana and Ohio state newspapers in response to the 2014 EPA Clean Power Plan rule. Moreover, this research presented important insights into the possible future policy approaches adopted by Montana and Ohio. As noted, each state is concerned with the economic implications of the Clean Power Plan rule more broadly, but Montana and Ohio vary in terms of their future response. Montana, we suggest, provides a pathway forward in which Governor Bullock is working with the state DEQ, and an advisory committee to craft a solution by July 2016.

In comparison, Ohio's governor and state legislature have decided not to devise a plan to comply with the Clean Power Plan rule. Instead, Ohio plans a two-year freeze on renewable energy development, and recently sued the federal government because of the economic concerns surrounding the rule. We contend that the current approach adopted by Ohio could lead to economic losses as renewable energy companies leave the state. Since the 2015 Clean Power Plan rule is pending due to litigation, whether or not states actually have to implement plans remains to be seen and will be determined by the DC Circuit Court of Appeals. Thus, if Ohio does not have a plan in place, the U.S. EPA will create one for the state to implement.

Moreover, this research also demonstrates the importance of using framing or issue definition approaches to understand the implications of rulemaking more broadly. The common approach to examine rulemaking processes is to focus our attention on the federal process and how and at what stage interest groups impact the language of a rule. Yet, what is missing from these conversations is a broader level of understanding of state involvement within this process. As demonstrated here, Nisbet's (2010) model is a valuable tool to better understand a state's response to a federal agency rule. The basic elements within Nisbet's model, along with our additions, can be used to uncover what strategies a state will use to implement the Clean Power rule. While this project is not exhaustive, the two case studies here provide an inside look behind state level strategies.

We suggest more research is needed to broaden our understanding about how states respond to federal rules. Additional research is important because as Mills et al. (2015) indicate, "[a] majority of Americans (54%) want their state to submit an implementation plan to comply with the Clean Power Plan. Another 22% would not submit a plan and instead let the federal government impose its own plan on their state, while 6% prefer that their state sue the federal government to bock the requirement" (npn). Additional research could use the revised Nisbet framework here as a stepping-stone for future research. Specifically, scholars could provide a 50-state comparison of newspaper articles in response to the Clean Power Plan rule. Such an analysis could illustrate if other states are more in line with Montana's pathway forward, or Ohio's approach to not doing anything unless forced to do so. Another viable area of research could use this research as a baseline and then conduct interviews with state policy actors (i.e., elected officials, state agencies, industry, or environmental groups). The frames prevalent in the news media and interview responses could be interesting to compare and further indicate future policy directions about the implementation of the Clean Power Plan rule.

How a state responds to a federal rule is important for understanding environmental rulemaking more broadly. The cases presented here suggest the rich potential for further study of state responses to federal rules, in this and other contexts. We are only beginning to understand the forces at work here and how the presentation of information amplifies, influences, or drives decision making.

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ENVIRONMENTAL PRACTICE
2017, VOL. 19, NO. 1, 38–49
http://dx.doi.org/10.1080/14660466.2017.1275709

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ENVIRONMENTAL REVIEWS AND CASE STUDIES

Institutional adaptation and effectiveness over 18 years of the New York City watershed governance arrangement

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ABSTRACT
In 1997, an unlikely group of governments, nonprofit organizations, and interest groups signed a Memorandum of Agreement (MOA) to share governance of the adjacent Catskill and Delaware watersheds in the Catskills mountains of New York. At stake was the quality of the source for 90% of New York City's municipal water, and the livelihoods and interests of the communities in the watersheds. The agreement was celebrated as an example of how regional approaches to water management may be possible in ways that promote equity, power sharing, economic growth, and resource protection, but has not since been assessed along those terms since a National Research Council report in 2000. Using interviews with governance actors, meeting minutes from a key decision-making forum, legal and policy documents, and 2015 survey data of policy actors, this article presents a retrospective of the first 18 years following the signing of the MOA to identify keys to its function as a living and changing policy system in the face of political and ecological change. As an example of adaptive co-management, the case is a rich and crucial test for large-scale regional watershed management, and presents insights for other large city watersheds.

ARTICLE HISTORY
Received 8 September 2016
Accepted 17 November 2016

KEYWORDS
Adaptive co-management; institutional adaptation; resource governance; watersheds

With a few notable exceptions, citizens in the United States rely on potable water on demand from municipal suppliers. Due to geographic and urban developmental differences, there exist a variety of water provision systems. One model of municipal water provision in the U.S. relies upon healthy watershed ecosystems to produce potable surface water that can be delivered to users without chemical filtration. Although most major cities rely on groundwater or chemically filtered surface water, other cities like New York City, Boston, Portland, OR, and San Francisco, CA instead rely on watershed governance to protect ecosystem services and produce clean municipal water. Because these cases do the dual task of providing a crucial public good to millions of people as well as protecting the health and function of watershed ecosystems, it is important to better understand how they do it, and what makes such a system durable over time.

This article examines the New York City watershed governance arrangement, a highly complex arrangement between governments, bureaus, and interest groups in the State of New York that created a suite of rules and obligations to achieve dual goals: to protect the quality of water in the City's upstate reservoirs, and to protect and promote the economic and political interests of those living in the jurisdictions that contain those reservoirs. The watershed governance arrangement, its design elements, and its development is described by other theorists and historians (see National Research Council, 2000; Soll, 2013). This article builds upon previous examinations of watershed governance, answering three questions that have theoretical and practical implications: Has the arrangement produced what it was designed to? How has the arrangement evolved? Do governance actors and stakeholders perceive the governance arrangement as fair and functional? We answer the questions by analyzing three types of outcomes produced by the arrangement over time: adaptation to changes in the biophysical system, responses to conflict among the parties, and perceived levels of fairness and

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effectiveness of the governance system. The answers may help policymakers and theorists better understand how to design such a governance arrangement, and also to identify potential challenges that require attention in New York.

Adaptive water resource co-management

Governing a resource system to produce a public good like potable water, which crosses political boundaries and is affected by often-unpredictable natural phenomena, is a tough task for governments and/or citizens. Because of these political and biophysical complexities, scholars have explored how adaptive co-management, as a management strategy, can serve as a flexible and effective governance system. The theory is still fairly general, but as defined by Huitema et al. (2009) in a far-reaching literature review, is characterized by multiple, overlapping authorities, public participation, experimentation, and a bioregional approach (Huitema et al., 2009).

Adaptive co-management encourages more widespread participation in decision making, the development and sharing of different forms of information, and multiple forms of accountability (Brunner et al., 2005; Huitema et al., 2009). The different decision making venues also support the resolution of disagreements and conflicts in ways that support problem solving and institutional adaptation (Ostrom, 1990, 2005; Huntjens et al., 2012). As a result, equity, or perceptions of equity in decision-making and resource allocation may be achieved, which is important for long-lasting governance systems (Larson, 2005; Oakerson, 1999; Steves, 1993).

In light of the above, how do examples of adaptive co-management as defined by Huitema et. al. (2009) actually work over time? We examine the New York City Watershed governance arrangement and its effectiveness as measured by the presence and use of venues of collective action and conflict resolution, the adaptation of rules in response to social and biophysical change, and perceptions of fairness and efficacy of the governance arrangement among stakeholders.

Data and methods

Data are gleaned from interviews with governance actors from 1995–2002 and 2013,[1] meeting minutes from a key decision-making forum from 1997–2014,[2] legal and policy documents,[3] and 2015 survey data of policy actors from all stakeholder groups and governments.[4]

The data were analyzed to identify instances of conflict among governance actors as well as challenges posed by biophysical conditions outside of the control of governance actors, and the solutions they crafted. Because such problems were fairly public, interviews, meeting minutes, legal and policy documents, and formal rule changes painted a defensibly valid picture of what the major governance challenges and responses were, regardless of how fair or effective different policy actors thought the outcome of those problems tended to be. To glean that information, anonymous surveys were administered to better understand how governance actors conceive of and evaluate the governance arrangement and outcomes along various criteria. The analysis is descriptive and policy analytic, but the results are used to draw some conclusions about the performance of the governance arrangement.

Case historical background

The New York City water supply system was developed in stages over the course of the 19th and 20th centuries in response to and to fuel rapid population

[1]1997 interviews were conducted by Nancy Burnett and are available online. See references. 2013 interviews were conducted by the authors of this paper with representatives of the New York City Department of Environmental Protection, New York State Department of Health, New York State Department of Environmental Conservation, Catskill Watershed Corporation, Watershed Protection Partnership Council, and the Coalition of Watershed Towns.

[2]Meeting minutes from the Catskill Watershed Corporation were used to identify and characterize conflicts among governance actors over time. Because the CWC became an accessible forum for a variety of issues related to the MOA to be discussed, meeting minutes were a rich source of data.

[3]These include iterations of the Water Supply Permit, CWC Program Rules, Filtration Avoidance Determination, press releases, and memos and decisions regarding lawsuits among MOA signatories.

[4]The survey was administered online to representatives and employees of all governments (State, City, Counties, Townships, Villages), agencies, and non-governmental groups involved in watershed governance and/or monitoring of water resources in the watershed.

and economic growth. Responding to the growth of lower Manhattan and the poor quality of well water in its neighborhoods, in 1799, the New York State Legislature passed 4 L. & A. 733, "Act supplying the City of New York with pure and wholesome water." The Act authorized the Manhattan Company to supply the City with water. A key revision in 1834 (1834, Ch. 256) took water supply out of the purview of a private corporation (the Manhattan Company) and made it the charge of the public City Water Commission to seek water sources in other jurisdictions to develop and transport to the City (New York State, 1855, pp. 771–775). This was in response to a cholera epidemic and poor ground water quality in lower Manhattan. The City implemented the 1834 Act by soliciting properties, constructing waterworks and flooding reservoirs in Westchester and Putnam Counties in the Croton watershed well north of the City, which served as the water supply until the early 20th century.

In 1905, responding to growth of the City, the State Legislature passed Law 1905 c. 724, The City Water Supply Act, which created the State Water Supply Commission and empowered it to use eminent domain to take lands outside of City jurisdiction for the purpose of expanding the New York City water supply system. The Catskills region presented several advantages: it was still relatively wild and thus produced potable surface water (unlike the much closer but more heavily populated and polluted Hudson River basin for example), and the higher elevation of the Catskills meant that gravity would do the work of water delivery to the City. In the decades since, the Catskill and Delaware watersheds were developed and connected to the City via aqueducts. The massive public project displaced Towns and took properties in order to construct the dams and reservoirs. Though an expected and common effect of large public works projects, this process fostered an animosity toward the City among residents in the Catskills that for many remains today.[5]

Figure 1 is a map produced by the New York City Department of Environmental Protection, which manages the water supply system for the City. The map shows the watersheds where the City sources its water. The larger darkened area furthest north encompasses the Catskill and Delaware watersheds, where the City gets 90% of its municipal water by volume. Within the watersheds, there exist six major reservoirs that hold the City's water, to be conveyed south via the Delaware and Catskill aqueducts to the Kensico reservoir at the southern tip of the Croton watershed, and then delivered across the City.

The foresight of the State Water Supply Commission produced a benefit that the City continues to enjoy today: it does not need to chemically filter water sourced from the Catskill and Delaware watersheds.[6] The ecological health of the landscape serves as the filter for the water, as dense forests and well-draining soils act as a filtering medium to prevent pollutants from entering the reservoirs. However, the watershed contains towns, villages, homes, and farms. The municipalities in the watershed themselves have wastewater treatment facilities which discharge treated effluent into the watershed, sometimes directly into reservoirs or streams feeding the reservoirs. Many thousands of Catskills homes use septic systems, which pose little threat to groundwater quality when working properly, but can seep sewage into groundwater as they age and deteriorate. Streams crisscross farms with livestock, which may defecate in flowing water and thus lead to excess nitrates, giardia cysts, fecal coliform bacteria, and viruses in the water. To make it possible for so many people and livestock to live in the watershed without polluting it, rules must balance the ability of the landscape to produce clean water while allowing for local communities and businesses to thrive.

In reaction to municipal water quality problems across the country, the Safe Drinking Water Act

[5]See Galusha (1999) and Platt, Barten, and Pfeffer (2010) for excellent histories that detail the process of constructing waterworks in the Catskills and the upstate-downstate tensions it created.

[6]New York City's municipal water is disinfected with chlorine and ultraviolet light, as well as treated with phosphoric acid and sodium hydroxide to reduce exposure to lead in pipes (NYCDEP Report, 2014). "Chemical filtration" refers to the more costly process of adding coagulants to water to bind to and settle out pollutant particles, a process that most other municipalities that source their water from surface reservoirs must do. Water from the Croton watershed, which is more heavily populated, is chemically filtered.

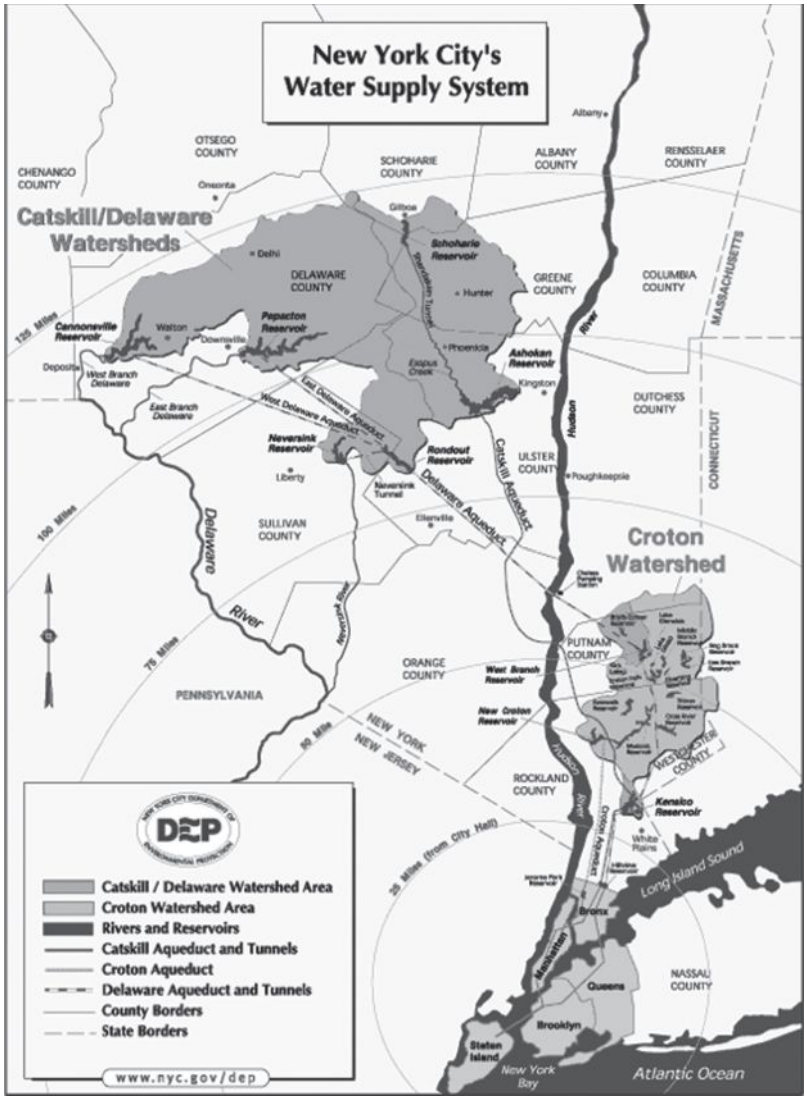

Figure 1. New York City water supply system (New York City Department of Environmental Protection, 2007; reprinted with permission).

of 1974 (P.L. 93-523) was amended in 1986 (P. L. 99-339) to include what was called the Surface Water Treatment Rule. This rule mandated the US Environmental Protection Agency (EPA) to promulgate rules requiring municipalities using surface waters to chemically filter the water (100 Stat. 642, 1986). In the regulations, the EPA defined municipalities must filter the public water supply unless they can "maintain a watershed control program which minimizes the potential for *Giardia lamblia* cysts and viruses in the source water" (Title 40 Code of Federal Regulations 141.71 (b) (iv) (2); 100 Stat. 642, 1986).

When faced with this decision, and given the immense price of constructing filtration facilities,[7] New York City opted for a watershed control program under the guidance of the EPA and the State agency with current primacy, the New York State Department of Health. Under this system, the New York State Department of Health periodically issues the City a Filtration Avoidance Determination allowing the City to continue providing unfiltered water if water quality remains above Federal standards.

To produce a watershed control program that warrants a Filtration Avoidance Determination, New

[7]Cost estimates of between $2.74 billion and $6 billion (New York City Independent Budget Office, 2000).

York City, New York State, the many municipalities in the watershed, and several public interest groups produced the 1997 New York City Watershed Memorandum of Agreement (MOA) to serve as a guide that would encourage behavior to preserve water quality. To do so, this governing arrangement fosters a collaborative environment among its signatories to respond to problems and conflicts as they arise over time in a mutually agreed upon way.

Before the creation of the MOA, the City of New York and the watershed communities were characterized by an antagonistic history, where the parties were making decisions regarding the use of the watershed without considering the interests of the other. The MOA addressed this issue by creating a new distribution of authority and new relationships among regional stakeholders. To obtain buy-in from Catskills governments, the City would relinquish its use of eminent domain in the region and would fund a suite of new economic, education, and infrastructural projects in Catskills communities. It was, in simple terms, a payment for deferred growth in the region to protect the ecosystem services of the landscape. The MOA also created the Catskill Watershed Corporation (CWC), a quasi-public organization composed of representatives from the major stakeholder groups and governments would design and administer the watershed programs funded by the City.

As the central document that guides intergovernmental relationships, the MOA is buttressed by other legal instruments. The State Department of Environmental Conservation issues a Water Supply Permit to the City, which requires certain activities by the City to protect water quality. The MOA contains provisions that State that if the City is out of compliance with the MOA, other parties may petition the Department of Environmental Conservation to deny the Water Supply Permit to the City. If the City fails Filtration Avoidance Determination standards, the determination may be revoked and the City obliged to filter its water. The NYC Department of Environmental Protection maintains the New York City Watershed Rules & Regulations, which regulate certain activities in the watershed by individuals, and have enforced these rules before the MOA and continue to do so. Finally, the New York State Supreme Court System serves as a conflict resolution forum that all parties may access with grievances—the venue in which any stakeholder may challenge the actions of others or of governments that would violate established law.

The complicated interaction of various rules (Filtration Avoidance Determination, Water Supply Permit, NYC Rules & Regulations, MOA) administered at various levels (Federal, State, City, regional) indicates an adaptive co-management system centered around a bioregional resource system (the watersheds) and serves as a good case to explore the performance of such systems.

Outcomes: Biophysical threats and institutional responses

The Catskill and Delaware watersheds produce the public good of clean water, as long as the hydrologic cycle is adequately slow so that natural filtration can occur. Severe storms that cause flooding, destabilize stream banks and cause high water turbidity are problematic. Legally, these events represent failures of the City to abide by water quality standards of the Filtration Avoidance Determination. Additionally, these events can damage and destroy private and public property.

In August and September 2011, Tropical Storms Irene and Lee produced flooding rainfall in the Catskills. Catastrophic flooding occurred in the Schoharie River and Delaware River basins, and the USGS stream gage at Prattsville on the Schoharie Creek recorded the greatest peak discharge in 109 years (Lumia, Firda, and Smith, 2014; The Daily Star, 2011). The Catskill reservoirs, receiving much of the floodwater, also received the storm debris, including garbage, structures, and automobiles. The Federal Emergency Management Agency was tasked with managing cleanup and relief for displaced people in the Catskills and also along the entire eastern seaboard, leading to a slow response. The CWC, as a local agency that under the MOA has the authority and funding to respond to local biophysical problems served as an intermediate relief agency disbursing funds provided

by the City, acting as a creditor for Towns. The CWC and the City had confidence that FEMA would eventually provide relief that they could then claim (personal interview with CWC representative, 2013).

On September 13, 2011, the CWC approved the creation of a watershed Flood Recovery Grant Program, to be funded by the City, which distributed $5 million to affected businesses to rebuild and reopen. Of that, $3 million went directly to business owners for rehabilitation, while $2 million was granted for debris removal from waterways (Catskill Watershed Corporation, 2014a; The Daily Star, 2011). The City provided and additional $1 million for business recovery, and donated manpower, materials, and equipment to an extensive cleanup effort (Catskill Watershed Corporation, 2014b).

The following year, on October 29, 2012, Hurricane Sandy caused a significant increase in the turbidity (suspended solids, caused by fast water scouring streambanks) of the reservoir water. That day, the turbidity level of the Kensico reservoir reached a peak of 11 nephelometric turbidity units (NTUs), exceeding the legal limit of 5 NTUs (New York City Department of Environmental Protection, 2012). The violation prompted the USEPA to require a significant improvement on the part of the City to control turbidity for the long-term (2012).

Toward this goal, the New York State Department of Environmental Conservation and City Department of Environmental Protection wrote a draft Local Flood Hazard Mitigation Program plan. As part of the plan, the City would fund the CWC Stream Management Program to model watershed flooding risks. The data would then be used to inform solicitation of flood prone properties that could be purchased in a New York City Flood Buyout program and returned to natural riparian buffer. Riparian buffers (natural and vegetated stream banks and floodplains) would serve to slow and absorb surface water during floods and reduce the chances of large displacements of soil into the fast-moving water.

This proposed rule change caused anxiety for watershed Towns and members of the CWC board, as it proposed a method by which the City could target properties for acquisition in hamlets. The Water Supply Permit forbids the City from buying habitable structures or structures within hamlets, yet the new plan would bring that possibility back.[8] When FEMA initiated their own flood buyout program following the flooding, they would have the right to offer market value of the property pre-flood to any and all affected and living in flood zones. The fear among Towns was that hamlets would become patchworks of Federal buyout land and local economies would suffer. A City sponsored flood buyout program would expand the agency's ability to purchase hamlet properties to the City. The core rationale for the City funded flood buyouts was this: buyouts are inevitable, and the two choices for who will conduct them are either FEMA or the City. FEMA will not conduct buyouts in a way that is sensitive to the character of Towns and the results may be devastating to local economies. The City knows the watershed and has working relationships with local governments and will conduct buyouts with greater sensitivity to local concerns and in line with the MOA.

Given these distinct choices, CWC agreed to a flood buyout program as part of the Local Flood Hazard Mitigation Program contingent on three criteria (Catskill Watershed Corporation, 2014b).

(1) That Towns have the option to hire their own consultant for completion of a Local Flood Analysis and not be forced into a multi-town analysis,
(2) That the Town board, not the City or Soil and Water Conservation District, have the final say in what recommendations of a Local Flood Analysis have priority; and

[8]Hamlets are areas that Towns designate as the population and economic centers within which the DEP is not allowed to solicit purchases. The boundaries of the hamlets may be modified by Towns over time as Villages grow and shrink. The purpose of the hamlet designation is to preserve the character, cohesion, and economic viability of population centers in the watershed.

(3) That for the implementation program, the CWC Board have sole decision on projects that get selected for funding.

The response of creating new City-funded projects for reducing future property damage and illegal turbidity levels is a good example of how the governance system adapted to unexpected biophysical changes. When faced with sudden environmental changes, the good working relationships among the parties resulted in a prompt and coordinated response. The existence of a regional venue like the CWC where the main parties could coordinate a response was critical for the resiliency of the governing arrangement.

Outcomes: Mitigating legal conflict over taxation

One of the characteristics of the New York City case is that it obtains its water from sources outside its jurisdiction. As a result, watershed municipalities have the right to levy property taxes on all property, owned by the City within their jurisdictions. City-owned properties include regular parcels, wastewater treatment plants, dams, and the land submerged under reservoirs. As such, it can be difficult to assess their value and they may be inflated in value due to few comparable properties. Because the City owns large properties in Townships, this constitutes enormous taxable property that make up the majority of some Towns' tax revenues.

Signatories of the MOA actually anticipated that there would be legal conflict over tax assessments[9] and stipulated in the MOA that the City provide a single account of $3 million to the watershed (shared by Town governments) for legal defense.[10] In 2006, during one of the CWC Board's meetings, several members voiced concern regarding ongoing tax assessment litigation between New York City and watershed municipalities. The fear was that, even though the suits were being dismissed or won by Towns, they would soon exhaust the shared fund and be forced to pay for their own defense. From the Towns' perspective, they would be forced into undervaluing (or fairly valuing) City properties for fear of being sued and having to pay for their own defense. From the City's perspective, the Towns were illegally overvaluing City properties, and the State courts were the only available recourse. The Towns were trapped in a dilemma: individual Towns wanted to maximize their tax base, but the watershed as a whole feared the ongoing effects of litigation. The City, on the other hand, was exercising its only recourse in suing over tax assessments. By 2010, the City had sued 10 different Towns over tax assessments of City owned property since the MOA had been enacted.[11] Both sides (at least as represented on the CWC) agreed lawsuits were undesirable, but without rules about property valuation, there was little hope for mutually beneficial resolution.

Following an intervention by the Governor in 2010, in which the Coalition of Watershed Towns (CWC, a regional interest group) and NYC Corporate Counsel met to discuss the underlying conflict, MOA parties developed a new tool for standardizing property value and depreciation assessments. Town property assessors and the City would use the same tool to assess value, and presumably come to similar figures. Additionally, new rules were written into the Water Supply Permit to codify the arrangement, and a new CWC program was created to administer the rule. In 2012, the CWC created a Tax Litigation Avoidance Program to provide consultations to tax assessors on how to use the tax assessment tool.

This response is another example of how the governing parties were able to arrive at a collaborative solution to a social dilemma. This time, the threat to the stability of the agreement was not caused by an environmental event but rather by disagreements among the signatories themselves. By amending the Water Supply Permit and creating the Tax Litigation Avoidance Program the parties may not have solved the conflict forever, but have significantly reduced the frequency of lawsuits. Again, the ability of a venue like

[9]Lawsuits of this kind were a common and known problem, occurring with frequency before the MOA as well. See Soll (2013) for a more comprehensive history.

[10]Lawsuits of this type had occurred prior to the MOA.

[11]Those Towns are Prattsville, Olive/Hurley, Andes, Hunter/Tannersville, Middletown, Neversink, Shandaken, Roxbury, and Thompkins.

the CWC with its capacity to coordinate positions and implement programs at a regional scale, allowed the parties to address a dilemma that could have undermined the entire agreement.

Outcomes and future challenges: Survey to assess the governance arrangement

In 2015, we administered an online survey to representatives of governments and organizations associated with the governance of the watersheds. Knowing that several major updates had been made, we wished to understand how these actors' perceptions of the fairness of the rules and of the future of watershed governance. Respondents (N = 44) were identified as representing Federal/State/City governments (10), County/Town/Village governments (15), or non-government/academic organizations (19). These three major interest types were represented at the creation of the MOA and are still present in various aspects of its execution.

Figure 2 displays the results of the prompt asking respondents to rate the fairness of the main rule sets defining the governing arrangement. The answers were given on a three-point scale, where a value of *1 indicates that a select few benefit from the rules, a 2 indicates that many or most benefit, and a 3 indicates that all benefit*. Results indicate that between groups there is variation in the perception of fairness of the CWC Program Rules, the Filtration Avoidance Determination, the Water Supply Permit, and the NYC Watershed Rules & Regulations. Higher scores indicate that the respondent group thought the rule set was "more fair" in that it benefitted most or all participants. Between groups, there is some variation in interpretation of fairness of different rule sets. Representatives of Federal, State, and City governments consider all five sets of rules to be most fair and whole watershed beneficial, relative to other groups. Representatives of Counties, Towns, and Villages consider the Filtration Avoidance Determination less fair, relative to other groups and relative to the other rule sets. To assess the strength of these differences, we conducted a series of t-tests for the difference in means between the scores. Results showed statistically significant differences only for perceptions of the Filtration Avoidance Determination. In this case, the perceptions of Counties, Towns, and Villages were significantly lower than those of Federal, State, or City actors and Nonprofits and NGOs. This could be due because this group have the least direct influence in its provisions, and the Determination dictates City land acquisition goals in the watershed.

Using the MOA as a benchmark for change, survey participants were asked two questions about their perceptions of watershed management affecting the environmental state of the watershed. The first question stated: In general, how would you define the environmental state of the watersheds today? Would you describe them as being in a bad environmental state, or in a good environmental state? Responses to these questions were captured on a 7-point scale, where a value of 7 indicates "an extremely good environmental state" and a value of 1 indicates "an extremely bad environmental state". The second question was: How has the environmental situation in the watersheds changed since the establishment of the 1997 Memorandum of Agreement? Has the environmental situation worsened or has it improved? In this case, responses were recorded on a 7-point scale, where a value of 7 means "dramatically improved" and a value of 1 means "dramatically worsened".

The results displayed in Figure 3 indicate that all groups believe that the watershed is in a good environmental state and has improved since the MOA (the neutral response on the scale was a 4). Although Counties, Towns, and Village representatives are most optimistic about the state of the watershed, they are least crediting of that state to the MOA. This difference is also statistically significant, showing a clear distinction in the perceptions of effectiveness by Counties, Towns, and Villages compared to the rest of the actors. Nonprofits tend to take the most cautious stance regarding the state of the watershed environment, but appear to credit improvements to the MOA. Federal, State, and City representatives are optimistic about the environmental state, and are most crediting of improvements to MOA.

Survey respondents were asked: *Since the establishment of the 1997 Memorandum of Agreement, how have watershed programs affected the economic*

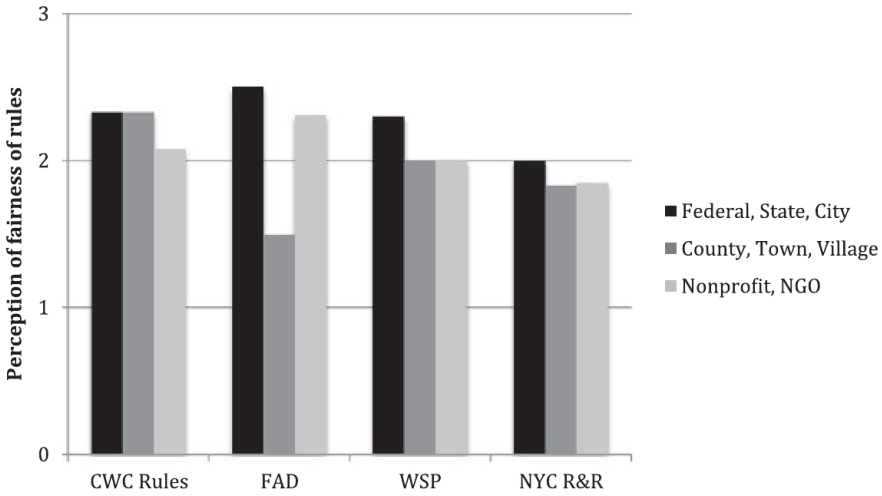

Figure 2. Perceived fairness of rules.

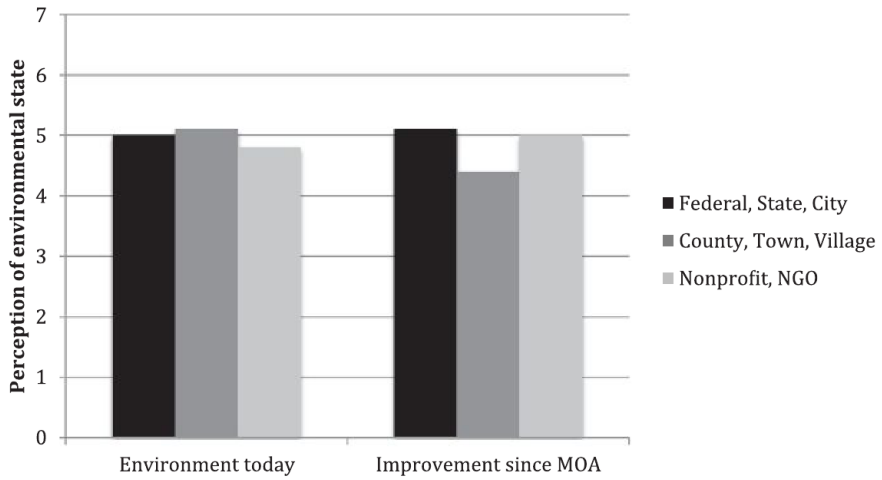

Figure 3. The environmental state of the watershed.

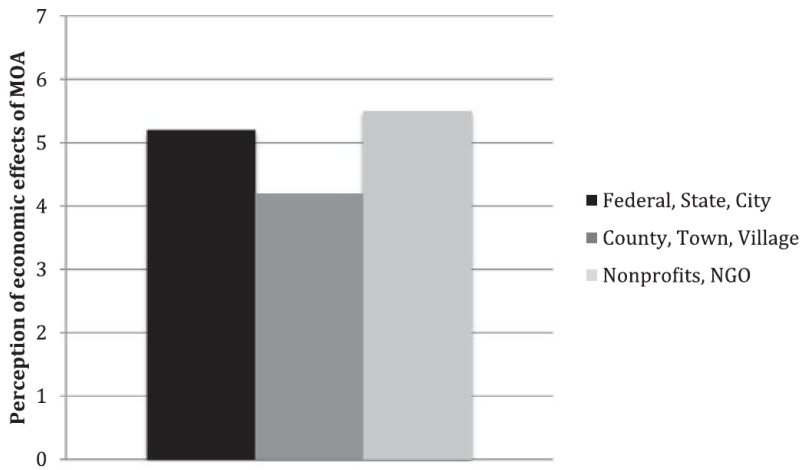

Figure 4. Economic effects of the MOA on the watershed.

prosperity of the communities in the watershed? Have they had negative effects or positive effects? and answered using a 7-point scale, 1 indicating dramatic worsening and 7 indicating completely positive effects. As Figure 4 indicates, all three groups were cautiously optimistic about the economic effects of the MOA on the economy of the Catskills, however, local representatives were notably more skeptical, taking a neutral stance. These values are statistically significant when compared to the perceptions of nonprofits and NGOs. We believe that this difference stems out of the dissimilar interests of both groups. Economic vitality is of fundamental concern for local communities, whereas nonprofits and NGOs often tend to focus more on biophysical outcomes and maintenance of environmental quality. This finding shows that though the arrangement is considered a success in many ways, there still exists concern about the economic future of the Catskills communities, especially among the representatives of those communities.

Finally, respondents were asked to explain what they believe to be the biggest threats or challenges to maintaining the effectiveness of the MOA. Respondents answered in distinct ways with some notable trends between groups of respondents. Federal, State and City representatives were most concerned about maintaining adequate funding for the CWC programs, open communication among all parties, leadership succession and continued shared understanding of the MOA, updating the MOA, and ensuring that decisions are made based on sound science. A common refrain among various representatives was a concern with the fact that many of those who were involved in crafting and enacting the MOA are retiring, and new representatives lacked this important shared negotiation experience.

Country, Town, and Village representatives were most concerned with expanding and improving economic development opportunities in the watershed, succession, and turnover of leadership, fewer economic opportunities for the young, the disconnect between changing needs of watershed Towns and the inflexibility of the MOA, maintaining adequate funding for CWC programs, and the Land Acquisition Program harming the economy and, in perception, as promoting City interests above local interests. These concerns highlight a continued rift in the interests (perceived or real) between local and City or State interests.

Nonprofit and NGO representatives were most concerned about public perceptions about the progress and necessity of watershed protection, a lack of shared understanding about what programs actually improve water quality versus which do not, ensuring that decisions are based on sound science, and the need to improve and continue stream management, wastewater management, and septic maintenance. Again, this displays that there remains a tension between the two major goals of the MOA, economic development and water quality, of which different groups champion, and which actors still have some anxiety over.

Discussion and conclusion

Looking at the evidence garnered from a variety of sources (rules, CWC meeting minutes, interviews, and surveys), some cautious conclusions can be made about the MOA and subsequent governing arrangement in terms of fostering adaptive co-management of the New York City watersheds. Assuming the propositions by Huitema et al. (2009), we examined how elements of adaptive co-management work in practice to produce rule adaptations in response to changes in the biophysical and social environments. Furthermore, we examined how participants perceived the effectiveness and equity of the institutional arrangement.

The creation of the Catskill Watershed Corporation as a forum for discussion and rule implementation has been an effective tool for bringing previously unconnected policy actors to the same table. This allowed the identification of conflicts and problems and served as a venue for constructive resolution. The development of new rules and programs to assuage flooding problems in ways that are more sensitive to watershed governments supports this notion.

The CWC also proved useful in addressing problems of a different nature, like that of litigation over tax assessments. As a baseline requirement for information sharing and monitoring of each other's behaviors, the MOA and the collective choice requirements it set up has created a space for policy experimentation and innovation. Actors' perceptions regarding the effectiveness of their governing arrangement showed it functioning well.

Depending on what role each actor fills, they tend to favor various aspects of the arrangement over others and have different interpretations of its effectiveness and fairness. All actors see governance rules as overall fair, though watershed governments are more skeptical of how fair the Filtration Avoidance Determination rules are to their interests. Those same governments perceive the environmental state of the watershed as in excellent health but are least likely to attribute that health to the MOA. They also have some enduring skepticism about how the MOA has affected and will affect their economic prosperity and future. Federal, State, and City governments and environmental interest groups share a concern that decisions need to be made based on sound science. The implication is that perhaps economic interests are being weighed more heavily than scientific findings. Keeping water quality high and producing policy changes based on scientific evidence may be a point of contention in the near future.

We conclude that the governance arrangement is producing what it was designed to, but that challenges remain. Governance actors generally see the MOA and other elements of the broader watershed governance arrangement as overall fair and functional, though particular challenges remain to maintaining this perception. In conjunction with the demonstrated ability of actors to adapt their rules to problems and conflicts, this overall favorability indicates some durability to the governance arrangement. The institutional structures appear to be in place for actors to respond with policy changes that protect the core agreement and the resource.

These conclusions indicate a means by which policy actors with different levels of authority and little social capital in the form of trust can institutionally bind each other to a new set of cooperative behaviors. Lessons from this particular case of adaptive co-management of a water resource system may prove instructive for other large municipalities that wish to mimic such an arrangement. By relying on resource co-management of this type, other regions in the US (and other federations) could realize the utility cost savings and landscape conservation that New York City and watershed communities have.

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ENVIRONMENTAL PRACTICE
2017, VOL. 19, NO. 1, 50–55
http://dx.doi.org/10.1080/14660466.2017.1275712

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PERSPECTIVES FROM THE FIELD

Assessing alternatives for sustainability: Quantitative analysis in NEPA

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ABSTRACT
This article proposes using an updated concept of sustainability that includes throughput, identifies tenets of sustainability already existing in the National Environmental Policy Act (NEPA) of 1969, and calls for the United States Environmental Protection Agency and the Council on Environmental Quality to promulgate jointly new regulations. These regulations would make the quantitative analysis of NEPA alternatives mandatory in an attempt to attain sustainability. Also discussed are the US EPA's efforts at incorporating sustainability into decision making.

ARTICLE HISTORY
Received 24 August 2016
Accepted 17 November 2016

KEYWORDS
Analysis; NEPA; quantitative; sustainability

The National Environmental Policy Act (NEPA) is the only U.S. law that requires federal agencies to perform alternatives analysis on "major federal actions significantly affecting the quality of the human environment."[1] This article's purposes are to update the concept of sustainability, explain where the concept of sustainability and the National Environmental Policy Act of 1969 are mutually reinforcing, and to suggest a way forward for improving the quantitative analysis of alternatives to attain sustainability.

The Environmental Protection Agency and the Council on Environmental Quality should promulgate jointly regulations requiring quantitative analysis for evaluating the environmental impacts of all proposed major Federal actions and reasonable alternatives under the umbrella of NEPA. NEPA mandates that the Federal Government shall "identify and develop methods and procedures, in consultation with the Council on Environmental Quality established by Title II of this Act, which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision making along with economic and technical considerations."[2]

All federal agencies perform alternatives analysis in accordance with NEPA. These analyses can be subjective in nature, and thus fall short of the mandate in the Council on Environmental Quality *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* to "Rigorously explore and objectively evaluate all reasonable alternatives…"[3]

Quantitative analysis is not a panacea, and it may not be applicable in all cases. However, when possible, quantitative analysis should be used in order to give decision makers and the public a common denominator to compare alternatives for sustainability. Cumulative impact assessments are already required in accordance with 40 CFR 1508.7 and the 1997 CEQ Handbook, but these do not mandate quantitative methods. In addition, the Handbook's Preface states that it is not formal CEQ guidance and is not intended to be legally binding.

Quantitative methods for analyzing NEPA alternatives should include both cost-benefit analysis and energy-based theories of value such as emergy,[4] and hybrid evaluations of human impacts on ecosystem services such as contingent valuation methods. Findings of no significant impact, which are common in environmental assessments, in the absence of quantitative evidence often lead to a false certainty that no significant impact will occur. Approximately five years ago, in a paper concerning strengthening NEPA, I wrote about the value of cost-benefit analysis: "Natural resources compete with economic

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profit in many decisions. Without an accompanying cost-benefit analysis, natural resources will be undervalued and overused because the total cost of production, consumption, and reuse—so-called externalities—will not be properly accounted for in the decision."[5] I contend this situation still exists and may have gotten worse. Without mandatory quantitative analysis, no meaningful balancing of ecological and social impacts can occur, which is unlikely to help society attain sustainability.

It is interesting to note that the Council on Environmental Quality regulation 40 CFR 1502.23, Cost-benefit analysis,[6] discusses cost-benefit analysis, but it does not specifically require it. Furthermore, the Council on Environmental Quality's *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews*, August 1, 2016, does not mandate quantitative analysis of proposed actions and alternatives. Instead, the guidance leaves the decision whether to *"monetize"*[7] costs and benefits up to the agencies. It is difficult to see how these two different sets of guidance, separated by almost 40 years, help the United States become sustainable.

Sustainability

Sustainability, often referred to as sustainable development, is a nebulous concept. Sustainable development has been defined in many ways, but one of the most frequently quoted definitions is from *Our Common Future*, also known as the Brundtland Report:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and
- the idea of 'limitations' imposed by the state of technology and social organization on the environment's ability to meet present and future needs."[8]

This was possibly an adequate definition of sustainability in 1987, but Daly and Farley created a better one for the 21st century,

> "The idea of 'sustainable development'…is development without growth—that is, qualitative improvement in the ability to satisfy wants (needs and desires) without a quantitative increase in throughput beyond environmental carrying capacity. Carrying capacity is the population of humans that can be sustained by a given ecosystem at a given level of consumption, with a given technology. Limits to growth do not necessarily imply limits to development."[9]

Daly and Farley[10] define throughput as "The flow of raw materials and energy from the global ecosystem's sources of low entropy (mines, wells, fisheries, croplands), through the economy, and back to the global ecosystem's sinks for high entropy wastes (atmosphere, oceans, dumps)."

This improved definition of sustainability mentions only human carrying capacity, which is somewhat problematic because it overlooks many other species in the biosphere. E.O. Wilson points out,

> "If global changes caused by HIPPO (Habitat destruction, Invasive species, Pollution, overPopulation, and Overharvesting, in that order of importance) are not abated, half the species of plants and animals could be extinct or at least among the "living dead"—about to become extinct—by the end of the century. We are needlessly turning the gold we inherited from our forebears into straw, and for that we will be despised by our descendants."[11]

The National Environmental Policy Act of 1969 contains the basic principles of sustainability.

NEPA and sustainability

NEPA has the following principles that encompass sustainability, which are under-used in Federal agency analyses of proposed projects and alternatives.

(1) Encourage productive and enjoyable harmony between man and his environment. (NEPA Statute, Purpose, Sec. 2)
(2) Promote efforts which will prevent or eliminate damage to the environment and biosphere. (NEPA Statute, Purpose, Sec. 2)

(3) Stimulate the health and welfare of man. (NEPA Statute, Purpose, Sec. 2)
(4) Enrich the understanding of the ecological systems and natural resources important to the Nation. (NEPA Statute, Purpose, Sec. 2)
(5) Create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of American. (NEPA Statute, Sec. 101(a))
(6) Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations. (NEPA Statute, Sec. 101(b)(1))
(7) Assure for all Americans safe, healthful, productive, and esthetically and culturally pleasing surroundings. (NEPA Statute, Sec. 101(b)(2))
(8) Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences. (NEPA Statute, Sec. 101(b)(3))
(9) Preserve important historic, cultural, and natural aspects of our national heritage, and maintain, wherever possible, an environment which supports diversity, and variety of individual choice. (NEPA Statute, Sec. 101(b)(4))
(10) Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities. (NEPA Statute, Sec. 101(b)(5))
(11) Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources. (NEPA Statute, Sec. 101(b)(6))
(12) Utilize a systematic, interdisciplinary approach which will ensure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on man's environment. (NEPA Statute, Sec. 102(2)(A))
(13) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity. (NEPA Statute, Sec. 102(2)(C)(iv))

When comparing NEPA's sustainability policies above with the following essential tenets of sustainability described by Gibson,[12] one can grasp how much sustainability NEPA actually encompasses. The numbers in parentheses refer to the number of NEPA's sustainability policies above.

(1) A challenge to conventional thinking and practice (1, 2, and 4).
(2) About long- as well as short-term well-being (13).
(3) Comprehensive, covering all the core issues of decision making (6).
(4) A recognition of links and interdependencies, especially between humans and the biophysical foundations for life (1 and 3).
(5) Embedded in a world of complexity and surprise, in which precautionary approaches are necessary (7 and 8).
(6) A recognition of both inviolable limits and endless opportunities for creative innovation (10).
(7) About an open-ended process, not a state (10 and 11).
(8) About intertwined means and ends—culture and governance as well as ecology, society, and economy (8, 9, and 12).
(9) Both universal and context dependent (5 and 6).

In order to attain sustainability, quantitative decision sciences will need to be required in the analysis of NEPA proposed actions and alternatives.

NEPA and science

Caldwell aptly pointed out "there are no simple ways to improve the quality of science in environmental impact analysis. But this is not to say that the NEPA process and the quality of environmental impact analysis cannot be improved."[13]

NEPA calls for the use of systematic, interdisciplinary natural and social sciences in planning and decision making:

"The Congress authorizes and directs that, to the fullest extent possible: (1) the policies, regulations, and public laws of the United States shall be

interpreted and administered in accordance with the policies set forth in this Act, and (2) all agencies of the Federal Government shall –

(A) utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making which may have an impact on man's environment;"[14]

NEPA also mandates agencies to "initiate and utilize ecological information in the planning and development of resource-oriented projects."[15] The National Oceanic and Atmospheric Administration's National Marine Fisheries Service in the Department of Commerce, the Forest Service in the Department of Agriculture, and the Bureau of Land Management in the Department of Interior have their own management acts that must be integrated with NEPA. These agencies also have social scientists and economists on staff that already performs some level of quantitative analysis. However, this analysis is sometimes directed more towards the natural resources in question than toward the environmental impact of managing and extracting goods and services from those resources.

NEPA furthermore states, "It shall be the duty and function of the Council – to conduct investigations, studies, surveys, research, and analyses relating to ecological systems and environmental quality."[16] According to Caldwell this part of NEPA "was never implemented, and the function was transferred under Reorganization Plan 3 of 1970 to the Environmental Protection Agency, where it has largely languished."[17] Although agencies such as the Forest Service and National Marine Fisheries Service have begun ecosystem-based management, it is unclear how it works in practice and how it relates to sustainability. Mandating quantitative analysis in NEPA to assess alternatives could be a big step forward towards integrating ecosystem-based management and sustainability.

In the last five years, the United States Environmental Protection Agency has addressed how to factor sustainability into its decisions. Lisa Jackson, EPA Administrator from 2009–2013, asked the National Research Council to do a study to improve the scientific basis for incorporating sustainability concepts into EPA's decision making.[18] In 2014, the National Research Council produced another report that described tools and approaches for sustainability decision making in the EPA.[19] Of particular interest to mandating quantitative analysis advocated in this article is Appendix E, Application of General Evaluation Criteria, which contains Table E-1.[20] Table E-1 portrays 22 tools, seven evaluation criteria, and color-coded entries denoting each tool's efficiency as rated by the report authors. There are several caveats for using Table E-1's evaluations. For example, the Ecosystem Services Valuation Tool gets five low ratings and two medium ratings. However, a note in the Appendix says that it is a "critical and emerging tool in support of sustainability considerations, but has had relatively modest work and support to date."[21] In 2016, the EPA released the proceedings of a workshop entitled Transitioning Toward Sustainability: Advancing the Scientific Foundation.[22] These proceedings are brief at 71 pages and do not discuss or consider NEPA. The first three sentences of the last paragraph in Chapter 2, "Decision Sciences, Demographics, and Integrated Assessment Modeling," state: "Sustainability is about decisions and making trade-offs under uncertainty. There are many different theories on how to conduct trade-offs and address uncertainty, but there needs to be more work on learning how to integrate theories and determine which ones function best in which context. In general, more work is needed in being more attentive to context—context matters."[23] NEPA provides an excellent statutory vehicle to analyze both context and uncertainty in its regulations on significance[24] and incomplete or unavailable information,[25] respectively.

There needs to be more focus on quantitative tools for assessing NEPA alternatives for sustainability. There are two important points to make concerning the Environmental Protection Agency's efforts at sustainability. First, none of the 22 tools shown in Table E-1 requires energy analysis, such as emergy,[26] or throughput. Everything runs on energy and agencies need to know any given project's energy return on energy invested, its total energy budget, and energy throughput. Without

knowing these parameters, agencies are guessing at what projects are sustainable and which are not.

Second, the Environmental Protection Agency's efforts at sustainability fail to integrate NEPA's substantive policies even although the EPA has a significant role in evaluating environmental impact statements under Section 309 of the Clean Air Act:

a. "The Administrator shall review and comment in writing on the environmental impact of any matter relating to duties and responsibilities granted pursuant to this chapter or other provisions of the authority of the Administrator. contained in any (1) legislation proposed by any Federal department or agency, (2) newly authorized Federal projects for construction and any major Federal agency action (other than a project for construction) to which Section 4332(2)(C) [NEPA Sec. 102(2)(C)] applies, and (3) proposed regulations published by any department or agency of the Federal government. Such written comment shall be made public at the conclusion of any such review.
b. In the event the Administrator determines that any such legislation, action, or regulation is unsatisfactory from the standpoint of public health or welfare or environmental quality, he shall publish his determination and the matter shall be referred to the Council on Environmental Quality."

Several gaps need filling to attain sustainability. First, NEPA's sustainability tenets need to be further clarified and pushed out to the Federal agencies, including sustainability training. Second, the Environmental Protection Agency and the Council on Environmental Quality should promulgate joint regulations mandating quantitative analysis methods for assessing alternatives for sustainability under NEPA. Last, the EPA should integrate its sustainability tools with the substantive policies and goals of NEPA.[27]

Conclusions

An updated definition of sustainability including the concepts of throughput, energy flows, and carrying capacity is needed to attain sustainability. NEPA provides a statutory framework for attaining sustainability. Mandatory quantitative analysis of NEPA alternatives could move society towards sustainability. However, there are currently no laws, regulations, or policies that mandate quantitative analysis of "major Federal actions significantly affecting the quality of the human environment."[28] The Council on Environmental Quality and the EPA should promulgate jointly regulations for requiring quantitative evaluation of alternatives under NEPA that could help attain sustainability. The Council could also create a handbook of quantitative methods and cause training to occur in all Federal agencies. These quantitative methods could form the foundation of NEPA alternatives analysis that leads to sustainability.

Quantitative analysis should not be the sole deciding factor in selecting environmentally sustainable alternatives in NEPA analyses. However, it should be a mandatory part of the calculus of decision making for taking sustainable actions. All life, but especially human life with its advanced science and technology, creates environmental degradation that increases with increased throughput. In order to be sustainable, society needs to identify alternatives that are the least damaging to the environment, i.e., those that create the least throughput and least disruption of ecosystems in order to "…prevent or eliminate damage to the environment and biosphere."[29]

Acknowledgments

The author would like to thank Professor Frank Muller-Karger, University of South Florida, College of Marine Science for helpful suggestions on an earlier version of this article. The author is also grateful to three anonymous reviewers for their insightful comments that were essential to improving the final article.

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ENVIRONMENTAL PRACTICE
2017, VOL. 19, NO. 1, 56–62
http://dx.doi.org/10.1080/14660466.2017.1275716

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PERSPECTIVES FROM THE FIELD

A GHG management professional's take: CEQ's guidance for climate change and NEPA

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ABSTRACT

After two draft documents and more than seven years, in the August 5, 2016 edition of the Federal Register, the White House Council on Environmental Quality (CEQ) published final guidance for federal agencies to incorporate greenhouse gas (GHG) emissions and climate change into National Environmental Policy Act (NEPA) reviews.

Questions and legal opinions on the final guidance are plentiful. Is the final guidance consistent with existing case law, is it binding, will it adequately protect agencies and project proponents from litigation, or does it require agencies to force reductions on project proponents? Questions and opinions aside, this article focuses on the practical implications of the final guidance—how environmental professionals can prepare NEPA reviews that align with its spirit and intent, meaningfully assess potential impacts and compare alternatives, and maintain consistency with established GHG accounting principles.

ARTICLE HISTORY
Received 26 September 2016
Accepted 3 January 2017

KEYWORDS
Climate change; environmental reviews; greenhouse gas; NEPA

Purpose and intent

Compared to other issues, GHGs and climate change present unique considerations in an environmental review. For example, nearly all proposed actions will directly or indirectly impact GHG emissions. By definition, cumulative anthropogenic GHG emissions are already causing unacceptable impacts globally. It is impossible to precisely forecast the impacts of emissions from a particular project or action on the climate. It is also impossible to predict the human and environmental consequences that result from those projects or actions, given the limitations of current tools and the imprecision of global inventories of both sources and sinks. Furthermore, the climate will continue to change with or without the proposed action(s), nearby cumulative sources, or even additional, unrelated GHG emission increases elsewhere. These considerations complicate even the simplest description of existing conditions, to say nothing of evaluation of the compatibility of the project with those conditions into the future.

The final guidance thus attempts to define common approaches for agencies to use when analyzing climate change considerations, and to improve the efficiency and consistency of reviews and resulting decisions. More broadly, the final guidance generally supports the Obama administration's efforts to reduce and respond to anthropogenic changes to the climate, and to reduce the federal government's direct and indirect GHG footprint.

Important provisions

Significance

The techniques used to predict changes to the environment due to GHG emissions are imprecise.

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The following article was written prior to the 2016 US Presidential election. President Trump's views regarding climate change are reportedly different than those of President Obama, raising questions of whether the subject guidance of the White House Council on Environmental Quality is still valid.

It is our view – as environmental professionals – that in interpreting NEPA the precedent set by the Courts and other parties clearly establishes climate change as an important consideration that must be reviewed in most NEPA studies. Any NEPA review that ignores climate change will therefore be potentially susceptible to challenge, resulting in a "business unfriendly" project delay.

It also remains unknown to us whether developing alternative guidance or striking the existing guidance will be a priority of the new Administration, and until the guidance discussed in this article is changed, it remains active and available to federal agencies. We thus believe that the conclusions and findings of this article are still valid, and provide a basis for successful review of the climate change implications of federal actions.

Many factors contribute to challenges in assessing future scenarios, including uncertainty regarding future global emissions, limited ability to quantify the benefits of natural GHG sinks, the differing atmospheric lifetimes of various GHGs, and the highly complex global circulation models used to assess future conditions. Clearly, quantifiable changes to the climate cannot be used to determine the significance of an action if such changes cannot be accurately forecast. Thus, consistent with prior versions of guidance from CEQ and other agencies, GHG emission rates are proposed as a proxy to predict climate impacts.

Both draft versions of the CEQ guidance identified a 25,000 ton per year (tpy) threshold. Projects that would increase emissions by more than this amount were not necessarily deemed to cause significant climate impacts, rather projects with less than this amount would likely be deemed insignificant, and qualitative vs. quantitative emissions assessments could be used. Not coincidentally, this threshold quantity was consistent with the trigger level for the United States Environmental Protection Agency's (EPA) GHG Reporting Program rules for industrial and energy facilities.

The final guidance eliminated reference to the 25,000 tpy threshold. Instead, significance determinations are largely left to the discretion of lead agencies, with emphasis on rule of reason and analysis of alternatives to the action.

The final guidance also clarifies that it is not appropriate to argue that GHG emissions from a particular project are insignificant because they represent a small fraction of regional or global emissions. In our experience, this was a common theme of NEPA climate change reviews in the prior decade. Even large power generation projects with greater than 10 million tpy of emissions would cause an increase of less than 0.1% in global anthropogenic emissions. Given the inability to model actual impacts and the lack of guidance, proponents and agencies sought any method to prepare an analysis that conformed to NEPA principles, and comparison to estimates of existing emissions became the "easy out." The final guidance emphasizes comparison of alternatives, and calls on agencies to determine significance based on the merits and impacts of individual projects. It also encourages the use of a "frame of reference," including analysis to determine whether the proposed action is consistent with federal, state, and local GHG regulations and reduction plans.

GHG emissions quantification

The final guidance suggests that agencies require quantitative analysis of GHG impacts from the proposed and alternative actions, whenever possible. Such analyses should include carbon sequestration impacts from actions that involve land management. The final guidance outlines special considerations for biogenic emission sources, given the uncertainty regarding life-cycle impacts of those sources. Where a quantitative analysis is not possible, the reasons should be explained and qualitative analysis should be included and used as a basis for decision making.

The final guidance allows for discretion by agencies regarding the detail and extent of analyses, within the rule of reason. Thus, it should be possible to exclude emission sources that clearly result in very small impacts, and to use simplified calculation techniques for those small sources where more rigorous input data may not be available. The key is for the emission estimates to support the comparison of alternatives, and help the agency evaluate whether the benefits of the project justify the GHG emissions.

Quantification methodologies

In terms of how to calculate emissions from a particular activity, the major GHG accounting protocols are in close alignment on most points. Relevant standards for projects in the United States include the GHG Protocol, EPA guidance, The Climate Registry, and the "Federal Greenhouse Gas Accounting and Reporting Guidance" (Department of Energy Federal Energy Management Program [FEMP] and CEQ, 2012) (FEMP Guidance) referenced in the NEPA guidance. For example, all GHG accounting protocols use the concept of emission factors, which

are reference values used in conjunction with more easily measured parameters such as quantity of fuel, instead of direct measurement of GHG emissions, and the numerical emission factors are very similar or identical between standards.

Key differences between protocols exist on points such as how the boundaries of the inventory are defined. For example, the GHG Protocol Initiative has published standards for Corporate, Corporate Value Chain, Product Life Cycle, City, Mitigation Goal (typically country-wide), Policies and Actions (also typically at a national or subnational level), and Projects. None of the protocols are tailored for estimation of emissions from infrastructure, industrial, or energy development projects.

The final guidance specifically cites the FEMP Guidance. This accounting and reporting guidance is geared toward top-down estimation of agency-wide emissions, developed in response to Executive Orders directing US federal agencies to inventory and manage their GHG footprint. On some points, it is very similar to the other protocols; for example, it would yield nearly identical results to other published guidance/protocols for estimating the combustion emissions from a defined quantity of fuel. It provides specific guidance for determining organizational and operational boundaries for federal GHG inventories (e.g., decision points for when to include energy for leased office space and information sources for the supporting data). It includes simplified, default estimation methodology for some source types. For example, emissions from wastewater treatment are specified based on estimates of population served and default emission factors for various treatment processes, with little process-specific input, consistent with a top-down approach. However, the Project Protocol is not geared toward comprehensive assessment of the impacts of a proposed action.

The *GHG Protocol Project Accounting Standard* (World Resources Institute and World Business Council for Sustainable Development, 2012) (Project Standard), was developed to estimate the benefits of a project or action designed explicitly to reduce or sequester GHG emissions. The fact that it is intended for quantification of reduction projects, as opposed to assessment of actions that may increase emissions, is relevant for several reasons. Most importantly, it is intended to produce very conservative results; in our view, professionals involved with the carbon offsets have and will always strive to maintain the integrity of the carbon markets. One way to do so is to ensure that the benefits of GHG reduction projects are never over estimated, and as a result, such benefits are usually under estimated. Furthermore, in the Project Standard and similar documents, significant attention is paid to the concept of additionality, to insure that GHG reductions from actions "which would have happened anyway" cannot be claimed or credited against a "corporate" footprint.

In our experience, despite these issues, the Project Standard provides the best basis for estimating the emissions increases associated with a particular project. In particular, the concept of comparing a project-related emissions estimate to a baseline emission scenario is very important. With this concept, an attempt is made to identify all GHG sources and sinks that could be affected by the proposed action. A forward projection of GHG flux is made for all sources and sinks under the project scenario, and a similar forward projection of GHG flux is made for the most probable baseline scenario(s), assuming the proposed action does not occur. In most cases, the baseline scenario is not static but rather dynamic (i.e., a future year emission is not necessarily the same as at a particular point in time before the proposed action start date). All such emission increases and decreases are included, regardless of who owns or controls the changing sources and sinks. The estimated project impact is calculated as the difference between the project and baseline cases, often with differing results for each future year.

For example, on a recent Environmental Impact Statement (EIS) project to evaluate potential expansion of a solid waste landfill, this concept was applied by CH2M. The landfill already contains waste that will continue to decompose and release GHG (especially methane) over time. The project would increase the amount of waste, and thus increase the GHG emissions. However, the project impact is not the total GHG emissions for

the landfill after the expansion, rather it is only the increase. Thus, landfill gas generation modeling estimated GHG emissions that would occur with the additional waste to be transported and placed with the expansion project, and emissions under the most likely future scenario without the expansion. The project impact is the difference between the two scenarios. The project impact ranges from a negligible amount in the first year (when quantity of waste placed differs little between project and baseline cases) and peaks after approximately 10–20 years in the future (when the additional waste reaches peak decomposition rate).

Practitioners should understand and follow the concepts of the Project Standard when estimating project level impacts. While some concepts of this guidance do not apply, such as additionality for projects claimed as GHG reductions, overall, it provides the strongest basis of any accounting protocol for comprehensively estimating project-related increases. The FEMP Guidance by itself is not adequate for this purpose.

Direct and indirect impacts

The final guidance also makes numerous references to the fact that emission estimates should include both the direct and indirect impacts of the proposed action. It is important to note that these terms may have different meaning for NEPA studies, as compared to other GHG estimation efforts.

The concept of direct (Scope 1) vs. indirect (Scope 2 and 3) emissions is fundamental to GHG accounting. Direct emissions are those that are owned or controlled, depending the selected boundary definition method, by the entity performing the inventory. Scope 2 indirect emissions are related to purchased energy, in particular electricity, consumed by the entity but generated by others. Scope 3 indirect emissions are all other GHG impacts caused by the entity's actions or operations but emitted elsewhere.

Although these scope-related terms are used to categorize emissions within all relevant protocols for organizational GHG inventories, they often make no sense for project impact evaluations, and different concepts are used for project GHG accounting. Consider the example of a proposed federal highway construction project, where the most important GHG impact would be from the fuel combusted by the vehicles using the road. Using the corporate protocol concepts, vehicle emissions would be deemed an indirect impact of the action and potentially excluded, because the vehicles using the road would not be owned or controlled by the Department of Transportation. Similarly, the concrete would be sourced from plants owned and operated by the concrete manufacturer, and the construction vehicles would be owned and operated by the construction contractor. Thus, "direct" emissions of the highway project would be minimal, and would exclude the more important emission sources, using the concepts provided in the corporate accounting standards or FEMP Guidance.

However, a comprehensive comparison of alternatives could not be accomplished without quantifying emissions from these "indirect" sources. Project Standard uses the concepts of primary and secondary impacts, and stresses that inventory boundaries should be defined to include all source and sinks of emissions potentially affected by the project, regardless of who owns or operates the source.

We suggest that application of the final guidance be based on the NEPA definitions of direct and indirect impacts, rather than on the corporate accounting standards and FEMP guidance definitions of these terms. Specifically, from 40 Code of Federal Regulations 1500:

"1508.8 Effects.

Effects include:

(a) Direct effects, which are caused by the action and occur at the same time and place.

(b) Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects

on air and water and other natural systems, including ecosystems."

Value chain

The final guidance emphasizes that connected actions should be included in the analysis. Those activities that have a "close causal relationship" to the proposed action should be included. More specifically, the final guidance notes that for resource extraction and development projects, the analysis should include, "…clearing land…, building access roads, extraction, transport, refining, processing, using the resource, disassembly, disposal, and reclamation." The second draft of the guidance specifically noted "downstream" emissions; while this term was removed, the concept remains the same. Arguably, one of the most important implications of this clause is as relates to the extraction or transport of fossil fuels; under the final guidance, the GHG emission estimates for a coal mining or coal transportation project must consider emissions from combustion of the fuel produced by the project, not just the emissions from the mining alone.

Clearly, this introduces a new paradigm for NEPA; historically, an EIS for a natural gas pipeline project would not have included criteria air pollutant emissions in another state or country from manufacture of the steel or combustion of the fuel. Rather, only the air emissions resulting from construction and use of the pipeline in the project vicinity would have been considered. This new focus on value chain impacts is reflective of the global nature of climate change impacts.

Cumulative impacts

The final guidance correctly notes that climate change is by definition a global phenomenon. In addition to the value chain focus noted above, two very important conclusions are made regarding cumulative impacts.

- Cumulative effects of all GHG emission sources globally cause impacts to the climate that are clearly significant, and most proposed actions would cause GHG emission changes which, however small, exacerbate that unacceptable global impact. The final guidance from CEQ proposes that a potential finding of cumulative significance is not a trigger requiring a full EIS for any individual action.
- Cumulative impact analyses are not required for specific projects or actions. Because such analyses would not have sufficient resolution to quantify additional changes to the climate that would be caused or contributed to by an individual action, however large, the cumulative analysis would essentially be identical to the results of existing global climate studies, such as the IPCC assessment reports.[1]

Mitigation

The final guidance specifies that agencies should require reasonable mitigation measures and alternatives, consistent with existing authority and policies. Mitigation includes avoiding, limiting, rectifying, reducing/eliminating over time, or compensating for such impacts.

As a practical matter, options for mitigation of GHG emissions fall into two main categories: reducing or eliminating the increased emissions by changing the proposed action, or implementing actions outside the traditional project boundary that would reduce emissions from other sources or cause additional sequestration of carbon dioxide from the atmosphere. The final guidance is silent on the ability of a project proponent to use carbon offsets, however, any action taken outside of the defined project boundaries to compensate for project GHG emissions could be viewed as a formal or informal offset.

This ambiguity presents both opportunities and risks for project proponents. On one hand, the ability to package project impacts with benefits from outside actions means that more options are available for reducing future GHG emissions

[1]http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml

where desired or required. On the other hand, associated costs could quickly become cost-prohibitive. Using the carbon offset markets as a benchmark for the cost of developing credible GHG reduction opportunities, such actions could cost $1–20/ton; if external projects are mandated to substantially reduce impacts associated with a proposed action, many energy development projects could become financially infeasible.

Where mitigation is required, agencies should ensure that the actions taken are additional, verifiable, durable, and enforceable, and that monitoring be required to verify that the actions and benefits are actually achieved. This requirement is consistent with the principles of the Project Standard and most carbon offset guidance.

Impact of climate on the project

Evaluation of the potential impacts of climate change on the project is a commonly misunderstood aspect of climate change analyses. It has been often quoted that NEPA requires analysis of "impact of the project on the climate, and impact of climate on the project". Arguably, impact of the environment on a project is outside of the scope of NEPA unless such impacts also cause additional adverse environmental or social impacts.

Again, climate change is unique in this context, in that the affected environment may change with or without the proposed actions and other local cumulative actions. As such, the final guidance notes that "The current and projected future state of the environment without the proposed action (i.e., the no action alternative) represents the reasonably foreseeable affected environment…".

In the past, some agencies have required project proponents to examine the vulnerability of the project to the changing climate, e.g., on a recent coastal project, a lead agency asked the proponent to review engineering information to document that the facilities were designed with sea level rise in mind. However, closer analysis of the final guidance shows it is not necessarily the intent to protect project owners from bad engineering decisions, rather it is to protect the environment and the public from any such flaws. Specifically, the more focused goal is to determine whether changes in the climate will exacerbate the environmental consequences of the action.

With emphasis added, the final guidance states, "The analysis of climate change impacts should focus on those aspects of the human environment that are impacted by both the proposed action and climate change. *Climate change can make a resource, ecosystem, human community, or structure more susceptible to many types of impacts* and lessen its resilience to other environmental impacts apart from climate change. This increase in vulnerability can *exacerbate the effects of the proposed action*. For example, a proposed action may require water from a stream that has diminishing quantities of available water because of decreased snow pack in the mountains, or add heat to a water body that is already warming due to increasing atmospheric temperatures. *Such considerations are squarely within the scope of NEPA* and can inform decisions on whether to proceed with, and how to design, the proposed action to eliminate or mitigate impacts exacerbated by climate change."

It will be important for project proponents to be on the same page as agency personnel on this point. Using the stream flow example above, it is a much different analysis to say whether decreased surface water flows would adversely affect an industrial facility vs. whether reduced flow increases the facility's impact on the stream. However, the final guidance suggests that where the public is affected, such as with a major transportation project, it is important to ensure that the project is designed to withstand climate change.

Importantly, the final guidance indicates that predictions of future climatic conditions should be based on existing studies. Proponents would not be required to conduct new climate modeling to predict those localized impacts.

Agency approaches

The progress being made by various federal agencies in conducting meaningful climate change analyses is

varied, but most recent NEPA analyses have differed significantly from CEQ's recommendations.

- Many recent NEPA documents for major transportation projects have stated that more detailed analysis of climate change impacts would not be warranted, because project-related GHG impacts would be a small fraction of national or global GHG emissions.
- The federal lead agency on a recent fuel transportation infrastructure project directed that the EIS should not review the impacts of climate change on the project or environmental consequences, and that indirect effects, such as emissions from remote combustion of the fuel products, should not be included in the project footprint. In contrast, state agencies involved with the same project did consider these aspects of the proposed project.
- Regarding impact of climate change on the project, EPA comments on a recent NEPA document noted that the draft EIS did not, but should, include "…implications of climate change for the environmental consequences of [the] proposed action". However, no suggestions were provided regarding the content of this analysis, other than mention of proposed changes to storm water flow.
- A recent EIS for construction projects at military bases quickly dismissed carbon emissions as de minimis.

Clearly, work remains for agencies to develop consistent, practical, and meaningful approaches to climate change analyses.

Conclusions

Release of the final guidance is an important step towards improving the quality and relevance of climate change analyses in NEPA reviews. The final guidance addresses many concepts, including how the unavoidable global impacts of other GHG emission sources should be incorporated in reviews of specific actions. It stresses quantitative comparison of alternatives, but notes that GHG emissions are the only practical proxy for predicting impacts. It also makes clear that direct and indirect impacts across the value chain should be included. The final guidance outlines procedures by which both impact of the action on the climate, and impact of climate change on environmental consequences, should be considered. Broad discretion is given to individual agencies regarding how to make the analyses relevant and how to use the results for informed decision making.

In our opinion, the final guidance remains a work in progress. In particular, the lack of specificity in this document or other GHG accounting protocols on project-specific emission estimates will likely yield inconsistent analyses between different agencies and project types. Without additional guidance or examples, widely divergent approaches for including the impacts of climate change on the project or project consequences may result. Therefore, as agencies define the intent of analyses, careful consideration must be given to emission impacts across the entire causal chain to ensure analyses are complete and meaningful, procedures for defining baseline cases against which future emissions with the projects are compared, fair and consistent procedures for determining project significance are used, and the types of external actions which could be required for mitigation are identified.

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ENVIRONMENTAL PRACTICE
2017, VOL. 19, NO. 1, 63–64
http://dx.doi.org/10.1080/14660466.2017.1284528

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Cristina Udelsmann Rodrigues is a researcher in the Nordic Africa Institute and works in Angola, namely on development

issues. She participated in several international research projects, including in the Okavango region, and is a member of the African Borderland Research Network. As a consultant, Cristina also worked on environment and education assessments in Angola.

Vladimir Russo is the executive director of the Kissama Foundation in Angola, dedicated to the environment. He is a consultant with experience in the area of biodiversity and environmental legislation, impact studies and audit, education and training, public consultation and communication. Vladimir worked for the Angolan Ministry of Environment, UNEP, Wildlife and Environment Society of South Africa.

Edella Schlager is a professor in the School of Government and Public Policy at the University of Arizona and the editor of the *Policy Studies Journal*. Her research focuses on comparative institutional analyses of watershed arrangements, including conjunctive management of ground and surface waters, interstate water sharing agreements, and regional intergovernmental arrangements that manage for habitat and water quality and quantity. She is the co-author of two books on water governance, the editor of a volume on federalism and climate change, and she has published in *Publius, Policy Studies Journal*, and the *American Journal of Political Science*, among others.

NATIONAL ASSOCIATION OF ENVIRONMENTAL PROFESSIONALS

Membership Application

P.O. Box 460
Collingswood, NJ 08108
P: 856-283-7816
F: 856-210-1619
E: naep@naep.org

www.naep.org

NAEP

Founded in 1975
Leading the Environmental Profession into the 21st Century

NAEP Membership Application

(Please Print)

Title (Dr/Mr/Mrs/Ms/Miss) First Name MI Last Name Suffix(es)

I prefer to receive mailings at: ❍ Home ❍ Office

Home Address:

Street_____

City_____ State_____ Zip Code_____

Telephone_____

e-mail _____

Office Address:

Title_____

Employer_____

Street_____

City_____ State_____ Zip Code_____

Telephone_____ Fax_____

e-mail _____

NAEP periodically publishes a membership directory. This directory is distributed to NAEP members free of charge and sold to non-members for a nominal fee. If you do not want to be included in a directory published in paper or electronic form, check here. ❍

NAEP membership is open to persons engaged in all aspects of the environmental professions in one of the following categories:

General Membership ❍ $175.00 / year

General membership is open to individuals who have earned an undergraduate or graduate degree and have at least three years experience working in the environmental field. General members may vote and hold office.

College or University_____ Specialties_____

Degree(s)_____ Years of experience_____

Associate Member ❍ $145.00 / year

Associate membership is open to individuals who do not meet the requirements for general membership.

Student Membership ❍ $60.00 / year

Student membership is limited to full-time students pursuing an environmental degree. A copy of a current transcript and college ID is required and must accompany the application.

Date entered current degree program:_____ Expected graduation date_____

Anticipated degree_____ College or University_____ Program/Major_____

Senior Membership ❍ $95.00 / year

Corporate Membership ❍ $850.00 / year

FEES

Membership Dues $_____

Chapter Dues $_____

Total Amount Due $_____

METHOD OF PAYMENT

❍ Check/money order for $_____ payable to **NAEP**
National Association of Environmental Professionals

❍ Charge $_____ to my Visa, Mastercard, Discover or American Express card.

Card Type: _____

Card No._____ Exp. Date_____

Signature_____

Security Code_____

Please be sure to read the information on the last page and sign this application.

To Help Us Serve You Better

Practice Setting
(Circle One)

Academe
Consulting
Contracting
Government
Industry
Military
National Lab
Nonprofit
Private Sector
Utility
Other_____

Discipline
(Circle one or two)

Administrator
Architect
Engineer
Faculty
Lawyer
Manager
Planner
Student
Scientist
Other_____

Specialty Area
(Circle one or two)

Audit
Compliance
Impact Assessment
Monitoring
Protection
Regulation/Policy
Research
Resource Management
Technology & Design
Other_____

Focus
(Circle one or two)

Air
Ecology
NEPA
Noise
Socioeconomic
Soil
Water
Waste
Wetlands
Other_____

How Many Years in the Field?

0-2	6-10	16+
3-5	11-15	

NAEP Chapters

In addition to membership in the national Association, NAEP maintains a network of regional, state, local and student chapters that offer additional opportunities for professional growth. Check below if you would like to join one of the chapters and include applicable dues in addition to the amount for NAEP membership.

State/Local Chapters

❍	Alaska	$25/year
❍	Arizona	$30/year
❍	California	$150/year
❍	Florida	$40/year
❍	Georgia	$30/year
❍	Hawaii	$30/year
❍	Illinois	$40/year
❍	Mid-America (IA, KS, MO, NE)	$15/year
❍	Mid-Atlantic (DC, MD, VA)	$40/year
❍	North Carolina	$40/year
❍	Northwest (OR & WA)	$45/year
❍	Texas (select one)	
❍	North Texas	$35/year
❍	Texas	$50/year

Please remember to ONLY use the box below if you are joining FAEP (the Florida Chapter of NAEP) or renewing your FAEP (the Florida Chapter of NAEP) membership. Questions call Tim Bower at 856-283-7816. For FAEP (Florida) State and FAEP Chapter membership is required; however, you may join more than one FAEP local chapter. Please only use this field if you are joining or renewing your FAEP membership. FAEP local chapters rates are as follows:

❍ FAEP Central Chapter $20/year
❍ FAEP Northeast Chapter $25/year
❍ FAEP Northwest Chapter $20/year
❍ FAEP South Chapter $15/year
❍ FAEP South Student Chapter $10/year
❍ FAEP Southwest Chapter $15/year
❍ FAEP Tallahassee Chapter $15/year
❍ FAEP Tampa Bay Chapter $40/year
❍ FAEP Tampa Bay Student Chapter $10/year
❍ FAEP Treasure Coast Chapter $20/year

NAEP Membership is individual (not your company's) and non-transferable. NAEP Corporate memberships are available; please contact the national office for more information. Your national dues (see page 1) include a subscription to our journal, Environmental Practice. Chapter dues are collected by NAEP on behalf of the affiliated chapters and passed to them along with your name and address. Some chapters are more active than others.

Send the completed application to:
NAEP
PO Box 460, Collingswood, NJ 08108

Tel: 856-283-7816
Fax: 856-210-1619
Email: naep@naep.org

Code of Ethics and Standards of Practice for Environmental Professionals

The objectives of Environmental Professionals are to conduct their personal and professional lives and activities in an ethical manner. Honesty, justice and courtesy form moral philosophy which, associated with a mutual interest among people, constitute the foundation of ethics. Environmental Professionals should recognize such a standard, not in passive observance, but as a set of dynamic principles guiding their conduct and way of life. It is their duty to practice their profession according to this Code of Ethics.

As the keystone of professional conduct is integrity, Environmental Professionals will discharge their duties with fidelity to the public, their employers, clients, with fairness and impartiality to all. It is their duty to interest themselves in public welfare, and to be ready to apply their special knowledge for the benefit of mankind and their environment.

Creed

The objectives of an Environmental Professional are:

1. to recognize and attempt to reconcile societal and individual human needs with responsibility for physical, natural, and cultural systems.
2. to promote and develop policies, plans, activities and projects that achieve complementary and mutual support between natural and man-made, and present and future components of the physical, natural and cultural environment.

Ethics

As an Environmental Professional I will:

1. be personally responsible for the validity of all data collected, analyses performed, or plans developed by me or under my direction. I will be responsible and ethical in my professional activities.
2. encourage research, planning, design, management and review of activities in a scientifically and technically objective manner. I will incorporate the best principles of the environmental sciences for the mitigation of environmental harm and enhancement of environmental quality.
3. not condone misrepresentation of work I have performed or that was performed under my direction.
4. examine all of my relationships or actions, which could be legitimately interpreted as a conflict of interest by clients, officials, the public or peers. In any instance where I have financial or personal interest in the activities with which they are directly or indirectly involved, I will make a full disclosure of that interest to my employer, client, or other affected parties.
5. not engage in conduct involving dishonesty, fraud, deceit, or misrepresentation or discrimination.
6. not accept fees wholly or partially contingent on the client's desired result where that desired result conflicts with my professional judgment.

Guidance for Practice as an Environmental Professional

As an Environmental Professional I will:

1. encourage environmental planning to begin in the earliest stages of project conceptualization.
2. recognize that total environmental management involves the consideration of all environmental factors including: technical, economical, ecological, and sociopolitical and their relationships.
3. incorporate the best principle of design and environmental planning when recommending measures to reduce environmental harm and enhance environmental quality.
4. conduct my analysis, planning, design and review my activities primarily in subject areas for which I am qualified, and shall encourage and recognize that participation of other professionals in subject areas where I am less experienced. I shall utilize and participate in interdisciplinary teams wherever practical to determine impacts, define and evaluate all reasonable alternatives to proposed actions, and assess short-term versus long-term productivity with and without the project or action.
5. seek common, adequate, and sound technical grounds for communication with and respect for the contributions of other professionals in developing and reviewing policies, plans, activities and projects.
6. determine that the policies, plans, activities or projects in which I am involved are consistent with all governing laws, ordinances, guidelines, plans and policies to the best of my knowledge and ability.
7. encourage public participation at the earliest feasible time in an open and productive atmosphere.
8. conduct my professional activities in a manner that ensures consideration of technically and economically feasible alternatives.

Encourage Development of the Profession

As an Environmental Professional I will:

1. assist in maintaining the integrity and competence of my profession.
2. encourage education and research and the development of useful technical information relating to the environmental field.
3. be prohibited from lobbying in the name of the National Association of Environmental Professionals.
4. advertise and present my services in a manner that avoids the use of material and methods that may bring discredit to the profession

.

AFFIRMATION

I hereby affirm and agree that I will abide by the Code of Ethics of the Association. I further understand that falsification of the contents of this application will be grounds for rejection and/or termination of my Association membership and revocation of all benefits resulting there from.

Signature_____ Date_____

Name of NAEP Member who gave you this application (if known)_____

Environmental Practice: Call for Papers

INFORMATION FOR CONTRIBUTORS

Environmental Practice is an English-language journal published quarterly by the National Association of Environmental Professionals. It serves an international audience of environmental professionals in practice and research. Environmental Practice is peer reviewed and accepts original manuscripts that have not previously been published in whole or in part in a peer-reviewed journal or in a widely available publication, either print or electronic.

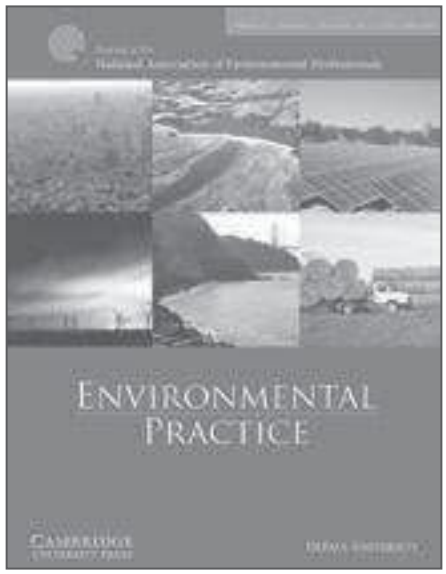
Priority for publication is given to manuscripts that offer clear, insightful views on an environmental problem from an interdisciplinary perspective. *Environmental Practice* seeks especially to publish studies that link data and findings in science and technology with issues of public policy, health, environmental quality, law, political economy, management.

Manuscripts are accepted throughout the year.

Kinds of Manuscripts Sought

Environmental Practice publishes several categories of manuscripts as described below. Two of these categories, Research Articles, and Environmental Reviews and Case Studies, are peer reviewed.

Research Articles: Manuscripts that report the results of systematic study on an environmental problem. Typically, research articles will (a) report the results of formal research or (b) summarize systematic analysis of one or more case studies of particular interest. Environmental professionals in academic or research laboratory settings may be more likely to submit formal research manuscripts. Professionals in consulting practice, agencies, or other organizations may be more likely to submit manuscripts based on case studies. Under most circumstances, Research Articles will not be over 5000 words of text. Most will be substantially shorter. Tables, figures, and reference lists need not be included in the word count. All Research Articles are peer reviewed. 2



Environmental Reviews and Case Studies: Manuscripts that organize and summarize a research literature similar to a meta-analysis. These manuscripts help clarify a problem, illustrate policy-making processes, or assist in pointing out discrepancies in the research of the topic over time, with greater emphasis placed on the details of a project than on data analysis. Case study oriented manuscripts provide readers with a unique insight on a development in the professional field using a case as an example or illustration; simple project reports will not be accepted. Environmental Reviews and Case Studies will generally be about 6000 words of text. Tables, figures, and reference lists need not be included in the word count. All Environmental Reviews and Case Studies are peer reviewed.

Reviews: Manuscripts that portray the content, quality, and significance of books or films of wide interest to environmental professionals and their practices. Reviews should normally not exceed 750 words, but with the approval of the editor may reach 1500 words.

Perspectives from the Field: Statements of informed opinion intended to provoke discussion and debate on particular issues. These manuscripts will generally range from 500 to 1000 words. Such manuscripts will not be subject to peer review, because they are personal opinion; however, the editor may seek advice on matters of tone and fairness.

Dialogue: Responses to other manuscripts or controversies within the professional or academic discipline. These manuscripts will generally range from 50 to 500 words, and take the form of a letter to the editor. Dialogues will not be peer reviewed, but they may be used to solicit responses from others for simultaneous publication. ■

Contact: Ruth Gaulke at ruth.gaulke@gmail.com

NAEP 2017 Annual Conference - Schedule At A Glance

Monday March 27					
8-12	**TRAINING SESSIONS (Additional Cost)**				
	NEPA: Basic NEPA Training	Air Quality – Regulations Overview	Ecosystem Services		
1-5		Air Quality– Best Practices for Managing Greenhouse Gas (GHG) and Energy Challenges	Wildlife Habitat		
5-7	Networking				
Tuesday, March 28					
8-9:30	Welcome & Planning (Tom Earnhardt & Tim Profeta)				
10-11:30	1- Incorporating Ecosystem Services into NEPA	2-From Mountains to Sea: Strategic Planning & North Carolina Case Studies	3- Roadway Projects and Navigating the Process	4-Climate Change: Implementing Climate Change into Environmental Assessments	
11:30 - 1	Lunch – Ted Boling CEQ, NEPA				
1:15 – 2:45	5- NEPA Case Law Update	6-From Mountains to Sea: Case Study Using Species Data and Distribution Models	7-Emerging Issues in Transportation Projects	8- Brownfield Success Stories	ECOSYSTEM RESTORATION TOUR (1-5)
3:15 – 4:45	9-Making NEPA practice better: Progress and perspectives from the Cohen NEPA Summit panels	10-Air Quality: Weighing the Impacts and Mitigation Measures	11-Climate Change: Effective Education and Communication Techniques	12-Water Resources: Stormwater Strategies	
6-10	Presidents Dinner				
Wednesday, March 29					
8-9:30	13-Tips & Tricks for Third Party EISs	14-Aquatic Habitat Restoration Design: Key to Functional Uplift	15-NEPA Best Practices	16- Public Involvement Guidance Manuals: Technical Requirements, Content Development and Process Challenges	
Break	Poster Session in Exhibit Hall				
10-11:30	17-Environmental Language Barriers	18-The Road to Maximizing Functions of Transportation-Induced Mitigation	19-Case Studies in Transportation Projects	20 - Public Involvement: Public Involvement: Preparing for the Next Generations	
11:30 - 1	Lunch - Awards				

NAEP 2017 Annual Conference - Schedule At A Glance

1:15-2:45	21-Beans, Bullets, and Bunnies: Navigating the Complex World of DoD NEPA	22-Water Resources: Assessment of Water Quality Near Environmentally Impacted Sites	23-NEPA and Airports	24-Current NEPA Issues	TOUR OF THE DUKE UNIVERSITY'S STREAM AND WETLAND ASSESSMENT MANAGEMENT PARK (SWAMP) (1-5)
Break	Poster Session in Exhibit Hall				
3:15 – 4:45	25-NEPA Compliance at the FDA	26-Recent Technological Applications in Cultural Resource Management	27-Endangered Species: Sentinel Landscapes	28-Remediation Techniques	
6-10	Dine Around Durham				
Thursday, March 30					
8-9:30	Membership Meeting/Awards				
10-11:30	29-Adaptive management under NEPA? Current Practice and Future Direction	30-Wetland Conditions: Where they have Come and Implications for the Future	31-Energy: Harnessing Energy from the Environment	32-Endangered Species: Saving Our Native Flowers	Duke Forest Tour (10-2)
11:45-1	33-NEPA HTL: In Dreams Begins Responsibility: Applying Environmental Assessment to Outer Space Development	34-Water Quality – HTL (TBD)	35-Public Involvement – HTL The environment from a faith-based perspective	36-NC - SEPA/Local Regs – HTL (TBD)	
1:30-3	37-Emerging NEPA Issues	38-Environmental Technology: Applying Electronic Tools to Make Data Collection Easier	39-Case Studies and Lessons Learned from Parks and Preservation	40-From Mountains to Sea: Protecting Coastal Floral and Fauna Communities	
3:15-4:45	41-NEPA Case Studies		43-Dealing with Cultural Resources, Questions you might be "afraid to ask"		

NAEP 2017 Annual Conference - Track Descriptions

Air Quality

Track Chair: Lynn McLeod, CEP, PMP, Battelle Memorial Institute

A lot is heard in the media regarding air quality these days. Whether the discussion is around ozone, NOx, carbon dioxide, or something else, to the lay person it can be quite confusing. This session will attempt to shine some light on this subject and how it interplays with society in North Carolina and elsewhere. We will discuss how trends in ozone can be correlated with socio-economic variables, look at the impacts of exempting small businesses, and talk about how planting trees in urban areas can help carbon sinks.

Brownfields and Remediation

Track Chair: Christopher Burkhardt, Falcon Engineering

The EPA defines Brownfields as properties with hazardous substances, pollutants or contaminants present. These properties can sometimes be large scale former industrial or commercial sites that are no longer in operation and are considered unsafe and unsightly. Through the Brownfields program these once dangerous and blighted areas can be cleaned and otherwise made safe prior to redeveloping them into something that can provide jobs, housing, or green space while providing economic growth to their surrounding area. This Session will highlight three successful projects that tuned lemons into lemonade.

Climate Change

Track Chair: Jonathan Welker, UAS Applications in the Environmental Industry

Climate Change is on the world's radar as a result of the recent changes throughout the world, and it continues to be one of the most important issues faced by environmental professionals today. This year's NAEP annual conference devotes two sessions to this vital topic. First, we will focus on how to include climate change in environmental assessments. In a second session, we will highlight education and communication techniques for explaining climate change, particularly in the media.

Cultural Resources

Track Chair: Heather Miller, Historical Research Associates

Cultural Resources are often an afterthought in world of environmental compliance and yet by law they are equally important as bugs and bunnies and air and water quality. Indeed, neglecting to address cultural resources (whether archaeological or historic) adequately can lead to anything from project delays and added costs, at best, to political black eyes, at worst—and everything in between. The sessions in the Cultural Resources track are designed to assist environmental professionals understand and negotiate some potential pitfalls of cultural resources compliance.

This year, we have three unique sessions in the Cultural Resources track. The first addresses three noninvasive or remote technologies that can be applied during various Section 106 processes: noninvasive geophysical testing, the use of drones and photogrammetry, and unmanned aerial systems (UAS). Using case studies, this session explores advancements in how LiDAR imaging, remote sensing, and digital data acquisition/transfer are being applied in cultural resource management settings to facilitate better site detection, evaluation, and preservation. The second session revolves around a case study of a recent inventory and evaluation of structures and buildings in the City of Los Angeles, which possesses one of the nation's largest municipal park systems. The project assessed resources' eligibility for listing in the National Register of Historic Places, California Register of Historical Resources, and/or the County of Los Angeles Register of Historic Districts and Landmarks. The inventory identified resources that are eligible

individually or within a historic district and provided management guidelines consistent with the Secretary of the Interior's *Standards for the Treatment of Historic Properties* and the National Park Service's *Preservation Briefs*. Additionally, the project led to development of a Worker, Education, and Awareness Program and a Cultural Resource Management Plan. Last, but certainly not least, is a roundtable that seeks to provide answers to your most pressing cultural resources questions, from "What are cultural resources?" to "What is the difference between the cultural resources sections of NEPA and Section 106 of the NHPA?" to "What is a traditional cultural property?" to "What does it mean to avoid, minimize, or mitigate for an adverse effect?" and everything in between. Ask questions of our panel of experts in archaeology, history and historic preservation, NEPA, and cultural resources policy or just come to listen. Note, too, that additional presentations are cross-listed with the cultural track, including a paper on a comparative analysis of identified best practices regarding historic bridges.

Ecological Restoration Track

Track Chair: Ward Marotti, WK Dickson

Ecological Restoration Projects are evolving with practitioners making creative and interesting new advances. . As more and more ecological restoration projects occur, our knowledge of how restoration of natural systems are accomplished has grown and the tools available for use in a variety of situations has increased. This track focuses on showcasing various approaches that agencies and practitioners can use to implement ecological restoration in their projects. From creative and innovative methods of stream restoration, to evaluating wetlands at different levels, to projects that are actively implemented to help the environment, and even projects that bank mitigation credits for future project impacts. Come see what exciting things are happening in the world of ecological restoration.

Endangered Species

Track Chair: Misty Buchanan, North Carolina Natural Heritage Program

The Endangered Species session features one panel and two single presentations that demonstrate how multiple state and federal agencies work together to assess the status and trends of endangered species, and how these collaborations benefit the rare species, as well as the multiple agencies, including the Department of Defense, NC Department of Transportation, and US Fish and Wildlife Service. The Sentinel Landscapes Panel (Session 27) features a group of speakers who helped develop a program in North Carolina that provides incentives to landowners in the vicinity of military installations to maintain their land in use that is compatible with existing military training programs conducted on the installations. The second Endangered Species Panel (32) features a collaboration between the NC Botanical Garden and the US Department of Defense to restore a rare plant on the military installation (Sandhills Lily), and a collaboration between the NC Department of Transportation, US Fish and Wildlife Service, and NC Natural Heritage Program to assess the status of a federally protected plant (Dwarf-Flowered Heartleaf), to determine if it continues to merit federal listing.

Energy

Track Chair: Ann Miracle, Pacific Northwest National Laboratory

As populations grow and concerns about meeting future energy needs and climate change increase, more research is being conducted on new locations for various forms of energy (oil/gas and renewable) and alternative sources of energy. This session will look at some of the activities being conducted in this area as they relate to the east coast of the U.S., nationwide, and portions of the world. Whether it is determining where we are willing to allow potential new energy sources to be accessed, where renewable sources of energy are viable enough to be developed, or looking at new ways of harnessing energy from the environment, this session will have something interesting for you.

NAEP 2017 Annual Conference - Track Descriptions

Environmental Technology

Track Chair: Misty Buchanan, North Carolina Natural Heritage Program

As computers become smaller and faster, and program development becomes easier, the use of technology in direct data collection becomes more common. This session focuses on some of the new tools available in the environmental arena as well as some old tools that have become more helpful in their capabilities. Whether it is an iPad or other hand held device to directly enter field data, the use of satellite imagery to conduct field surveys, or employing drones in the conduct of field data collection, the use of technology to conduct environmental assessment or to directly collect and make field data more accessible is clearly a path down which we all find ourselves following.

Mountains to Sea

Track Chair: Jonathan Welker, UAS Applications in the Environmental Industry

This track focuses on several environmental issues impacting North Carolina and other states where you find a variety of habitats, everything from mountains to the sea. The first of three sessions under this track looks at strategic planning throughout North Carolina. Items such as state wide fish and wildlife habitat conservation plans, the need for wider riparian buffers, and applying rapid wetland and stream assessment methods will be discussed. In the second session folks from the North Carolina Heritage Program will discuss a new model – NatureServe – to collect and analyze species distribution data across the state. Lastly, the third session will look at protecting coastal flora and fauna communities.

NEPA

Track Chair: Michael Smith, ENERCON

The purpose of the NEPA Track is to provide practitioners with a comprehensive overview of the most important recent NEPA policy and legal updates, as well as tips and techniques for improving NEPA practice and analyses in a number of critical areas. Federal, state and private-sector practitioners and legal experts will showcase real-world examples from project case studies for a wide range of project types and agency actions. This year's Track, will feature progress made over the past year on issues discussed during the 2016 session regarding the Cohen NEPA Summit. In addition to this special session, this year's panel and individual paper sessions will address a wide array of NEPA topics including: Annual NEPA Case Law and Policy Update; Incorporating Ecosystem Services into NEPA; Tips and Tricks for Third Party EISs; NEPA Best Practices; Environmental Language Barriers; Beans, Bullets, and Bunnies: Navigating the Complex World of DoD NEPA; NEPA Case Studies; Adaptive Management Under NEPA; and NEPA Compliance at the U.S. Food and Drug Administration.

Public Involvement

Track Chair: Lynn McLeod, CEP, PMP, Battelle Memorial Institute

Public Involvement is an ever changing landscape with its share of pitfalls and land mines. Sessions throughout this track focus on informing on ways of traversing this road with the goal of getting to the end of the line in one piece. Whether you are developing or updating your policies/guidance, managing public involvement for large-scale remedial projects or complex NEPA projects, or just need to learn how to include the Next Generations, these sessions are for you. This track also includes a rather unique Hot Topic Lunch as we delve into considerations of the environment from a Faith-Based Perspective. We encourage people to join into the conversation in all of these sessions.

NAEP 2017 Annual Conference - Track Descriptions

Remediation Techniques

Track Chair: Christopher Burkhardt, **Falcon Engineering**

Have you found a client with unlimited time and money? No? Well, we haven't either. Remediation is no different than other business ventures when time is of the essence and budgets are limited. Come listen to these four knowledgeable professionals explain how they have used technology to meet and exceed these two criteria. Presentations include topic such as precipitating Arsenic out of ground water as arseno-oxyhydroxides and the stable mineral arsenopyrite; fixating Chemicals using a new approach insensitive to toxicity and well performing in environments with high concentrations of metals, organic contaminants, salt, and pH levels (high and low); developing more accurate groundwater flow models including suitable well screening intervals and groundwater remediation programs using geophysical logging instruments; and mitigating Vapor Intrusion on large scale projects and the importance of choosing the right contractor.

Transportation

Track Chair: Kristen Maines, Infrastructure Consulting & Engineering

2016 was a strong year for federal transportation funding under President Obama. However, states still face a shortfall between existing transportation revenues and projected needs. Funding and finance options for transportation projects include traditional revenues such as gas taxes and other taxes on motor fuels, motor vehicle fees and tolls, and less traditional approaches like per-mile charges and taxes on alternative fuels. States also are considering finance solutions that borrow against or otherwise leverage revenues, such as bonds, federal credit assistance, state infrastructure banks and public-private partnerships (National Conference of State Legislatures, 2017).

This year, we have four unique sessions in the Transportation Track covering a variety of transportation-related topics. *Roadway Projects and NEPA: Navigating the Process* will present case studies of three roadway projects—each dealing with issues and challenges that many planners face. *Emerging Issues in Transportation Projects* will focus on trends in transportation planning including alternatives to Level of Service as the primary metric for assessing transportation facilities, and the findings of a recent survey of 46 committees of the Transportation Research Board of the National Academies regarding environmental "performance". The third session, *Case Studies in Transportation Projects* will have two presentations dealing with historic bridges. We will hear an evaluation of states' approaches to navigating historic bridge projects with some guidance for professionals to improve project outcomes; and a discussion of the challenges of replacing a historic bridge in an environmentally-sensitive and dynamic coastal environment. The track will wrap up with *Evaluating Impacts of Transportation Projects* which will explore issues in the world of air transportation and differences between handling transportation projects under the California Environmental Quality Act (CEQA) and NEPA.

Water Resources

Track Chair: Jonathan Welker, UAS Applications in the Environmental Industry

Innovation and technology are aiding the water resource community by adding new procedures and tools to their repertoire. In efforts to reduce flooding and reduce potential health hazards, engineers use these tools to build more efficient infrastructure. This session will highlight projects throughout the country that have been effective in incorporating blue and green drainage structures, technology into storm water Best Management Practices, and incorporation of updated regulation in storm water permitting.

Dear Sponsors and Exhibitors:

The National Association of Environmental Professionals (NAEP) and its North Carolina chapter (NCAEP) cordially invite you to participate and exhibit at the 42nd Annual Conference which will be held March 27-30, 2017 in Durham, North Carolina. The conference will take place at the Durham Convention Center, and a block of conference-rated sleeping rooms has been reserved at the Durham Marriott City Center. Building on the success of prior conferences, we anticipate approximately 400 attendees and are sure you will enjoy networking opportunities to demonstrate and discuss your company's products and services.

The exhibit hall will open formally on Monday evening, March 27 with the Opening Networking Reception to which all conference participants are invited. Exhibit booth and table top set-up is scheduled for Monday afternoon. Exhibits close Thursday afternoon, March 30.

Please note the following exciting changes which we have implemented for 2017:

- Exhibitors will be provided with an eight-by-ten pipe-and-draped booth, a table, two chairs, a wastebasket, and a company ID sign. A general services contractor (decorator) will be available to assist you with any freight or additional furniture needs which you might have.

- The exhibit hall is located on the main hallway of the convention center, next to the general sessions and a few steps away from the various concurrent breakout rooms.

- Every effort has been made this year to offer sponsors and exhibitors full access to every attendee who enters the exhibit hall. **When you look at the floor plan, note that every booth has two (2) open sides from which to engage attendees.** Both horizontal and vertical aisles have deliberately been made wider so that all food and beverage will be interspersed among the exhibits. There will also be several high cocktail tables scattered throughout. The exact placement of these will be determined closer to the conference.

- All morning and afternoon breaks and the two continental breakfasts will be placed in the exhibit hall. Preliminary planning calls for a dedicated poster session in the hall which not only will add another exhibit hall event but also will provide several participants the chance to showcase their work by speaking peer-to-peer with other conference attendees.

- The Opening Networking Reception will offer several food stations and space for attendees to mix and mingle. Naturally you are invited to participate in all social events held in the exhibit hall.

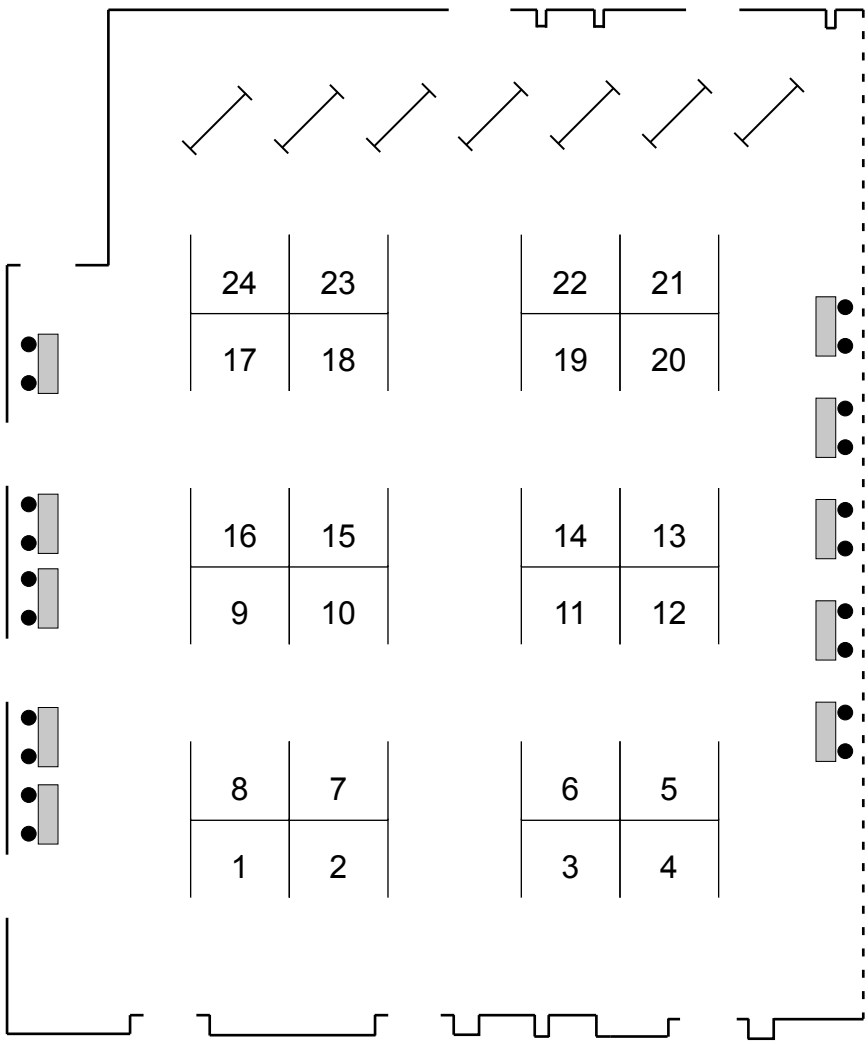
- There is complimentary Wi-Fi offered throughout the Durham Convention Center.

Diamond, Platinum, Quantum, and Gold sponsors and exhibitors will receive at least one (1) complimentary full conference registration. (Please see the accompanying paperwork for the tiers of

sponsorship.) Table-top exhibitors will receive a one-day registration to attend the conference on the day of your choice. Additional registrations, of course, can be purchased at the regular conference rates.

We look forward to welcoming you to the 42nd Annual Conference in Durham.

John Jamison
2017 Conference Co-Chair



HOLLINS Exposition Services
PO Box 49837
Greensboro, NC 27419
(336) 315-5225

	Grand Ballroom I & II Booth Size: 10x8 Booths Number of Booths: 24	National Association of Environmental Professionals 2017 Annual Conference March 27-30, 2017	Durham Convention Center Durham, NC	Revised: 12/9/16

NATIONAL ASSOCIATION OF ENVIRONMENTAL PROFESSIONALS
2017 ANNUAL CONFERENCE
DURHAM CONVENTION CENTER
DURHAM, NC – MARCH 27 - 30, 2017

SPONSORSHIP OPPORTUNITIES

All sponsors and exhibitors will receive:

- Recognition in the final program
- Recognition in the exhibit/meeting area
- Recognition on screen before general sessions and luncheons

IMPORTANT DEADLINES

- Advance program (Register by November 11, 2016)
- Final program (All materials no later than February 6, 2017)

DIAMOND SPONSOR $20,000 (one available)

- Company branding on all printed materials throughout the conference
- Your logo on the NAEP web site plus link to your web site
- Exclusive recognition as the major sponsor of your choice of President's Reception, Opening Session, or Keynote Luncheon
- Exhibit booth in prime location in the exhibit hall
- Four (4) full conference registrations
- Two (2) full-page advertisements in the final program
- Company logo on lanyards and promotional item if utilized
- Company literature on display table in registration area
- Option to place a welcome gift in attendees' hotel rooms
- Pre- and post-conference attendee lists (excluding opt-outs)
- One (1) year corporate membership

PLATINUM SPONSOR $10,000

- Your logo on the NAEP web site plus link to your web site
- Exclusive recognition as a major sponsor of your choice of Welcome Reception, Opening Session, or Keynote Event
- Exhibit booth
- Three (3) full conference registrations
- Full-page advertisement on the back cover or inside front cover of the final program
- Pre- and post-conference attendee lists (excluding opt-outs)

QUANTUM SPONSOR $7,500

- Your logo on the NAEP web site plus link to your web site
- Recognition as a major sponsor of your choice of Welcome Reception or a Keynote Luncheon
- Exhibit booth
- Two (2) full conference registrations
- Full-page advertisement in the final program
- Pre- and post-conference attendee lists (excluding opt-outs)

GOLD SPONSOR $5,000

- Your logo on the NAEP web site plus link to your web site
- Exclusive sponsorship of a breakout room with in-room recognition and a literature display table
- Exhibit booth
- One (1) full conference registration
- One-half page advertisement in the final program
- Pre- and post-conference attendee lists (excluding opt-outs)

SILVER SPONSOR $2,500

- Your logo on the NAEP web site plus link to your web site
- Recognition as a sponsor on conference signage
- One (1) table-top space
- One (1) full conference registration
- One-quarter page advertisement in the final program
- Pre- and post-conference attendee lists (excluding opt-outs)

COPPER SPONSOR $1,500

- Your logo on the NAEP web site plus link to your web site
- Recognition as a sponsor on conference signage
- Two (2) meal tickets for a lunch
- One (1) quarter page advertisement in the final program
- Pre- and post-conference attendee lists (excluding opt-outs)

BRONZE SPONSOR $750

- Your logo on the NAEP web site plus link to your web site
- Recognition as a sponsor on conference signage
- Business card size advertisement in the final program

OTHER SPONSORSHIP OPPORTUNITIES:

- Audiovisual
- Conference App
- President's Dinner
- Luncheon
- Breaks, specific sessions, etc.

Call Ann Mitchell at 856-793-0782 for further information.

NAEP 2017 ANNUAL CONFERENCE

DURHAM, NC - MARCH 27 - 30, 2017

NAEP Sponsor, Exhibitor and Program Ad Registration Form

Company Name:		
Address:		
City:	**State:**	**Zip:**
Contact Name:		
Phone:	**Fax:**	
E-Mail:	**Website:**	

Sponsor Levels: *See descriptions for benefits of each category.*

___ Diamond Sponsor - $20,000 **Event I wish to sponsor:** _____ President's Dinner ____ Opening Keynote Session ____ Keynote Luncheon		
___ Platinum Sponsor - $10,000 **Event I wish to sponsor:** ____ Welcome Reception ___Opening Keynote Session ____ Keynote Luncheon		
___ Quantum Sponsor - $7,500 **Event I wish to sponsor:** ____ Welcome Reception ____ Keynote Luncheon		
____Gold Sponsor - $5,000	**___ Silver Sponsor - $2,500**	**___ Copper Sponsor - $1,500**
___ Bronze Sponsor - $750	**___ Student Sponsor**	**___ Other Sponsor: $_____** I wish to help sponsor: _____
Booth Number Requested _____ (See floor plan.) *This pertains to Diamond, Platinum, Quantum and Gold Sponsors.*		

Exhibits:

_____ Booth (8 feet x 10 feet) $1,750 • One (1) Full Conference Registration • Pre-Registration list (excluding any opt-outs) • Link from NAEP website to yours, plus your logo on the website	**_____ Table Top (6 feet x 30 inches) $1,200** • One (1) day registration • Pre-Registration list (excluding any opt-outs) • Link from NAEP website to yours, plus your logo on the website

Ads: Specifications and Fees

____ Full Page (7.25 wide x 10 high) **$1,600**

____ Half Page (7.25 wide x 4.75 high) **$850**

____ Quarter Page (3.375 wide x 4.75 high) **$500**

____ Business Card (3.375 wide x 2.125 high) **$250**

Digital Specifications:

- Only digital files will be accepted.
- Black and white or grayscale JPEG 600 resolution at 100% size, or high resolution PDF.
- Files must be smaller than 4 MB.

Send all ads to: Ann Mitchell amitchell@ahredchair.com

Ad Submittal Deadline: **February 6, 2017**

Payment Information:

_____ Check	_____ Visa	_____ MasterCard	_____ American Express
Credit Card Number:			
Expiration Date:		Verification Code:	
Name on credit card:			
Billing address for credit card:			
Billing City:	State:	Zip:	

Mail checks to:
NAEP
1120 Rt. 73, Suite 200
Mount Laurel, NJ 08054
Att: Ann Mitchell

Questions: Ann Mitchell
NAEP Conference Manager
Ph: 856-793-0782
E-mail: amitchell@ahredchair.com

Cancellation Policy: If written cancellation is received by January 20, 2017, a full refund MINUS a $100 administrative fee will be given. If cancellation is received after January 20, 2017 and before February 10, 2017, an 80% refund MINUS a $100 administrative fee will be given. After February 10, 2017 refunds will not be given.

NAEP
The National Association of Environmental Professionals
TM *Promoting Excellence in the Environmental Profession*

NAEP announces two new topics for the Community Forum

NAEP is pleased to announce two new Community Forums have been added to the existing NEPA Policy and Practice Forum. These forums are a great way to ask questions and share resources with your fellow NAEP members. For more information on the Forums or help using them please call Tim Bower at 856-283-7816. The three current Forums are listed below:

Climate Change and Adaptation Forum

Climate change and adaptation are considered by many to be the most urgent environmental issue on the planet. Our understanding of climate change, our ability to predict its effects, and accepted practice for evaluation and planning are all areas in constant flux. This forum provides a virtual meeting space for environmental practitioners to share information, ask questions, or engage in a dialogue on this subject.

NEPA Policy and Practice Forum

The National Environmental Policy Act (NEPA) of 1969 requires all federal agencies to consider relevant environmental effects before making a decision or taking an action. This consideration largely takes the form of an EIS, EA, or CE, following procedures established by the Council on Environmental Quality (CEQ) and individual federal agencies. This forum provides a venue for anyone involved with or interested in the NEPA process to post information, ask questions, or engage in a dialogue with other NEPA practitioners. Note that subjects specific to climate change or transportation may be cross listed with those forums.

Transportation Forum

Transportation facilities and operations are one of the most common subjects of environmental analysis, planning, and policy. The potential effects of transportation include span a wide variety of subjects and technical disciplines. The planning and evaluation of transportation projects is guided by variety of federal and state regulation and guidance. This forum provides a venue for environmental professionals involved with transportation to share information, ask questions, or engage in dialogue. Note that some subjects may be cross listed with the NEPA forum.

NATIONAL ASSOCIATION OF ENVIRONMENTAL PROFESSIONALS BOARD OF DIRECTORS

Committed to achieving the highest standards of ethics and competence within the environmental professions

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Meeting Manager
2017 Annual Conference
National Association of Environmental Professionals
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For more information about the NAEP, please visit the association's Web site at www.naep.org.

Environmental Practice

Volume 19 Number 1 2017

Instructions for authors can be found at www.tandfonline.com/uevp.