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Sustainability in community organizing: lessons from the Community Organisers Programme in England (2011 – 2015)

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This article presents findings from an impact evaluation case study of the UK Coalition government's Community Organisers Programme (2011-2015). Whilst the program achieved some of its objectives, case study participants raised concerns of how sustainability was understood and practised. Five elements undermined the program's sustainability: (i) a weak definition of sustainability; (ii) the short duration of the training contract; (iii) an over-emphasis on autonomy; (iv) insufficient training and support for volunteer community organizers, and (v) a lack of progression opportunities. The article concludes the lack of conceptualization of sustainability within the program, and the Coalition government's commitment to austerity, enfeebled a trailblazing experimentation with state-funded community organizing.

Introduction

This article assesses the ambiguous use of sustainability throughout the Community Organisers Programme (COP) (2011-2015) in England, which was introduced by the UK Coalition government (2010-2015). On May 12th 2010, the Conservative Party and the Liberal Democrats formed a coalition government. This followed a hung parliament general election result five days earlier. They quickly announced a program of public sector reform and austerity to reduce the 10% deficit they inherited from the 2007/8 financial crisis (Taylor-Gooby & Stoker, 2011). Prior to the election, the Conservative Party leader was delivering speeches about the need to reduce big

government by creating a Big Society (Cameron, 2009). This became a significant policy driver for the COP. Big Society was introduced as the antithesis of the previous New Labour government's 'excessive' public spending, bureaucracy and unwelcome interference (Alcock, 2010). Big Society offered citizens, communities, the voluntary and community sector (VCS), and the private sector more opportunities to run British public services without excessive red tape (Alcock, 2010; Cabinet Office, 2010a). Three policy offshoots - social action, localism and social enterprise – germinated from this overarching policy agenda (Davoudi & Madanipour, 2013; Dean, 2013; Thornham, 2015). The Localism Act 2011 assisted communities, the VCS and the private sector "…to take over public services, community assets and influence planning and development" (My Community, 2012, p. 1; Featherstone *et al.*, 2013). Thus, public sector, VCS and private sector professionals, and voluntary groups could legitimately 'bid' to take over council assets – including community youth and children's centres – and galvanize social action to run them as social enterprises. Social action was defined as: "… people giving what they have, be that their time, their money or their assets, knowledge and skills, to support good causes and make life better for all" (Cabinet Office, 2010b, p. 4).

The adoption of austerity as the Coalition government's principal economic strategy steered these agendas. Austerity proposed £81 billion in spending cuts over five years, with £53 million cut from government departments and local government budgets alone (Clayton *et al.*, 2016). This resulted in the closure of two hundred and eighty-five public bodies, including the Community Development Foundation and the Sustainable Development Commission. The previous New Labour administration set-up, and funded, both to independently monitor and advise UK governments on their progress in community and sustainable development (Levitt, 2015; SDC, 2010). In 2011, the Coalition government assigned the Department for Environment, Food and Rural Affairs (DEFRA) to mainstream sustainable development and embed it "at the heart of each Government department" (Cabinet Office, 2011b, p. 3) whilst also reducing DEFRA's budget by 30% (Wheeler, 2015).

The Department of Communities and Local Government was the hardest-hit department with its budget slashed by 51% over the five-year span. This resulted in local governments in England making one-third to one-half of its public sector workers redundant (Bailey *et al.*, 2015; Wheeler, 2015). Local government cuts also affected funding available to the VCS, ensuing unprecedented losses in community development and community work infrastructures in both sectors (Clayton *et al*, 2016; Lowndes & McCaughie, 2013). In response, the Coalition government invested over £40 million in volunteering and social action projects, with half allocated to the COP (Cabinet Office, 2013; Fisher & Dimberg, 2016).

This article presents findings from a case study of the COP in one local

authority in England. It concludes that the program's weak conceptualization of sustainability – driven by the Coalition government's unwavering commitment to austerity and public sector cuts - compromised its impact and legacy. To achieve this, this article divides into five sections. The first introduces the COP, its objectives, methodology and understanding of sustainability. The second presents an overview of how sustainability and sustainable development came to underpin community organizing and development methodologies. The third then discusses our methodology. The fourth section presents the findings and argues that five elements of the COP undermined how sustainability was understood and practised. The final section concludes that the COP's problematic interpretation of sustainability – driven by the Coalition government's pledge to austerity - enfeebled a trailblazing experimentation with state-funded community organizing.

The Community Organisers Programme (2011-2015)

The £20 million state-funded COP set out to train 5,000 community organisers over four years. Five hundred paid, trainee community organisers (TCOs) were trained for fifty-one weeks and were tasked to recruit and train 4,500 volunteer community organisers (VCOs). In 2011, two national civil society organizations working in partnership were commissioned to deliver the program. *Locality* led and managed it whilst *RE:generate* delivered the training. RE:generate's training had yet to be tested on such a large scale (Imagine, 2014; 2015a). TCOs were based in local VCS organisations known as host organisations, and allocated to small geographical 'patches' in low income neighbourhoods in England (Cameron *et al*, 2015). Their aim was to work "…closely with communities to identify local leaders, projects and opportunities, and empower the local community to improve their local area" (Cabinet Office, 2011a, np).

The COP's methodology fused the works of Saul Alinsky, Paulo Freire, Edward Chambers and Clodomir Santos de Morais who set out to resist and challenge state authority and power. This was trailblazing for a national, state-funded program (Fisher & Dimberg, 2016). The COP also incorporated "…long traditions of English radicalism and self-help" (Locality, 2010, p. 2). Although community organizing is traditionally associated with the left, it has a range of theoretical underpinnings and practices across the political spectrum (Fisher and DeFilippis, 2015). Posthumously, Fisher & Dimberg (2016, p. 100) have labelled the COP the "moderate middle" of community organizing methodologies and strategies.

The COP's objective was to support the delivery of Big Society and localism through working directly with local people to help raise community spirit; encourage local community action; promote indigenous leadership in local communities; create new, locally-run community groups and social enterprises; and inspire democratic and social change (Locality, 2010). To achieve this, Locality

set the TCOs four targets to complete in fifty-one weeks. First, to listen to at least five-hundred people in their patch on doorsteps. Second, to recruit at least nine VCOs. Third, to co-produce with local residents three to five community projects. Fourth, to establish community holding teams of VCS organizations and other local leaders to listen, research, plan and take coordinated action (Cameron *et al*., 2015). Locality also set nine impact indicators to assess each TCO's impact in their patch.

Figure 1 **Nine impact indicators for the Community Organisers Programme**

1. *Individual possibility* – moving individuals from apathy to agency, and building a sense of possibility
2. *Early wins* – early wins that inspire and invigorate
3. *Community spirit* – sense of community spirit, coming together and overcoming isolation
4. *Activating networks* – using the network to solve problems, either one-to-one connections or by mobilizing numbers
5. *Neighborhood housework* – extending the tidying up and caring work that goes on in households into the wider neighborhood
6. *Influencing decisions* – influencing decisions about resources and plans for the neighbourhood
7. *Assets and services* – community takeover of assets and services
8. *Enterprise* – starting up new businesses, services and projects
9. *Democracy* – inspiring and transforming democracy

(Locality, 2014, p.1)

Engagement with sustainability is not explicit in these indicators. This is surprising due to the Coalition government's vow to stimulate sustainable development (Cabinet Office, 2011b) and a prominent COP figure claiming community organizing "… is necessary to the long term sustainability of our neighbourhoods" (Gardham, 2015, np). The Coalition government defined sustainable development as "stimulating economic growth and tackling the deficit, maximising wellbeing and protecting our environment, without negatively impacting on the ability of future generations to do the same" (Cabinet Office, 2011b, p. 2). Reflecting the three pillars of sustainable development: economic, social and environmental, the Coalition government argued these pillars should not "be undertaken in isolationbecause they are mutually dependent" (ibid). Arguably, impact indicators 3, 4 and 9 could be included under the social pillar, which includes civic and political activity (Cabinet Office, 2007; 2011b); 7 and 8 under the economic pillar, and 5 under the environmental pillar. But, this is not explicit in national policy

documents discussing the COP nor materials released by Locality and RE:generate. There is also no clear definition of sustainability or how the COP understood sustainable development. This article now turns to explore conceptualizations of sustainability that underpin community organizing methodologies.

Sustainability, Sustainable Development and Community Organizing

In the US, UK and beyond, increasing numbers of community development and organizing bodies support the three pillars of sustainable development model by demanding that "…all development should be inherently sustainable, that is, seeing economic and social development within an environmental framework that conserves resources and is carbon neutral" (Beck & Purcell, 2012, p. 24). This coincides with appeals for social and environmental justice to underlie community organizing and development strategies (cf. Beck & Purcell, 2013; Ife, 2016; Ledwith, 2016). Community organizing's growing interest in sustainability, sustainable development and environmental justice stems from both the Millennium Development Goals (MDGs) and the Sustainable Development Goals (SDGs) (Beck & Purcell, 2013; Blewitt, 2015). Introduced in 2000, the MDGs were eight international development goals proposing to "improve the health, nutrition, and well-being of some of the 1.2 billion humans who live on less than the equivalent of a dollar a day" (Nelson, 2007, p. 2041). In 2015, these were superseded by the SDGs which placed further emphasis on environmental sustainability through supporting more participatory and sustainable models of development on a global scale (Ziai, 2016). Both goals have been endorsed by the UN, The World Bank and at least 193 governments worldwide (Nelson, 2007; Ziai, 2016).

Before the arrival of the MDGs, environmental sustainability and sustainable development were mainly practised separately in community development and organizing methodologies. Throughout the 1940s and 50s, both US community organizing and UK community development aimed to create empowered and sustainable communities through professionals cultivating indigenous community capacity and leadership skills (Alinsky, 1989; Miller & Ahmad, 1997). Thus, both community organizers and development workers were tasked "to work themselves out of a job" (Miller & Ahmad, 1997, p. 275; Alinsky, 1989) through fostering indigenous leadership and capacity in communities until professionals were no longer required. Community organizer Saul Alinsky (1989) criticized 'do-gooders', public administration workers and charities who remained in community leadership roles for years. Established by Alinsky in 1940, the US community organizing network, also known as the *Industrial Areas Foundation*, advocated a golden rule: "no one should ever do things for people that they can do for themselves" (Pyles, 2014, p. 79). Inherent within this

statement is a debate about capacity in communities for leadership; specifically, who already has it and who can develop it. UK community development echoed this through its explicit commitment to community capacity building (cf. Batten, 2008; Mayo, 2008). Banks (2011, p. 6) defines capacity building as "the promotion of self-help and participation in civic life on the part of residents in local neighbourhoods." In the 1990s, the United Nations Development Programme (UNDP) adopted capacity building as their principal development strategy and, in conjunction with The World Bank, strove to create active, entrepreneurial and self-reliant citizens that participate in public life (UNDP, 1993; Ziai, 2016). Both community organizing and community development methodologies became more mainstream in the majority and minority worlds to build-up community capacity to cultivate indigenous leadership and self-reliant citizens that participate in civic life. This remained a shared definition of sustainable development in mainstream community development and organizing until the MDGs and SDGs in the early 21st century (Beck & Purcell, 2013; Ife, 2016).

Although a focus on environmental sustainability and its benefits for local communities is not new to community development or organizing (cf. Blewitt, 2008; Downie & Elrick, 2000; Fisher, 1994), was never a dominant paradigm prior to the SDGs (Beck & Purcell, 2013; Ife, 2016).

Yet, in 1987, the Brundtland Report identified "environmental justice and social deprivation as very real problems for many communities" (Blewitt, 2015, p. 113). The Rio Earth Summit followed in 1992 and released Agenda 21, also known as the *Earth Action Plan*. This asserted that local people and communities were core to achieve environmental sustainability, and needed to "foster a sense of personal environmental responsibility and greater motivation and commitment towards sustainable development" (UNCED, 1992, p. 267). Due to their shared principle of fostering self-reliance in communities, both community organizing and community development were identified as facilitative processes that could develop such ecological communities; characterized as respecting all life and nature, and committed to reducing their dependency on depleting natural resources (Blewitt, 2008; Ife, 2016; Ledwith, 2016).

Following the methodology section, this article moves on to scrutinize how sustainability and sustainable development was understood and practised in the COP.

Methodology

Data was collected during an impact evaluation of the COP in one local authority district in England. We evaluated

Figure 2 **Five stages of data collection**

1. Initial interviews with TCOs and host managers (September to October 2014)
2. Shadowing TCOs for one day (January to February 2015)
3. Interviews with VCOs (April to May 2015)
4. Final interviews with TCOs and host managers (April to May 2015)
5. Questionnaires with local residents in each 'patch' (June to July 2015)

it against the nine impact indicators outlined in *figure 1.* Nationally, fourteen cohorts of community organizers trained in groups between October 2011 and June 2015 (Cameron *et al.,* 2015). Other evaluation (ibid) and research (Imagine, 2014; 2015a; 2015b) focusses primarily on the earlier cohorts. This case study includes one of the final cohorts. The data consisted of semi-structured interviews with six TCOs, two host organization managers and five volunteer community organisers (VCOs); and questionnaires with fifty-seven residents across the six patches. Participants were asked to participate based on their informed consent and pseudonyms were given to assure anonymity. *Figure* 2 outlines the data collection stages that coincided with the TCOs fifty-one week training contract.

Sustainability in community organizing

Elements of the COP received considerable praise. Most participants viewed the door-knockings, listenings and newsletters as successful in engaging with hard-to-reach local people and promoting community spirit. These were core to the COP's methodology, called Root Solutions-Listening Matters (RSLM), which emphasized listening to and then supporting people in their communities to develop collaborative solutions (RE:generate, 2009). The listenings followed residents answering their doors and responding to questions written by RE:generate and delivered by the TCOs. Topics frequently raised were: (i) environment, spaces and places (litter, overgrown trees, speed limits, parking, flooding and dog poo); (ii) well-being (noise, community spirit, sport facilities, anti-social behaviour); and (iii) public services (changes in council services such as children's centres and libraries; need for activities for children, young people and the aging population). TCOs then compiled these responses in newsletters and distributed them locally. These encouraged residents to form local groups and work together to overcome issues raised. TCO Matt noted:

> "Some [local residents] actually say to you [that] you are the first person whose ever came out and asked me about the area, about the community. So, it's knowing that you're giving people a voice."

A local resident concurred: "[the COP] is essential. It can change people's lives for the better". TCOs, VCOs, host managers and some local residents applauded such methods for initiating new

relationships, recruiting new volunteers and reaching those previously inaccessible. This resulted in fifteen community projects developing across the six patches; ranging from litter-picks and park clean-ups to developing petitions, and creating youth services provision and additional needs groups.

Overall, the TCOs impressed the host managers. Ally commented their TCOs "were very mature individuals… and we had good communication". Nicky, the second host manager, praised two TCOs for successfully organizing a Christmas party for older, socially isolated community members recruited solely through door-knockings. Nicky reflected:

> "Now, a year before [the HO] ran a project for older people in the community centre and, over the year, you might get three, four, five people coming in a week. But, in one day [the TCOs] managed to fill the hall. And it gave me a thought, well, you know, it can be done."

Discussed more were concerns regarding how Locality and RE:generate understood sustainability; with TCOs, VCOs and host managers providing converging accounts of how this compromised the COP's impact and legacy. Locality and RE:generate's understanding of a VCO was criticized; defined as local residents taking "social action" resulting from a RSLM listening to become "new leaders in their community". TCO Heather elucidates:

> "I question [Locality's] definition of a volunteer. [The TCOs] were told a volunteer is someone who takes any form of action for the community. So, that could be introducing you to someone, handing out some leaflets… like handing out your business card to someone and them taking it. Or, someone who handed flyers out for you. That counts as a volunteer."

Most TCOs, VCOs and host managers agreed this definition was unsustainable and surprising, given that volunteers were the lifeblood of the program and to whom its legacy was dependent. Ally had emailed Locality and challenged them on this definition, explaining that a volunteer "is someone who has actively engaged in an activity on a regular basis" and has "a clear understanding of what it is they are doing". TCOs Paula, Heather and Gary also raised these concerns with Locality. All four reported not receiving "a satisfactory response". Similarly scrutinized was the COP's understanding of a project. Matt explains:

> "Some [TCOs] have marked down a single litter-pick or a single coffee morning as a project… But, in my eyes - and the methodology and theory of community organizing - the projects are supposed to be mid-to-long-term in both the development and the results.

> Because it is supposed to be a self-sufficient thing with the people in the community doing it for themselves, to continuously do it for themselves. It is supposed to take a little longer to build it up, but it is supposed to last even longer. So, instead of talking two weeks to organise a project and then it runs for three weeks, it's supposed to take six months to a year. And then run for the next ten kind-of-thing."

Matt highlights a discord between more traditional community organizing objectives to build-up long-term capacity, and Locality and RE:generate's more target-driven RSLM methodology. This overlaps with the second element reported as undermining the program: the limited timescale of the TCO training contract. All TCOs, VCOs and host managers concurred fifty-one weeks was not enough time to build-up sufficient capacity in each patch to create new networks. Nicky, who had worked in the area for over twenty years, reflected: "with the kinds of communities that we're working in, the timeframe that there is to really develop something strong and lasting is so minimal". Most TCOs found local residents reluctant to take the lead, with Gary reflecting it was "daunting for anybody to think about setting anything up". Influenced by Alinsky (1989), one of the 'golden rules' of the program was to not do for others what they could do for themselves. As a result, the TCOs were actively discouraged from taking the lead in bourgeoning projects. Matt was critical of this:

> "And it doesn't matter if you feel someone *can't* do it for themselves, that's not how [the COP] works. It's that you have to *not* do it for them. So, [the COP] is really saying, if they say they can't do it for themselves, they really can. [The rule] should be: if they can do it for themselves, don't do it. But some people can't until you show them."

Similarly, the host managers appraised the COP as erroneously assuming that capacity and motivation was "latent" in neighborhoods and that residents "just needed somebody just to say what do you fancy doing and they would rise up like an army". To the TCOs, this was a misguided interpretation of Alinsky's methods. To the host managers and experienced VCOs, it was "poor community work". Most participants also questioned the COP's rationale for such a short training contract. VCOs thought it was "too short" as the local area needed "somebody who can work with the community, and the community can get to know them". TCO Gary was adamant that "… training should be at least 18 months… that real results won't start showing until the 18 month period". In fact, Locality and RE:generate's original bid stipulated this (Grimshaw *et al.*, 2018). During training RE:generate informed the TCOs:

> "RSLM is supposed to be done over three to five years, rather than a year. So, I think that definitely comes into play, when [RE:generate trainer] says to build relationships she's kind of coming from a foundation where in the past she's always had three to five years to do that." (TCO Paula)

This issue of short-termism is reflected in national research, with TCOs requesting a second year of training (Imagine, 2015a; 2015b). TCOs, hosts and some VCOs made connections between the "too-short" training contract and the austere economic climate. TCOs regularly encountered local community organizations barely surviving on reduced public sector funding who were fearful of closure. Like neighboring community organizations, Ally and Nicky were having to "make-do with less". They concluded this fate had also befallen the COP, with austerity having "taken over what [the COP] potentially could have become" by scrapping the second year of the TCO contract.

The third issue reported as compromising the COP was that the RSLM methodology encouraged TCOs to work autonomously from their host organization and local VCS organizations. In training, TCOs were advised to remain independent from existing organizations, to not signpost local residents to these organizations and "to organize people separately" from them. This perplexed the participants and actively worked against TCOs achieving their targets. Matt explains:

> "I mean [local residents and I] first talked about doing a litter pick and straight away I mentioned this to some members of [the host organization] and they were saying 'oh we know this person who will lend you the equipment. We know someone who will arrange collection of the waste…' But, we're not allowed to do that. It makes no sense whatsoever."

TCOs reported challenging Locality and RE:generate on this during supervision and training. Locality's response was "to keep following the methodology" and focus on creating new networks in their patches rather than use existing networks. This was reported as problematic as TCOs were using the buildings, office spaces and facilities of the host and other VCS organizations. Yet, they were prohibited from becoming involved in work these organizations undertook in case they were "co-opted". TCOs stated this created uncomfortable working environments for all involved. Host managers responded they did not expect to co-opt TCOs. But, they had (falsely) envisaged the TCOs as a means of bringing of bringing additional resources into a sector suffering austerity and funding cuts. They also imagined the TCOs working less autonomously, building on existing networks and strengthening local community organizations. Not doing

so, they argued, had compromised the survival of both the COP and the local community sector.

TCOs also discussed the ethics of not signposting local residents to existing community organizations. Particularly eye-opening was Locality's chastisement of a TCO for signposting a suspected alcoholic to a local drug and alcohol service. The host managers remarked this was unethical and regularly advised the TCOs "not to struggle with their conscience" and signpost as appropriate. They also claimed it compromised local organizations dependent on new service users to attract increasingly scarce funding. TCO Heather reported frequently "clashing" with Locality for six months on this issue, and added that Locality were "only interested" in local residents forming social enterprises. Through door-knocking Heather met two local residents interested in starting projects; one a French class and the second an additional needs support group. During supervision, Locality advised Heather that both residents should form social enterprises even though "[the residents] didn't want to put in too much time and effort to setting up all that". Heather then informed Locality she had located a local community organization who would allow these residents use their building to run their projects, and offered their charity number to assist funding applications. As this was contrary to the RSLM methodology, Locality insisted that Heather encourage the residents to start a social enterprise. Yet, the empirical findings show no social enterprises were set up in these patches during the training year. TCOs maintained that the local residents encountered did not have the required capacity, i.e. the time, skills or commitment, to develop fledgling projects into social enterprises. They also concluded the COP was not doing enough to build-up such capacity.

Frustrating to the TCOs after so many clashes, Locality's "goalposts changed" at the end of their contract. Locality were now encouraging TCOs to signpost existing VCOs and fledgling projects on to other community organizations and groups for support. The TCOs speculated this was due to community holding teams not forming in these patches. This exasperated the TCOs who had argued throughout the training year that it made more sense for VCOs and fledgling projects to work with existing provision rather than "setting-up social enterprises". This suggests the RSLM methodology was overly fixated on achieving its targets at the expense of an underpinning in sustainable development where its impact would be measured by how many new projects were still running, at least, a year later. This study recommends that RSLM should be less rigid and embrace more traditional community organizing methodologies rooted in capacity building and development.

The fourth element undermining the COP's sustainability was the insufficient training and support for VCOs. TCOs understood the difficulties encouraging residents to become VCOs, especially in poorer areas. Each TCO managed to recruit two or three and were expected to teach

them about community organizing. Since TCOs did not have a full understanding of the method themselves, they felt unprepared for this. Although training for VCOs developed towards the end of the COP and ran in fourteen areas in 2014/15 (Imagine, 2015c), this was not mentioned by the TCOs. In this case study, VCO training consisted of VCOs accompanying TCOs on door-knockings to learn RSLM. None of the VCOs were in direct contact with Locality or RE:generate and were unsure how they could "keep the principles of community organizing alive" after the TCOs' left. TCOs Paula and Heather challenged both Locality and RE:generate why the VCOs did not have "access to the training [we] were getting". They stated they "never received a response".

All VCOs stressed they would not undertake door-knocking and listenings without the TCOs. VCO safety and lack of direction were key concerns:

> "You can't just expect people to walk the streets as volunteers. The safeguardings are paramount to me. But it's not just that, you'd need direction. Which comes from having a structure, like a management type structure in place. Somebody to pass down what the aims and objectives are and how they are going to be achieved. There's no point asking a thousand people what do you think about litter if there isn't a plan of action to follow it up with." (VCO Steve)

In consequence, TCOs reported feeling pressure to continue training the VCOs after their contracts ended. TCO Louise confided that she had "… heard about people who, when they finish their [training] year, have ended up as a volunteer having to support people. I have a problem with that because it's a job at the end of the day". The sustainability of the COP is once again called into question; particularly its short-termism and insufficient capacity building of VCOs. For TCO Paula, building knowledge and expertise requires time and money:

> "But, I think, ultimately for things to be sustainable, like, you've got to pay people to do jobs. We were given a one year contract and that's just not long enough… I'm against this whole idea of like sustaining things by… just lowering all the costs associated to it. I think sometimes things actually do cost money and it means you have to pay people to do things if you want it to carry on. And that is sustainable."

By the end of their training contracts, most TCOs, host managers and VCOs concluded that the Coalition government's commitment to austerity had compromised the sustainability, impact and legacy of the COP. As previously outlined, Locality and RE:generate's original bid specified TCOs

needed *at least* three training years to sustainably learn RSLM and achieve their targets. Academics and participants in this case study have suggested this pledge to austerity put pressure on Locality and RE:generate to also "make-do with less" (see also Bunyan, 2012; Grimshaw *et al.*, 2018). A likely compromise between Locality / RE:generate and the government was the COP's part-funded second year. To progress to second year and become a Senior Community Organiser (SCO), TCOs had to achieve their targets and obtain part-funding from a local VCS organisation for a year. This comprised half their salary or at least a quarter contribution towards the salary and additional payments "in kind". The government would then "match" this. Paradoxically, as previously discussed, the TCOs were encouraged to work autonomously from these potential future employers, thereby lessening their chances of identifying a progression opportunity. This dilemma was also identified nationally (Imagine, 2015a). This was the final element that impaired the program's sustainability.

Host managers recounted increasing pressure to 'find' the TCOs a progression opportunity even though this was not part of their role. Nicky admitted that even obtaining one-quarter of the progression salary was a significant ask as VCS organizations were struggling to locate funding hence "were making staff redundant". RSLM had also excluded these organizations from working directly with the TCOs. Thus, the benefits of having a RSLM-trained, paid staff member were not obvious. Only one TCO 'officially' progressed to SCO. This progression opportunity came directly from their host manager to use both RSLM and more community development approaches. One TCO did not officially progress but worked for another national community organizing program that used a more "ecological approach to community organizing". Remaining TCOs decided either community organizing was not for them or could not obtain sufficient funding to progress. This progression rate is much lower than the national average of 60 percent (Cameron *et al*., 2015). The empirical evidence suggests the RSLM methodology struggled to adapt to this particular local authority and required an additional training year to incorporate more capacity building and development work into its initial stages.

Conclusions

Our case study provides empirical evidence that the COP's problematic understanding of sustainability enfeebled a trailblazing experimentation with state-funded community organizing. Although the program achieved some of its objectives, participants recounted five elements as undermining the program's impact and legacy. First, the COP lacked a coherent, and conceptual, definition of sustainability. It was unclear whether the program endorsed the three pillars of sustainable development, with evidence further suggesting RSLM was not grounded in sustainable development practices committed to longevity. Second, the TCO training contract was too short and required an extension of *at least* one

year to allow TCOs to carry out vital capacity building and development work. Third, the TCOs were discouraged from working with neighboring organizations and networks, and could not signpost local residents to them. This fixation on bypassing existing provision to encourage new projects was reported as compromising the sustainability of the COP and the local community sector. Fourth was the insufficient training, support and resources for the VCOs. Fifth was the TCOs' progression opportunities hindered by an overly autonomous RSLM methodology and severe cuts to public expenditure.

Further analysis establishes these five elements can be reduced to one internal and one external factor. Internally, the COP did not directly engage with sustainable development theory, policy or practice. Whilst the impact indicators outlined in *figure 1* suggest some accountability to the three pillars of sustainable development, this is not explicit in any COP or related documentation. Also, the TCOs never discussed sustainable development as a core component of their training. Whilst the COP's focus on facilitating local leadership is compatible with sustainable development, its problematic assumption that capacity and motivation is solely "latent" in poor neighbourhoods is not. More traditional community organizing and development methodologies appreciate that capacity building needs time, resources and skills. This case study found time and resources to be lacking in the COP. Of the fifteen community projects developed across the patches, the TCOs predicted only three would be "running a year later". This was due to a deficit of capacity building training within RSLM. Instead, RSLM was consumed by achieving its short-term targets; leaving TCOs, VCOs and fledgling projects struggling to achieve longevity.

The external factor was a policy context dominated by austerity. Most participants deduced the Coalition government's covenant with austerity, and the severity of the public sector cuts, had compromised the sustainability of the COP. Locality and RE:generate's original bid was clear that TCOs needed at least three training years to sustainably learn RSLM and achieve their targets. After winning the bid, this reduced to one year and progression was reliant on TCOs locating part-funding from a local VCS organization. Yet, evidence shows austerity reduced the capacity of the community sector by at least one-third (Clayton *et al.*, 2016; Lowndes & McCaughie, 2013). As a result, only one TCO in our case study progressed to second year.

Nevertheless, the gains of the COP should not be overlooked. In this case study, door-knocking, listenings and newsletters all evaluated as successful means to engage with local residents; bringing them together to forge community spirit. This resulted in fifteen fledgling projects developing across the six patches. At a national level, the COP's targets were exceeded and the Coalition government considered it a success (Cameron *et al.,* 2015). Although the

program ended in 2015, several extensions were granted. In 2015, the Office of Civil Society funded a second round of the program for one year at the scaled-down cost of £500 000. But its focus had changed to providing start-up grants of up to £16 000 to community organizing projects using the powers of the Localism Act 2011 (Cabinet Office, 2015). The Company of Community Organisers (COLtd) - formed in 2015 to continue the legacy of the COP – managed this. In 2017, COLtd then secured a further £4.2 million to increase the number of community organizers in England over three years (COLtd, 2017). Based on our findings, we strongly recommend that this extension program is underpinned by a definition of sustainability that engages with both traditional and modern sustainable development theory and practice. These foundations should be prominent in all training materials and explicitly incorporated into the extension program's impact indicators and methodology. Finally, future research on this extension program is vital to establish the long-term sustainability, impact and legacy of the COP.

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ARTICLE

Sustainability as Livability: Two Community Case Studies in East Texas

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"Livability" studies were conducted of two small cities in East Texas, analyzing them from the perspective of the "triple bottom line" (economics, environment, society) used in sustainability. Livability tends to be a lesser known, less threatening term for conservatives than sustainability. This paper provides background on the use of the term livability in place of sustainability, summarizes the two small city livability studies, and makes recommendations for future research.

Introduction

A new research center in sustainable community development began in 2012. The goal was to create a niche program different from other programs in the state, region, or nation. It would address sustainability mostly through the humanities and social sciences, rather than primarily through engineering or natural science disciplines.

The new research center published three anthologies on the human dimensions of sustainability. Named Center for a Livable World, "livability" was chosen as a less contentious term than sustainability, for the purpose of conducting livability studies of small cities in politically conservative East Texas.

The idea was to assist smaller municipalities, typically with limited planning staff, in analyzing their city through the "triple bottom line" of livability/sustainability. The traditional economic development framework of attracting "big box" stores and large industries would shift to a focus on mutually-reinforcing economic, environmental, and social amenities (McMahon, 2011, 2014; Hammer & Pivo, 2017; Savitz, 2006).

The Center conducted livability studies of two small East Texas cities: Kilgore (pop. ~13,000, in 2012) and

Nacogdoches (pop. ~33,000, in 2014-17). This paper provides background on the use of the term livability in place of sustainability, summarizes the two small city livability studies, notes how livability, sustainability, and the triple bottom line were addressed, and addresses concerns for future Center work.

Literature Review

The term sustainable development arose in the 1980s, primarily to insert environmental concerns into mainstream economic development. Commissioned by the United Nations, the Bruntland Report outlined a more expansive view of economic development that raised the profile of environmental (and social) issues to more equal status with economics. Concern for the future is also included in their definition summary: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987).

Critiques emerged from the academic and environmental communities, many bemoaning the retained "mantra" of economic growth within the Bruntland Report, a paradigm seen by many as fundamentally incompatible with environmental and social concerns (Daly &Townsend, 1993; Daly & Cobb, 1994; Campbell 1996).

Starting in the 1990s, businesses began adopting sustainability through the "triple bottom line," an idea that economic, environmental, and social values accrue beyond a purely financial bottom line (Elkington 1998; Savitz 2006). Many firms have since conducted analyses and implemented sustainability measures such as reducing packaging to save costly waste and retrofitting buildings to save on costly energy bills (Hume, 2011).

Triple bottom line performance measures have recently entered the framework of municipal planning, including the comprehensive, 500-indicator STAR Community Rating System (Hammer & Pivo, 2017; STAR Communities, 2016). Examples of the triple bottom line approach also include planning by Salt Lake City in 2011 and the City of Boulder, Colorado in 2007 (The National Association of Regional Councils, 2012).

Triple bottom line efforts have also moved into economic development. Hammer and Pivo (2017) state: "Technically, TBL (triple bottom line) development refers to strong environmental, social, and economic performance, and sustainable development refers to environmental, social, and economic performance that can endure over time. The two terms are often used interchangeably..."

Case studies include a range of development initiatives and projects. One of the more relevant community economic development projects occurred in Newton, Iowa, a town of 15,500, located on Interstate 80 east of Des Moines. Newton lost 3,900 jobs from 2001-2006. An ad hoc council was created by local citizens, which held an open community forum attended by 300. They developed a shared vision and linked with seven counties in a regional development plan (Hammer et al., 2018).

Newton today has 1,100 new jobs, a 39% increase in hotel revenue and $80 million dollars in new property assessed value. Mixing economic, environmental, and social values, the community diversified its economic base by recruiting companies to fit its renewable energy focus (wind and biodiesel) and by converting a warehouse into a community college training center. Local livability assets like preserved historic buildings, parks, and hike/bike trails helped recruit firms (Hammer et al., 2018).

Despite inclusion of business and economic development concerns, sustainability can still be a contentious word in regions dominated by conservative politics. Some sustainability projects have been deemed by citizens to be attacks on freedom, as part of a United Nations conspiracy to control local communities through government planning (Harman, 2015; Trapenberg Frick 2013; Trapenberg Frick et al. 2015).

Municipal sustainability issues in Texas

A "Tea Party" uprising in the Dallas-Fort Worth area derailed a city's sustainability plan after major citizen participation had already occurred in many meetings. Foss (2018) compared the failed sustainability effort with a more successful effort in a smaller Dallas-Fort Worth area city. The smaller city (similar to Cedar Hill, Texas) used ad hoc committee meetings with selected members. This combined with regular, open neighborhood outreach events not specifically focused on the plan.

The larger city (similar to McKinney, Texas) had more open public meetings about its plan, which allowed co-opting by an opposition group. More recent planning documents there no longer contain terms related to sustainability. Foss (2018) suggests future efforts might try to legitimize some conservative concerns and tie the plan to quality of life, a term included in that city's economic development efforts.

Whittemore (2013) observed "Tea Party" meetings in the Dallas-Fort Worth area, reviewed their out-of-state websites and literature, and interviewed local officials who interacted with them. Some actions planners can take to address conservative ideology include: 1) enhancing property rights (through flexible measures such as "up-zoning"); 2) emphasizing fiscal restraint as counter to subsidized sprawl (publicly funded utilities, roads, etc.); 3) critiquing "crony capitalism" when subsidies link with select developers; 4) including single-family homes when discussing increased housing choice; 5) downplaying non-local best practices and jargon; and 6) highlighting local business in redevelopment scenarios, perhaps through business improvement districts. Energy conservation and mobility choice were other areas of possible overlap.

Grodach (2011) studied fifteen cities in the Dallas-Fort Worth area to determine barriers to sustainability among *economic development* practitioners. The literature review stated, in general nationwide, that "while many cities pursue actions related to sustainability, these practices are often piecemeal, are not pervasive throughout city operations, and are subject to controversy and opposition." Methods

included review of economic development documents and interviews with practitioners.

Conclusions highlighted six local barriers: 1) a conventional economic development mindset, which emphasizes economic growth over social and environmental concerns; 2) incentive-based practice, which uses the 4A/B economic development sales tax to drive industry toward lower density, peripheral areas; high energy-use industries can also get reduced utility contracts as incentives; 3) lack of resources and staff, leading to a focus on marketing and information rather than innovative initiatives; 4) economic development pursued in isolation from other associated topics such as workforce development; 5) inter-regional competition for jobs and investment, which reduces focus on regional environmental and social issues; and 6) a lack of coordinated regional planning to address such sustainability issues (Grodach, 2011).

Even in a more progressive Texas city like Austin, which implemented sustainability plans with economic and environmental benefits, results can be critiqued. Long (2016) notes that, after 1990s conflicts, the city's culture and leadership has rallied around principles of Smart Growth and won awards for environmental initiatives that help promote the city's image. However, citing critical geographer David Harvey (1996), both Long (2016) and Tretter (2013) note a lack of social equity in Austin resulting from sustainability initiatives, including "green" gentrification. Social equity and justice is often the lowest scoring component in STAR Community ratings nationwide.

Holman (2014) reviewed sustainability in the context of planning in two larger East Texas cities, Tyler (~ 105,000 population) and Longview (~ 82,000 population), both located on Interstate 20 approximately 100 and 130 miles east of Dallas, respectively. Holman's objective was to analyze sustainability in the context of "hard-to-reach" places, not only away from the cutting edge of progressive planning but where citizens traditionally harbor deep suspicion of government regulation. She reviewed planning documents and meeting minutes and also conducted twenty-five interviews with planners, other municipal staff, active citizens, and long-term residents.

East Texas is a conservative region, illustrated by its Tyler-based congressional representative Louie Gohmert, who has won numerous terms in office. He is characterized as considerably farther to the right than typical conservatives (see GovTrack, 2018). While both Longview and Tyler have a historically oil-based economy, Longview to the east is more blue-collar, while Tyler is more white-collar. Thus, Longview tends to be more skeptical of regulation, while Tyler is more receptive to planning that can address its recent sprawl and related traffic issues (Holman, 2014).

Holman found that, even in more resistant Longview, elements of sustainability were initiated through a simple 2002 comprehensive plan that gave few specifics. Under that context, a historic preservation ordinance and tree ordinance were adopted without use of the term sustainability. The plan showed local

concern about recent piecemeal annexation and sprawl and initiated some receptivity to regulation (Holman, 2014).

Tyler has a long-range plan based on smart growth principles, *Tyler 21*, with a related Unitary Development Code that helped with more specific guidance. Planners and active citizens thought Tyler is a progressive city where residents understood the value of planning. Sustainability as a term was not used in *Tyler 21*, but related elements were adopted more than in Longview, including adaptive re-use, detailed landscape ordinances, and more historic preservation. A key reference for Holman was Tregoning et al. (2002), which cites the ability of smart growth concepts to appeal to "self-interest" rather than "self-sacrifice," thus making it more palatable to conservatives. Smart growth is still a target for many, due to issues such as increased housing costs. "Quality of life" enhancement was another less controversial term used in both cities (Holman, 2014).

Municipal livability issues in Texas

The term livability has been connected with sustainability. A literature review suggests that livability is less focused on environment and has a narrower strategic mission than sustainability (National Association of Regional Councils, 2012). As an example, the AARP Livability Index, developed by a team of academics, consultants, policy analysts, and practitioners, has environment as only one of seven categories; other categories include engagement, health, housing, neighborhood, opportunity, and transportation, which could all fall under the social category in sustainability. Their definition of livability follows (AARP, 2015):

> For some, a livable community makes it convenient to travel by foot, bike, or transit to access nearby stores, parks, and other amenities. For others, affordable housing or open space is more important. Because people look for different things when searching for a satisfying place to call home, measuring the livability of cities and towns across the United States can be challenging. This Index gives higher scores to communities with diverse features that help people of all ages, incomes, and abilities—not just older Americans. Livability is about realizing values that are central to healthy communities: independence, choice, and security. Livable communities help residents thrive, and when residents thrive, communities prosper.

Livability tends to be a lesser known, less threatening term; less tied to top-down, government-led, "green" planning. Yet the 2012 literature review indicates the two terms were used interchangeably by many researchers: "even though livability and sustainability may operate on different scales, both can achieve similar outcomes." A common overlap area incorporates livability as support for sustainability programs. A notable case is the multi-agency (US) Partnership for Sustainable Communities, formed in 2009, which

incorporates principles of livability within its framework. The National Association of Regional Councils (2012) states: "The incorporation of the triple bottom line as a goal of the Partnership's livability efforts…directly ties the two concepts."

Texas examples include the North Central Texas Council of Governments (NCTCOG), which cited the Partnership for Sustainable Communities and its livability principles in its 2011 transportation plan. The Houston-Galveston Area Council (H-GAC) used language similar to the Partnership in its 2011 Livable Centers program, designed to "facilitate walkable, mixed-use places with multimodal transportation options, improve environmental quality and promote economic development."

The Center for a Livable World used the term sustainability in its publications, including three anthologies on the human dimensions of sustainability (Forbes and Trusty 2019, Boring and Forbes 2014, Williams and Forbes 2012). More local research, working directly with city governments in East Texas, has used the term livability. Livability studies were conducted with two small East Texas cities: a pilot project in Kilgore in 2012 and a more expansive project in Nacogdoches in 2014-17.

Kilgore is a city of approximately 13,000, located on Interstate 20 in between Tyler and Longview. It lies about 120 miles east of Dallas and 75 miles west of Shreveport, Louisiana. As the central, oil-based "boomtown" in 1930s Texas, the oil industry is very important to its identity. At one time there were 1,100 oil derricks within its city limits (Chambers, 1933; Clark & Halbouty, 1972; Eason, 1979). Today replica oil derricks dominate the downtown landscape. The oil and gas service industry still dominates the local economy, with Kilgore Junior College (over 5,000 students, home to the "Rangerettes"), satellite communications, some unique retail (such as high-end furniture), and varied manufacturing adding to its diversity (KEDC 2016).

Kilgore was chosen for the pilot project due to its success attracting small industry through its Kilgore Economic Development Corporation (KEDC), in part due to its location on Interstate 20. It also had a pro-active city manager at the time, along with a Kilgore 20/20 Vision Committee citizen planning effort, made up of local leaders.

Issues highlighted before the study included a desire to attract more residents, to help the city become more "livable" and diversify its tax base. Numerous former well sites limited housing development, and many workers lived in larger nearby cities such as Longview. Thus, an externally-financed livability study was of interest.

Nacogdoches is a city of approximately 33,000, located on highways 59 and 259 about 60 miles south of Kilgore and 140 miles north of Houston. Nacogdoches also has a unique historical identity, located on Highway 21, the former El Camino Real connecting Spanish San Antonio to French Louisiana. It bills itself as the "Oldest Town in Texas," based on an early Spanish mission and (later) trading post at the site of a Caddo Native American

settlement (McReynolds 1978). Nacogdoches is likely more diverse/resilient than Kilgore, with animal feed, chicken farming/processing, a university (Stephen F. Austin State, with over 12,000 students), two medical complexes, heritage tourism, and other manufacturing and services playing major roles (Burayidi, 2013; NEDCO, 2016).

Nacogdoches was chosen for the first "full-scale" livability study as it was easily accessible for university researchers and local issues were familiar to them. Issues highlighted before the study included a high poverty rate, a historic downtown slow to redevelop with attractive businesses, and a lack of economic development funds.

Research Question

The main research question is: how can a research center best apply interdisciplinary expertise to small, politically conservative cities to help them enhance mutually-reinforcing economic, environmental, and social amenities, through livability/sustainability's triple bottom line?

Methods

The National Association of Regional Councils (2012, p. 21) states: "livability programs appear highly tailored to the local communities that are responsible for implementing them." The World Commission on Environment and Development (1987, p. 39, item 51) states: "no single blueprint of sustainability will be found, as economic and social systems and ecological conditions differ widely…" Sustainability initiatives can be unique to each community (Wheeler, 2015). Kilgore and Nacogdoches are different and local staff wanted issues addressed that are unique to their communities.

Thus, a flexible approach was applied to the "triple bottom line," addressing the three categories of economic, environmental, and social issues, yet adapting the study to each site in collaboration with local officials. Some methodology is described in the results section under each city. Due to the many surveys, each individual survey's methodology is not described, but can be supplied upon request, and the most comprehensive survey is cited (Szafran et al., 2017).

Some approaches to the triple bottom line address environmental, economic, and equity concerns under the "Three E's" framework (Long, 2016; Tretter, 2013; Campbell, 1996). This framework was not chosen, partly due to the political connotations of equity, but also because researchers were not as familiar with this format. However, equity concerns were addressed under the general social category, especially with respect to Nacogdoches and its poverty issues. Another alternative term for the triple bottom line, 3Ps (people, planet, profit), is closer to the format used here (Hammer & Pivo, 2017).

Several key livability/sustainability indices have emerged both during and after the two livability studies, such as the AARP (2015) Livability Index, the Triple Bottom Line (TBL) Tool (Hammer et al., 2015), and the Sustainability Tools for Assessing and

Rating (STAR) system (STAR Communities 2016). Although the AARP index is partially age-related, the TBL Tool is on hiatus, and the STAR system is time-consuming, the frameworks still provide guidance on the three topics. Efforts are made to address how the methodology/results of this study fit within those three sets of standards.

Results

Kilgore Livability Study

The Center for a Livable World conducted its first (pilot) livability study in Kilgore, Texas, from January to December 2012. The Center drew from expertise in diverse academic programs such as economics, health sciences, geography, government, history, and social work. Financial support (~$10,000) for this pilot project was provided by IHS, Inc. and The Cynthia and George Mitchell Foundation.

The pilot project coincided with a citizen planning effort, termed the Kilgore 20/20 Vision Committee, which sought to enhance diverse aspects of the City of Kilgore over the next 5-10 years, including annexation to include the I-20 area, retail attraction, residential livability, and other amenities.

Nine study areas follow, with three in each of the "triple bottom line" categories. Several of the study areas were selected to respond to specific interests of the city manager, including (under economics) revolving loans, realtor survey, and (under society) a citizen survey about city services. The city manager and staff actively participated in these parts of the livability study.

The other six study areas were chosen through various academic disciplines. All nine study areas fit within categories of the AARP Livability Index, Triple Bottom Line (TBL) Tool, or STAR Community Rating System. Results one year after the project (December 2013) are summarized for each study area:

1) *Economics - a revolving loan study*. Housing is an important component of both the livability, TBL, and sustainability indices. Housing affordability would theoretically increase with increased housing supply, dropping prices. The city manager had interest in a revolving loan fund to support housing developers, thereby attracting more residents. Revolving loan funds create investment capital that renews by placing returned principal, interest, and fees back into the fund. Such funds are often created by a combination of federal/state grants and private institution or nonprofit funds, for specific public purposes (e.g. housing, environmental cleanup, energy efficiency, small business). This study suggested the City establish a revolving loan fund following basic steps in the report.

One-year follow-up results - the revolving loan fund was then created as a resource for home developers. Two large projects, a 30-unit and 64-unit development, utilized the fund to pay infrastructure costs. The City of Kilgore did the infrastructure work and the developer paid the City back *pro rata* as homes were sold. After the first year, the $1.5 million fund was largely tapped out, with about $150,000 paid back.

2) *Economics - a survey of realtors on perceptions of Kilgore livability*. The city manager had an interest in surveying realtors about Kilgore livability, since many reportedly send prospective residents to nearby cities instead. Forty-nine respondents indicated: a) the biggest deterrents to locating in Kilgore are lack of available homes (47%) and properties (47%), poor schools (37%); and lack of shopping (30%), healthcare services (28%), job opportunities (26%), and dining options (26%).

One-year follow-up results - the City started a GIS inventory of potential housing developer properties and constraints to assist builders. The survey was shared with developers and the school district, which stimulated respective responses.

3) *Economics - a location quotient assessment to analyze local economic diversity*. Economic diversity plays an important role in resilience of local economies. It receives some emphasis in the TBL and sustainability index, but far less in the livability index. Location quotient was analyzed to identify what sectors provided a higher or lower proportion of county employment than the national average. Unsurprisingly, oil and gas support firms and (to a lesser degree) manufacturing and construction created the largest sectors. Adverse shocks to these economic bases that pull in money from outside the region can have a disproportionate impact. Underrepresented sectors included information technology, management/finance, insurance, and large retail. These service economy sectors, if able to access a customer base, can also pull in money from outside.

One-year follow-up results - This assessment was not really used to attract underrepresented sectors. The Kilgore Economic Development Corporation tends to work on recruiting/supporting secondary sector industries. The City's simultaneous contracted study by the Buxton Corporation, a specialist in retail location analysis, also included location quotients. That study attracted site visits by a national store and major restaurant chain, yet trends towards online sales are making retail a less attractive development tool.

4) *Environment - a walkability assessment*. Walkability is a common goal for livable communities. It can increase health, reduce polluting vehicles, and enhance downtown business. Walkability is in three of seven livability index categories and is also in the sustainability index. The web-based Walk Score, sometimes used in the TBL index, indicated Kilgore scored higher overall than cities such as Austin. A field study, using a survey (PBIC 2018) applied in several parts of the city, found generally lower scores in neighborhoods. Kilgore is a "somewhat walkable" community with a clustered downtown, stores/amenities, and a nice park system. Walkability could improve through safety, aesthetics, and connectivity. Funding sources were given for trails, sidewalks, etc.

One-year follow-up results - A year later a sidewalk and bike lane plan was being developed for City streets. Two large projects were underway that incorporate sidewalks/bike lanes: a) adding/rehabilitating sidewalks in a

residential area close to downtown; b) $600,000 in three new road projects with associated sidewalks/bike lanes.

5) *Environment - an assessment of trail opportunities*. Access to parks and recreation is covered under two of seven livability index categories. Short trails within individual Kilgore parks are popular. Nearby Longview purchased floodplains decades ago, allowing longer, linear trails with greater health benefits. Easements may be acquired, but grant programs may not fund facilities on easements, requiring City bond measures. A large loop trail was proposed from Meadowbrook Park north to the annexed area on I-20, back downtown and east back to the Park. A leg was also proposed south to the new school complex along with an extension from I-20 to the Sabine River.

One-year follow-up results - A city-wide proposed trail map was presented to the City Council. A grant application was submitted to the Texas Parks and Wildlife Department for $195,000. $350,000 was also requested from the Economic Development Corporation to partner with $100,000 of City funds to acquire a key 75-acre bottomland property north of Meadowbrook Park. These efforts would facilitate a two-mile section of 10-foot wide concrete, multiple-use trail running north-south through the heart of town. A two-mile section of mountain bike trails was also mapped out on the north end of town.

6) *Environment - Ecosystem services and habitat corridor (greenway) opportunities* The dollar value that nature's services provide is an obvious area of overlap between economy and environment. It is addressed in the TBL and sustainability indices, but not in the livability Index. The highest ecosystem service values are typically in urban flood storage capacity. Bottomland habitats slow storm water runoff that would otherwise necessitate expensive flood control structures. Based on assessments in other Texas cities, Kilgore's bottomlands could save nearly $3 million per year in flood control structure costs (American Forests, 2000, 2006). A habitat map was provided.

One-year follow-up results - Efforts to create trail opportunities coincide with floodplain/greenway protection, such as purchase of the 75-acre property and the mountain bike trail, both of which will engage citizens with bottomland forests.

7) *Society - A report on Kilgore school district programs*. Good schools not only prepare the local workforce but attract business. It is covered in the sustainability index but received low emphasis in both the livability and TBL indices. Kilgore ISD staff were interviewed and the district's webpage, TEA reports, and board minutes were reviewed. Among the findings: 100% of teachers were highly qualified; the decreasing dropout rate was below the state average; the district won a Readiness Award in 2011; a home liaison was established to help with parent involvement; attendance exceeded the state average; and most scores on standardized tests were either at or slightly above the state average. Several staff suggested Kilgore ISD is the "best kept secret in Gregg County."

One-year follow-up results - A new superintendent came with aggressive new

district goals. A follow-up was planned to see how valuable the project report was.

8) *Society - A citizen survey on livability and city services*. Governance is a key aspect of the TBL and sustainability indices. Various city services align with key amenities in the livability index. The city manager wanted to get feedback on city services. A survey was sent in June water bills. The 346 responses did not provide a rigorous, representative sample of the population but still provided valuable feedback. Findings include: general satisfaction, with 91% satisfied with living in Kilgore, 90% consider the city safe, 74% satisfied with responsiveness of City government, 79% satisfied with traffic control, 76% satisfied with local sense of community, and 62% satisfied with recreational opportunities. Highest spending priorities were streets (94%), water and sewer (87%), healthcare facilities (87%), and attracting large retailers (70%); high satisfaction existed with the Main Street Program, Kilgore Economic Development Corporation, curbside recycling, park appearance, and natural areas; more shopping and dining are needed (50% of discretionary funds were spent in Kilgore, 30% in Longview).

One-year follow-up results - The mayor used this survey in election efforts, as it indicates 91% of citizens are satisfied with City services. It was also used to set priorities on projects, as citizens indicated their highest priority was street improvement, which the City was working on. Another high priority for citizens was water and sewer improvements – in response, an $8 million water project was to be completed.

9) *Society - Reports from focus groups held with diverse local citizens.* While all three indices address social services, only the sustainability index specifically covered minority groups. Focus groups were held with a) local social service providers; b) employees at a small local business; c) a church of mostly white members; d) a church of mostly black members; and e) Hispanics, the latter through informal surveys.

a) Local service providers brought up limited financial resources for local non-profits; lack of reliable transportation for certain groups, which endangered health needs; limited access to mental health services; lack of engaging opportunities for ages 15-18; absence of skilled volunteers; a weak networking system among local agencies; a limited pool of available housing and home repair resources, and lack of a homeless shelter. They considered community support for non-profit organizations adequate; low crime rates could be attributed to an active police department and a neighborhood watch program.

b) *Employees at a small local business* noted activities are offered that promote involvement, including Main Street concerts, a Shakespeare Festival, Pump Jacks, and Downtown Days. Community familiarity promotes a sense of safety and improved services. Lack of housing causes some workers to live elsewhere, losing business from income earned locally. Kilgore benefits from proximity to larger cities, allowing residents a "small town"

atmosphere, while enjoying big city amenities; goods and services are less expensive, lessening financial strain; a revived spiritual/emotional well-being improves quality of life; a commitment to buy locally increases sense of reciprocity.

c) *Predominantly white church members* expressed high overall satisfaction, with services, jobs, and housing in close range, which positively affects quality of life. Members feel safe because of familiarity, but a "transient" population brought some insecurity. Volunteer options are many, creating outlets for individuals and reciprocity among members. Many options exist for children to succeed, adding to parents' sense of satisfaction. A large wage discrepancy exists for men and women with a high school education or lower – an example is oil field work available for men but not for women. Members were concerned about future housing and workforce for the oil industry.

d) *African-American church members* suggested spirituality has been the community's anchor, especially for rural elderly; this was the key to enhancing quality of life. Members believed social injustice and discrimination remain sensitive areas for African Americans, which negatively affects their quality of life. Resentment and lack of forgiveness may create division among races and are certainly impacting equal access to services; yet social capital and cultural diversity are major assets. More interactions could foster solidarity among groups. More cooperation among churches could help the elderly with depression/isolation. More school/organization social workers could offer services more sensitive to needs of the African American culture A study on African American males could help understand their needs. Schools/churches could teach youth farming.

e) *Hispanic community members* were surveyed. Four recent migrants (day-laborers) indicate Kilgore is a decent place to live but without work they will move to bigger cities. Many lack transportation and private quarters, lack food when there is no work, and lack electricity and entertainment when no one works. Two long-established immigrants (15 years) like the tranquility but lack fresh foods. They miss Mexico but not the danger. There is generally little work for females, yet most locals are friendly.

One-year follow-up results - The City has not done much with various focus group input as it is up to social service agencies to take the lead on such recommendations. The City is continuing Neighborhood Watch and other community policing not related to the study. Community activities mentioned as positive aspects are also continuing.

A recent, supplementary result came from use of the web-based AARP (2015) Livability Index, which rates communities instantly based on algorithms tied to publicly available data sources. Kilgore scored 49, based on a national average of 50. Of eight categories, higher scores were in opportunity (inclusion, possibilities) at 61, housing (affordability, access) at 56, environment (clean air, water) at 55, and transportation (safe, convenient options) at 54. The high housing score was surprising – the index may include housing in nearby

cities such as Longview. Lower scores were in health (prevention, access, quality) at 22 and neighborhood (access to work, life, and play) at 42.

In summary, study recommendations each reinforce more than one of the three "triple bottom line" categories. An example is walkability/trails, which supports greenways (environment), attracts residents (economics), and fosters social interaction and health (society). Publicizing ISD programs fosters community pride (society), leads to more qualified workers (economics), and attracts residents (economics).

The Kilgore city manager believed the Center for a Livable World's livability study provided strong justification to get things done that citizens could not get done beforehand. Out of a long list of possible project areas, the study, along with efforts of the Kilgore 20/20 Vision citizen planning group, helped identify what is most important. It helped greatly that the Center report was shaped around identified needs of the City. The study helped provide buy-in for important, large projects. Many positives also came about through initiative of City of Kilgore staff and citizens. Although the city manager is not sure he would have funded such a study, the pilot project was viewed as a success.

Nacogdoches Livability Study

The Center for a Livable World was awarded a $35,500 contract by the City of Nacogdoches in fall 2014. The objective was to enhance the community's ongoing efforts to improve quality of life. As in the Kilgore pilot project, issues were addressed under the economic, social, and environmental "triple bottom line" framework. However, more expansive survey techniques were used here to determine issues and related projects.

Phase One

The study was divided into two phases. The first phase included review of previously commissioned studies; existing data; and academic literature. Three opinion surveys and eighteen focus groups were also conducted. Faculty then constructed a related "menu" of initiatives and project options for City leadership to prioritize.

Previously commissioned studies included a 2003 comprehensive plan, main street plan, two retail reports, and four tourism studies. These studies, while valuable in recommending action such as downtown revitalization, business attraction, and tourism direction, did not fully clarify implementation methods (Phase Two was to address this).

The Center also gathered local demography from the census, business activity from the Nacogdoches Economic Development Corporation, real estate market analytics from Charles Pool Real Estate, and school performance from the Texas Education Agency. Data show areas of stress (poverty, racial segregation, weak retail market) and accomplishment (wide medical access, low unemployment rate, broad education options).

Academic literature on community development revealed a movement away from big box stores to downtown "place-making" and local entrepreneurship (Artz

& Stone, 2011; Lambe, 2008; Markuson, 2006; McMahon, 2011, 2014; Murray, 2011).

Three audiences were surveyed: the community at-large, university students, and faculty. Each survey instrument was different in terms of format and questions because the audiences were sufficiently unique and only marginally overlapped. Extraordinary effort was devoted to soliciting participation of minority segments of the population to achieve a representative sampling of community-wide interests (see Szafran et al., 2017).

Survey results provided two sets of information about community attitudes: (1) existing strengths and weaknesses of the City - higher ranking *strengths* included (in descending order) religious life, downtown, (low) crime, recreation, appearance of city, and health care; lower ranking *weaknesses* included (in ascending order) shopping, entertainment, new businesses, job opportunities, public transit, and public schools; and (2) aspects of community life that matter most to residents – top ranking aspects included crime, job opportunities, health care, traffic flow, restaurants, and city appearance.

In contrast, focus groups delve deeper into the beliefs and attitudes of individuals than an opinion survey (Green 2015, Vincent 2015). The focus groups included discussion by a small set of individuals (6-12), guided through pre-determined questions by a moderator – what are community assets and issues, and what projects might best address the issues? Eighteen gatherings were assembled: retail business operators; service sector employers; retirees; African-American community; Hispanic community; recently hired faculty members; long-term faculty members; public school teachers; public school parents; artistic community; religious leaders; heritage tourism operators; heritage tourism public at-large; health care practitioners; bike-pedestrian enthusiasts; natural heritage experts; parks, trails, garden enthusiasts; and community resilience activists.

A list of initiatives, based on literature, focus groups, and surveys, was provided under the three categories: economic, environmental, and social, in summer 2015. Initiatives, each with a list of short-term/long-term project options (total 101), included:

Economic - Initiative #1: Ensure the local climate supports business development. Initiative #2: Develop policies that attract/retain types of businesses that are drive economic development. Initiative #3: Identify and leverage local comparative advantage.

Environmental - Initiative #1: Beautify entry corridors into the City; Initiative #2: Expand sidewalk network and create a bike lane network; Initiative #3: Promote natural history and eco-tourism (see Forbes et al. 2007); Initiative #4: Grow and improve trail system; Initiative #5: Encourage energy efficiency and reduce waste and sprawl.

Social/Cultural - Initiative #1: Revitalize downtown by making it a destination for arts and arts-related business; #2: Connect to the El Camino Real National Trail; #3: Create linkages between university arts and local cultural offerings; #4: Cross promote, bundle events and

tourism services; #5: Develop/market financial incentives for cultural and heritage development; #6: Encourage development in minority neighborhoods.

Three over-arching issues

Three *over-arching* areas emerged outside of the triple bottom line categories:

Workforce: Surveys, focus groups, and economic data highlight the need to address the high poverty rate and low-skill workforce. It is a community-wide problem requiring sustained, inclusive (rather than piecemeal) efforts, involving key actors.

"Town-Gown" relations: the local university is a leading employer; faculty and students are a large part of the population; and spending by the university and its personnel are a major economic engine. Fostering "town-and-gown" interaction can include: service learning, service provision, faculty involvement, student volunteerism; and applied research to address local problems (Martin, Smith, & Philips, 2005; Curwood, Farrar, & Mackeigan, 2011; University of Minnesota, 2018).

K-12 Education: Surveys and focus groups noted discipline is undermining education, a national issue (Maryland State Board of Education, 2012). Frequent rotation of leadership (superintendents, principals, etc.) is also preventing implementation of change. Performance on state-mandated tests is making the community an undesirable relocation destination for families and businesses (Weiss 2004). Research indicates school principals are key to performance, rather than school systems (Perry and McDermott 2003; Miller 2015). A study was recommended to look at three school districts isolated by the Texas Education Agency that mirror NISD in rural context, poverty rate, minority student body—yet perform well on standardized exams.

Another, more recent supplementary result came from use of the web-based AARP (2015) Livability Index, which rates communities instantly based on algorithms tied to publicly available data sources. Nacogdoches scored 46, based on a national average of 50. Of the eight categories, higher scores were in housing (affordability and access) at 63 and environment (clean air and water) at 56. Lower scores were in health (prevention, access, and quality) at 32 and opportunity (inclusion and possibilities) at 37.

Phase Two

Phase Two of the livability study was to focus on *how* to implement prioritized options, including funding sources. Yet response to Phase One was not immediate in summer 2015, with concern over negative survey results and the K-12 education issue. City staff surveyed citizens again, electronically, to help prioritize the 101 project options. Over one year later (autumn 2016), a list of priority projects emerged, with new project categories and options, several tied to existing City plans (such as a food truck ordinance and parks plan). Many of these overlap with categories in the livability, TBL, and sustainability indices. However, the triple bottom line format was removed with environment minimized. A related action plan was developed in spring 2017:

Economics – Formulate a plan to target small business growth and fund it by finding local investors; Build financial literacy services and alternate financing options to support business creation; Review City food truck ordinance to make operation easier. Small business development and economic literacy receive strong emphasis in the TBL and sustainability indices, but less in the livability index.

Arts and Culture – Formulate a plan to restore downtown along the lines that mirror the Nacogdoches brand and accentuate small town charm. Designate downtown as an official Texas Cultural District and create a community music series. Arts and culture get strong emphasis in the livability and sustainability indices, and some in the TBL tool.

Tourism – Develop regional tourism where Nacogdoches is the "hub" for smaller destinations; Develop tourism itineraries, maps, and guides; Create eco-tourism package deals combining outdoor activities. Surprisingly little emphasis is given to tourism in the three indices, despite potential for ecotourism to overlap with business and environment.

Built Environment – Create a complete streets master plan for the City, with priority sidewalk and bike lane routes; Create a parks/trails master plan; Pass a flexible sidewalk ordinance that will encourage more sidewalks at new developments. The term "built environment" is one of eight categories in the sustainability index, while parks, walkability, and access are highlighted in the livability index, but less so in the TBL tool.

Several implementation meetings then occurred between City planning staff and Center leadership. Much downtown redevelopment, once a priority, is severely challenged by historic structure renovation costs. A South Street business/beautification initiative became a priority for remaining study funds, as it could build on existing business initiatives (many Hispanic) and tie that transportation artery to the historic downtown, acting as an impetus for entrepreneurship and development. South Congress Street in Austin was suggested as a model. Debate emerged over this shift in focus.

Center leaders have many other university duties and had a desire to efficiently complete the project. Many prioritized options were already being handled by City and CVB staff. With more delays on the horizon, it was decided to return remaining study funds (~$25,000) to the City so they could implement initiatives more efficiently.

Discussion

The research question was: how can a research center best apply interdisciplinary expertise to small, politically conservative cities to help them enhance mutually-reinforcing economic, environmental, and social amenities?

Feedback from city staff, though somewhat limited, can help answer the question. The Kilgore pilot project was considered a success by their city manager. It supported several emerging city initiatives, occurring in all three areas of the

triple bottom line. However, it was externally financed. The city manager indicated that he would not likely use city funds to pay for such a study. Also, issues with social services were outside the duties of the city government, so they were not addressed in implementation.

City staff in Nacogdoches had several valuable critiques. A first project "update" meeting was deemed unnecessary by one staff person, which led to the next update being given when Phase One was complete. More regular "check-ins" were later suggested by another staff member. Erring towards more updates is probably advisable.

City staff were also concerned with valid public representation in the focus group format, with attendances ranging from six to twelve. A more open meeting format was suggested after the fact. This could have resulted in project shut-down by conservatives, as described in the literature (Foss 2018). The citizen survey, representative of different ages, incomes, and ethnic groups, could be a replacement (Szafran et al. 2017). It allowed for comments but not open discussion. Results contained lower ratings from minorities.

The K-12 school issue was not something city staff were charged with fixing; a more private discussion could have lessened controversy. Another critique was a lack of funding sources provided to the resolve some issues. As an example, linking SFA alumni with investment to revitalize downtown did not materialize, disappointing some city staff.

Center leaders were dismayed by the one-year delay between submitting Phase One and beginning Phase Two. After submitting a draft of Phase Two, another delay was perceived, which made most (not all) of them want to end the project. One Center advisory group member suggested the Phase One report itself could be worth up to $100,000 (about $10,000 had been spent). Center leadership felt under-appreciated.

Two important lessons emerged from the City-Center relationship. One was about the *presentation* of community issues. An asset-based community development approach may have reduced some of the negative reactions. The approach emphasizes existing community assets (strengths) first, creating a positive "snowball" effect, with weaknesses not ignored but dealt with later (Kretzmann and McKnight 1993; Haines 2015).

A second lesson was about *prioritization* of community issues and potential projects. The city took a year to prioritize proposed projects, partly to poll citizens. Yet some prioritization was already done through focus groups and surveys, and the city council represents locals. The triple bottom line prioritizes economics, environment, and society equally. Yet the city poll results did away with this *foundation* of the study. Minorities (by definition) are less likely to dominate surveys that prioritize projects. The Sustainability Tracking and Ratings System (STAR Communities 2016) has a comprehensive framework of 7 goals, 45 objectives and 500+ outcome and action measures. Social equity and justice are often the lowest scoring STAR components. Future studies might prioritize a project for

each group and ensure each is implemented.

Environment/nature can also often be left without a voice. The main impetus behind sustainable development was a need to put environment on more equal status with economy. As Leopold (1949) stated…

> The first ethics dealt with the relation between individuals…Later accretions dealt with the relation between the individual and society…There is as yet no ethic dealing with man's relation to land and to the animals and plants that grow upon it…The extension of ethics to this third element is…an evolutionary possibility and an ecological necessity.

Community development can be a complex field, fraught with issues such as social capital, power relations, integration of disparate concerns, and personal one-on-one relations (Hustedde, 2015, LaChappelle, 2015). Habermas' (1987) communicative action theory offers a bridge between "rational" technological expertise and the everyday *lifeworld* of community members, through continuous dialogue. Extending discussions beyond project timelines may yield more understanding and shared vision.

Comprehensive, holistic planning is typically preferable to piecemeal efforts (Grodach, 2011; Holman, 2014). This may suggest continuing such efforts to help cities under the triple bottom line planning format, but the immense effort put into Phase One may have been unwarranted. The format was eventually undone by the city for Phase Two, although some suggested projects still overlapped with two or three categories.

Conservative politics did not seem to play a major factor in the implementation of either the Kilgore or Nacogdoches study. This could have been due to less open public input formats, or the less controversial term livability in place of sustainability (Foss 2018). Holman (2014) notes progress in some measures of sustainable development in two conservative East Texas cities without use of the sustainability triple bottom line, simply due to some acceptance of planning. Nacogdoches may eventually have to follow the example of Tyler, if a new Interstate 69 brings significantly more growth as expected.

Holman (2014) and Whittemore (2013) both cite energy conservation as a possible area of overlap between conservatives and sustainability planning. Alternative energy development was also cited as a key strategy in the example of Newton's revitalization under the triple bottom line in Iowa, a conservative state (Hammer et al., 2018). The topic did not gain much traction in discussion with the oil-based city of Kilgore, but wind and solar prices were higher in 2012.

Future such triple bottom line livability studies might expect: a call to include existing City initiatives in recommendations; skepticism among minorities that City initiatives will benefit them; and defensive reactions to negative survey results.

Based on mixed results in both Kilgore and Nacogdoches, the Center for a Livable World will consider a change in focus (and name) to address how specific sustainability initiatives can be implemented in small cities. Center leadership is assisting two local non-profits in applying for grants to offset energy bills with solar panels.

A Center for Sustainable Community Development or Center for Community Sustainability Initiatives would see how such projects would fit under existing comprehensive (or other) plans, then more efficiently assist in directly implementing such energy initiatives. This would combine with new service-learning study abroad courses, working on ecotourism initiatives in villages bordering nature reserves, to foster high-impact learning experiences and outcomes for both students and community members.

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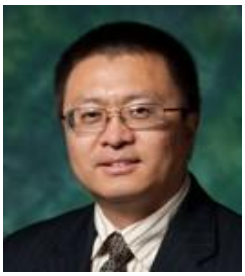
ARTICLE

Application of nanotechnology in water and wastewater treatment: A short review



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The world is facing formidable challenges in meeting rising demands of clean water. Providing clean and affordable drinking water is one of the modern-times challenges. The article briefly reviews the recent advances and application of nanotechnology for wastewater treatment. Nanomaterials have high reactivity, large specific surface area, and size-dependent properties which makes them acceptable for applications in wastewater treatment and for water purification.

Introduction

According to World Health Organization, 884 million people lack access to adequate potable water and 1.8 million children die every year from diarrhea mainly due to water contamination. The world is facing formidable challenges in meeting rising demands of clean water as the available supplies of freshwater are depleting due to extended droughts, population growth, more stringent health-based regulations and competing demands from a variety of users (U.S. Bureau report 2003; EPA, 1998; WHO, 1996).

Most manufacturing processes generate large volumes of polluted wastewater. The specific pollutants present in industrial wastewater depend on the manufacturing process and can include specific organic constituents, high salinity, heavy metals, extreme pH, and high turbidity from inorganic particles. The occurrence of new/emerging microcontaminants (e.g., endocrine disrupting compounds (EDCs)) in polluted water/wastewater has rendered existing

conventional water/wastewater treatment plants ineffective to meet the environmental standards. These chemicals can create problems with development, behavior and reproduction in a variety of species. Biological treatment systems such as activated sludge and biological trickling filters are unable to remove a wide range of emerging contaminants and most of these compounds remain soluble in the effluent. Physicochemical treatments such as coagulation, flocculation, proved ineffective for removing different EDCs and pharmaceutical compounds. Chlorination only provide residual protection against regrowth of bacteria and pathogens. Ozonation has been a less attractive alternative due to expensive costs and short lifetime. Some advanced treatments like ultraviolet (UV) photolysis and ion exchange are not viable alternatives for micro pollutants.

Twenty-first century has brought to the water sector exciting new opportunities associated with nanotechnology. 'Nano' is derived from the Greek word for 'dwarf'. The high surface area to mass ratios of nanoparticles can enhance the adsorption capacities of sorbent materials. Nanotechnology is a deliberate manipulation of matter at size scales of less than 100 nm (Fig.1) in at least one dimension meaning at the level of atoms and molecules as compared with other disciplines such as chemistry, engineering, and materials science.

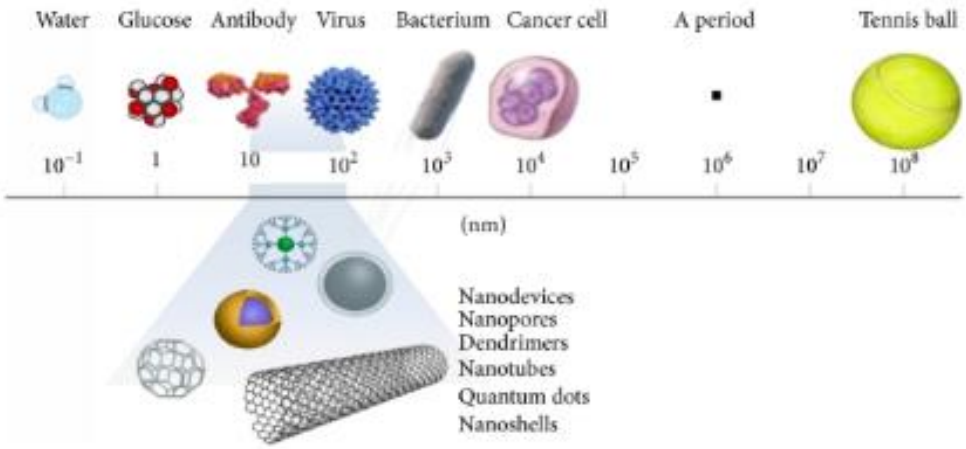

Figure 1: A size comparison of nanoparticle with other larger-sized materials

Through control over material size, morphology and chemical structure, nanotechnology offers novel materials that could endow some water treatment systems that enhance treatment cost-efficiency.

Zero-Valent Metal Nanoparticles:

As a good antimicrobial agent, silver nanoparticles have been widely used for the disinfection of water. In recent years, AgNPs have been reported to be able to adhere to the bacterial cell wall and subsequently penetrate it, resulting in structural changes of the cell membrane and thus increasing its permeability. Even the incorporation of nAg into polymer materials have also shown microbial

properties against *E. coli* and *Salmonella entrica*.

In recent years Fe, Zn, Al, and Ni are some zero-valent metal nanoparticles, which are used in water pollution treatment.

Metal Oxides Nanoparticles

Titanium oxide (TiO_2) Nanoparticles

Among the existing adsorbents nanosized metal oxides, TiO_2 is classified as one of the promising oxides for pollutant's removal the most exceptional photocatalyst due to its high photocatalytic activity reasonable price, chemical and biological stability. Besides, TiO_2 NPs show little selectivity and thus are suitable for the degradation of all kinds of contaminants, such as chlorinated organic compounds, phenols, pesticides, arsenic, cyanide, and heavy metals. The photocatalytic properties of TiO_2 NPs can kill a wide array of microorganisms, such bacteria, fungi, algae, protozoa, and viruses.

Zinc oxide Nanoparticles (ZnO NPs)

In the field of photocatalyst candidate in water and wastewater treatment because of their unique characteristics, such as direct and wide band gap in the near-UV spectral region, strong oxidation ability, and good photo catalytic property. ZnO NPs are not only environment-friendly they are compatible with organisms which makes them suitable for the treatment of water and wastewater.

Iron Oxides Nanoparticles

Magnetism is a unique physical property that independently helps in water purification by influencing the physical properties of contaminants in water. Iron oxides nanoparticles, in recent years iron oxides nano particles is used for the removal of heavy metal due to their simplicity and availability. Magnetic magnetite (Fe_3O_4) and magnetic maghemite (γFe_2O_4) and nonmagnetic hematite (α-Fe_2O_3) are often used as nano-adsorbents due to their simplicity and availability. Laboratory investigation indicated that iron oxide NMs could effectively remove a range of heavy metals, including $Pb^{2+,}$ $Hg^{2+,}$ $Cd^{2+,}$ and Cu^{2+} and organic contaminants.

Carbon nanotubes

Carbon nanotubes are one of the allotropes of carbon and has diverse application in wastewater treatment due to their exclusive properties like large specific area, fast kinetics and selective towards aromatic compounds. Carbon nanotubes are graphene sheets rolled up in cylinders with diameter as small as 1nm. CNTs can be classified into two types (Fig. 2) Multiwalled carbon nanotubes (MWCNT) Is comprised of multiple layers of concentric cylinders with a spacing of about 0.34 nm between the adjacent layers, and single-walled carbon nanotubes (SWCNTs), which consist of single layers of graphene sheets seamlessly rolled into cylindrical tubes. The use of CNTs as a catalyst is also reported for wastewater treatment due to their mechanical strength, mesoporous nature, and large surface area.

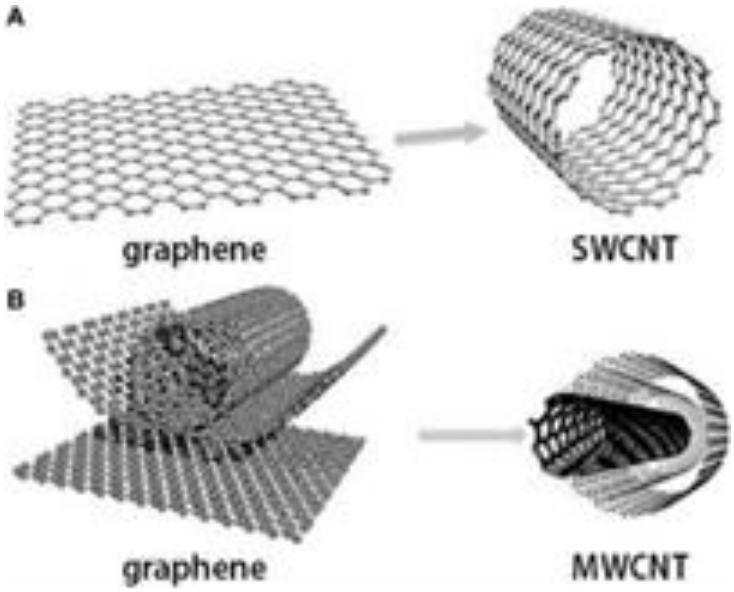

Figure 2: Classification of carbon nanotubes [A] Single walled carbon nanotubes [B] Multi-walled carbon nanotubes.

Extensive studies have reported both MWCNTs and SWCNTs have been applied for the removal of contaminants in water like organic, inorganic, and biological contaminants including heavy metals, radionuclide and organic dye.

Membranes and membrane processes

Nano Filtration (NF) Membranes

NF membrane is a type of pressure driven membrane with properties between reverse osmosis and ultra-filtration membranes and can be utilized ground surface and waste water treatment. Nano filtration has been used to treat ground water having relatively low TDS (total dissolved solids) and high total hardness and color. Studies were conducted to remove pesticides, micro pollutants, arsenic and multivalent anions from ground water successfully. NF is a reliable surface water treatment as the surface water keeps changing according to seasons. Removal of pollutants from a water of pH 7-9 was achieved implying that the pH adjustment of water prior to treatment is not required as well as bacteria Bacillus subillus was removed from surface water.

In the last two decades, the development of polymeric and ceramic membranes has positively impacted on the use of membranes. Porous carbons have a great potential in adsorption and in membrane synthesis for water filtration as they are considered as "molecular sieve materials". Those filters were re-usable, sustainable and showed effective removal of bacterial pathogens (Escherichia coli and Staphylococcus aureus) and Poliovirus Sabin 1 from contaminated water.

Conclusion

Nanotechnology is a very promising area that can show the wastewater treatment a

new dimension. The use of nanotechnology in wastewater treatment holds the promise of transforming many of these processes by lowering the treatment cost and offer great potential for 'point of use' systems.The challenge of the growing nanomaterials industry is to ensure that this novel technology emerge as tool mitigating risk to environmental and public health and enable sustainable water management.

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ARTICLE

Postmodern Prometheus
A Discourse Analysis of Energy Dominance

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The administration of President Donald Trump is pursuing a policy agenda of "American energy dominance," which entails the promotion of fossil fuel extraction, use, and export. Administration officials and supporters often defend energy dominance on the grounds of national security and economic prosperity, but they also justify their energy policies in environmental terms. In this paper, we use discourse analysis to examine the ways in which the administration frames energy dominance from an environmental perspective. They appear to use what John Dryzek calls the Promethean discourse, but this is complicated by the administration's climate change denial, which calls into question the very notion of a discourse. We use two case studies to illustrate how energy dominance is described and justified. We conclude with a discussion of wider implications about climate, science, media, and democracy.

1. Introduction

Life in the United States, like any industrialized nation, depends on high-energy inputs. Developing, processing, and transporting energy in turn relies on complex social and technological networks. Managing those networks could broadly be construed as the province of US energy policy, which covers an enormous and diverse terrain. We can carve that territory in a variety of ways, with perhaps the crudest division being that between public (governments) and private (markets). On the private side, any number of further divisions could be made, say, between different kinds of companies or between individual consumers. On the public side, the main actors are local (municipal), state, and federal governments.

The federal government, then, is not all-powerful when it comes to energy policy. This is especially so in the largely market-driven US compared with countries that have nationalized mineral

resources and state-owned energy companies. Non-national US actors can have big impacts. For example, in the face of the Trump administration's planned withdrawal from the Paris Agreement on climate change, multiple non-federal actors (cities, states, and businesses) reaffirmed their commitments to helping the US achieve its Paris climate goals. If these non-federal entities were a country, their economy would be the third largest in the world (America's Pledge Initiative on Climate, 2018).

Nonetheless, the federal government does exercise a great deal of influence over the direction of US energy policy. It does so in a variety of ways, including research and development, environmental regulations, federal land and water leasing, subsidies and other budgetary decisions, general foreign and economic policymaking, and more. Thus, federal energy policies are important topics for critical examination.

Within the federal government, the executive branch does much to set the agenda for energy policy. In the wake of the oil embargoes of the early 1970s, for example, the Nixon administration embraced "energy independence" (the ability to rely solely on energy produced domestically) as a strategic goal. Several administrations have since more or less adopted the goal of energy independence, including the Obama administration, which often referenced the need to free the country from foreign oil. However, energy independence has also long been controversial and many have questioned the wisdom and potential impacts (political, economic, and practical) of seeking energy self-sufficiency, and have proposed alternative goals such as "energy resilience" (see Damgaard, 2018).

In May 2016, presidential candidate Donald Trump promised to make "American energy dominance" a strategic policy goal. Though the exact meaning of energy dominance is debated (see Raimi, 2017), the basic idea is to increase the extraction and exportation of fossil fuels. Energy dominance pushes the goal beyond self-sufficiency to becoming a net-exporter of energy (i.e., fossil fuels) in order to influence global markets and exercise geopolitical power. Once elected, President Trump began implementing his plan primarily through a raft of deregulatory activity.

There are many ways to read energy dominance as a strategic goal. In political terms, the emphasis on coal fits Trump's need for electoral votes and grassroots support in swing states and rural areas, not to mention the importance of appeasing a wealthy and influential donor class with strong ties to fossil fuel industries. In cultural terms, fossil fuels have come to stand in as bedrock 'conservative' symbols and as icons of an age before the disorienting forces of globalization, multiculturalism, and automation (see Schneider & Peeples, 2018). In geopolitical terms, fossil fuel exports can provide leverage to aid allies and undercut enemies. In economic terms, an emphasis on fossil fuel extraction promises jobs and growth.

All of these dimensions of energy dominance have been contentious. But the most controversial and consequential aspects of energy dominance pertain to the environment. Energy dominance is predicated on the denial of climate change, which President Trump considers a "hoax." This is in stark contrast to nearly every other nation and the Intergovernmental Panel on Climate Change (IPCC), the world's foremost scientific authority on the climate. These different views on climate and the impacts of fossil fuel use point to a deep division in US politics.

One way to frame this problem is in terms of "tribal epistemologies" or incommensurable worldviews. It seems as though the participants in US political discussions lack a common or shared reality. This stems at least in part from increasingly polarized partisanship along with a media landscape that filters people into like-minded echo chambers. It also stems from the erosion of trust in traditional gatekeepers of truth: science, the academy, the judiciary, and the media (see Roberts, 2017). This erosion has happened across the political spectrum but is especially pronounced on the right wing, which has developed over the past few decades a strong alternative media-scape in talk radio, Fox news, Breitbart, the Daily Caller, Infowars, and other outlets. With his repeated accusations of "fake news" and his demonization of mainstream media and institutions (including the IPCC), President Trump is pushing to new levels the long-standing US conservative movement's distrust of and attack on institutions deemed to have a liberal bias.

This situation poses a challenge: can we find ways to bridge deep divides in order to understand other views and engage in productive dialogue? This strikes us as an important prerequisite for a robust democracy. In what follows, we attempt to understand how the Trump administration and their supporters justify the energy dominance agenda in environmental terms. In so doing, we will do our best to practice what philosophers call a "hermeneutic of faith," which means we will assume sincerity or good-faith on the part of the administration. After all, there are good arguments to be made against environmental regulations and the precautionary discourses that often lie behind those regulations (cf. Sunstein, 2003).

The danger of assuming sincerity is that it may be naive. Thus, in our discussion we offer a "hermeneutic of suspicion" that looks for ulterior motives -- in this case, that any environmental justification of energy dominance is merely a way to greenwash powerful and self-centered interest groups. Energy dominance may be nothing more than plunder by oligarchs. To presume good-faith arguments or logical consistency may be to presume too much.

To put it more broadly, the new Trump-wing of American conservatism may not be about an epistemology (or what we will call a discourse) at all. An epistemology or a discourse implies a rationally defensible understanding of reality and a sincere quest for truth that

abides by some standards of coherence and consistency. By contrast, Eric Levitz (2018) may be right that there simply is no rational policy agenda behind much of what the Trump Administration does. There is no good-faith, evidence-based argument that President Trump actually won the popular vote in 2016, but nearly half of Republicans believe that. Similarly, there is no rational way to defend the notion that climate change is a hoax perpetuated by the Chinese. Yet such talk from the highest levels of government combined with a more general attack on science and the removal of climate change information on federal websites has real impacts on public opinion. In 2017, 53% of Republicans thought that most scientists believe climate change is occurring. In 2018, that number declined to 42% (Berke, 2018).

In seeking to understand the environmental justifications for energy dominance, we will use the political scientist John Dryzek's book *The Politics of the Earth* (2013). Dryzek takes a discourse approach to environmental issues, where "discourse" means roughly the worldviews that people use to make sense of environmental problems. A discourse, he argues, is a plausible perspective that is difficult to prove wrong in a simple or straightforward way. In using his framework, we will at first assume a hermeneutic of beneficence, that is, to assume that energy dominance is justified by a rationally defensible, sincere, and intelligible discourse.

The Promethean discourse is the closest candidate for the Trump administration's point of view – with its emphasis on free markets, human ingenuity, and infinite progress. Prometheus stole fire from the gods, giving humanity god-like technological powers. Though he is a figure from ancient Greek mythology, Prometheus is a fitting icon for the modern age with its quest to control nature for human material prosperity. Yet as we take a closer look at two case studies about energy dominance, it begins to look less like an expression of modernity and more like a form of what Dryzek calls "extreme postmodernism." Energy dominance may represent a postmodern Prometheus where truth itself is just another resource to manipulate in the service of power.

2. Energy Dominance

To understand the policy of energy dominance, it is important to first look at its origins in previous US energy policy goals. By 1970 the United States had become a net oil importer, so when the US faced an oil embargo in 1973, prices shot up dramatically (Homans, 2012). This led to the idea of an energy shortage, and President Nixon turned the nation's eyes towards the policy of "Energy Independence," the goal of relying solely on energy produced in the US. This marked the beginning of the focus on energy independence, an initiative seen in all subsequent administrations.

Another important development to note as a precursor to the energy

dominance agenda is the revolution in domestic oil and gas production that occurred under the Obama administration. Beginning around 2010, and thanks in large part to successful private-public R&D partnerships, the US began to reverse a decades-long dip in domestic oil and gas production. The key technologies enabling this fossil fuel renaissance were hydraulic fracturing, 3-D seismic imaging, and horizontal drilling (see Briggle, 2015). Indeed, even though the Obama administration is criticized by the Trump administration, there can be no denying that the former put in place the fossil fuel infrastructure that made the latter's campaign promises of energy dominance a practical possibility.

Energy dominance entails a complete self-sufficiency in energy production (where 'energy' is understood almost exclusively as fossil fuels), as well as a focus on coal, oil, and natural gas exports. The stated aims of this policy are to create American jobs and wealth, prevent hostile nations from using energy as a means of leverage against the US and its allies, and meet US demand via domestically attained energy.

Deregulation has been a defining task of the Trump administration from its first days when the new President signed Executive Order 13771 (January 30, 2017) directing agencies to repeal two existing regulations for each new regulation. Not surprisingly, then, energy dominance has been pursued primarily through deregulation. Indeed, just two months into his administration, President Trump issued Executive Order 13783, requiring all executive agencies to review any existing regulations "that potentially burden the development or use" of domestic sources of energy. The Environmental and Energy Law Program at Harvard University has since tracked the regulatory rollback efforts following from this order. By October 2018, the rollback tracker had 47 entries on its list, which includes both finalized rule-making as well as policy proposals under review (Harvard Environmental Law 2018).

The deregulatory actions are broad in scope, including: opening more land and coastal waters to fossil fuel production, repealing the Stream Protection Rule (which had protected water resources from coal mining impacts), expediting pipeline construction, relaxing standards under the Clean Air Act for toxic emissions, and eliminating and curbing rules on greenhouse gas emissions. When it comes to greenhouse gas emissions, the most important deregulations are efforts to repeal the Clean Power Plan created by the Obama administration, weakening rules that govern methane leaks by natural gas producers, and lowering fuel efficiency standards for cars and trucks.

Another key tool for implementing the energy dominance agenda is the federal budget. The Trump administration's fiscal 2019 budget proposal included: increases for oil production on the outer continental shelf, a 24% increase for fossil fuel research and development (including clean coal

technologies), a 34% overall cut to the EPA and an 18% cut specifically to the EPA's enforcement division, the elimination of the Global Climate Change Initiative, elimination of five programs at NASA that monitor climate change impacts, and elimination of the Advanced Research Projects Agency -- Energy (ARPA-E) Initiative, which funds high-risk research programs including grid-scale battery storage technologies to aid the transition to renewables.

Of course Presidential budget proposals rarely survive intact through the Congressional process, but they nonetheless stand as statements of values and priorities. In order to sketch a more detailed and comprehensive picture of those values, we turn now from an empirical overview of energy dominance to our theoretical lens. We will use an environmental discourse framework in an attempt to understand the worldview behind energy dominance. In the next section, we introduce this framework, and in the section after that we apply the framework to two cases where the administration or its supporters discuss and justify the energy dominance agenda.

3. Environmental Discourses

Environmental issues are complex. They involve multiple interconnections across human and non-human systems that are studied by a variety of disciplines. As we have seen, for example, the environmental dimensions of energy policy cannot be disentangled from the economic and foreign policy dimensions. Despite this complexity, people manage to make sense of even the most difficult social and political issues. They do so by filtering what would otherwise be a cacophony of information through a set of assumptions, judgments, and premises that enable them to piece together a coherent story. This filter is a worldview, or what John Dryzek, in *the Politics of the Earth* (2013), calls a discourse, "a shared way of apprehending the world." In this section, we draw heavily from Dryzek's analysis, though we modify it in some ways.

According to Dryzek, our environmental discourse tells us what kinds of things exist and how they are related. It also fills out our narrative with key actors (and whether they are good or bad) and provides metaphors and other rhetorical devices for making sense of things (e.g., spaceship earth or nature as machine). One's discourse conditions how one defines and interprets environmental problems. A 'problem,' in other words, does not exist objectively or independent of human agency and conceptualization.

This does not mean that there is only discourse or social constructions. As Dryzek notes, "just because something is socially interpreted does not mean it is unreal" (p. 12). Pollution actually exists, species do go extinct, and habitat does in fact disappear or reappear. Yet people can understand such phenomena in different ways (often picking out different sets of data), depending on their

conception of the natural world and the human place in it, how they prioritize different values, their attitude toward risk – in short, depending on their discourse.

Dryzek argues that complexity breeds a proliferation of discourses: "The more complex a situation, the larger is the number of plausible perspectives upon it—because the harder it is to prove any one of them wrong in any simple terms" (p. 9). Disagreement between discourses fuels debates about environmental problems – how to define them and what to do about them. One important question this raises is the extent to which we can become aware of our own discourses and whether they are susceptible to rational comparison and criticism.

For at least the past two-hundred years, industrialism has been the dominant discourse. It is defined by its "overarching commitment to growth in the quantity of goods and services produced and to the material wellbeing that growth brings" (p. 14). Modern ideologies as diverse as liberalism and Marxism share the industrial commitments to growth and material affluence. Though there were earlier critics of industrialism such as John Muir, Henry David Thoreau, and Aldo Leopold, it was not until the 1960s that this discourse came under sustained criticism. Rachel Carson, Paul Ehrlich, and others began to problematize industrialism, opening the possibility for alternative discourses.

In 1972, the Club of Rome published *The Limits to Growth*, which captured the essence of newly emerging discourses (Meadows et al., 1972). As the ecologist Garrett Hardin (1986) wrote: "Thou shalt not transgress the carrying capacity." Dryzek classifies such views into two kinds of 'radical' environmental discourses, Green Radicalism and Survivalism. Both call for the wholesale rejection of industrial society, primarily from the belief that its imperative of economic growth will run headlong into ecological limits.

Though culturally influential, these discourses remained on the margins of policymaking precisely because of their radical implications. No politician would be elected on a platform of, say, returning to small-scale agricultural communities or drastically curtailing consumption or reproductive rights. By far the most politically powerful form of environmental discourse became what Dryzek calls Problem Solving or, at times, Administrative Rationality. This discourse takes the basic social patterns and expectations of industrialism as given and seeks to make adjustments in ways that can account for environmental factors that had previously been treated as externalities or unintended consequences. The establishment of the Environmental Protection Agency, other forms of institutionalized environmental expertise, and the signing of major legislation such as the Clean Air and Clean Water Acts exemplify this discourse. Though not nearly as radical as the other discourses, Problem Solving

shares with them a focus on limits, usually framing those limits in terms of government regulations (often paired in a various ways with market mechanisms).

This explains the other crucial development across the 1960s and 1970s: the articulation of what Dryzek calls the Promethean discourse. When industrialism reigned relatively unchallenged, there was little need to explicitly defend it. As it came under attack, this changed, and a group of economists based initially at the independent research organization Resources for the Future began to articulate the Promethean (or Cornucopian) discourse. The objective was to counter the emphasis on *limits* that was central to the radical discourses in popular culture and the political discourse of administration and regulation. The economists Harold Barnett and Chandler Morse argued that scarcity is just another name for increase in price. Since real prices had dropped across the 20th century, natural resources were actually becoming more abundant.

Another important early contributor to the Promethean discourse was the economist Simon Kuznets. His research showed an inverted U shape relationship between income inequality and economic growth – income inequality first increased with growth but then decreased after a certain threshold. This Kuznets Curve was soon modified to show a similar relationship between negative environmental impact and economic growth. At first, a rising GDP brings environmental harms, but after the point of "peak impact," pollution and other harms start to decrease even as growth continues. This is often known as a process of "decoupling" environmental harm from economic growth.

The Promethean discourse is centered on the boundless potential of human intelligence harnessed by the free market. When prices increase, entrepreneurs in a free market are incentivized to develop new technologies to find more of the resource or invent an alternative. This phenomenon can be seen in the correlation between higher gas prices and more fuel-efficient technology in automobiles (Crabb & Johnson, 2010). For Prometheans, nature is effectively unlimited, because humans are clever enough to solve any problems that result from industrial production and consumption. Michael Shellenberger and Ted Nordhaus (2011) capture the essence of this discourse when they write that, "The solution to the unintended consequences of modernity is, and has always been, more modernity." The goal is to decouple economic growth from environmental harm largely through innovation, so that growth can continue in environmentally benign ways (see McDonough & Braungart, 2013).

Departing now slightly from Dryzek's taxonomy, we think there are two main camps within the Promethean discourse. They are distinguished primarily by their attitudes toward government regulations. The first camp is Ecological Modernization or ecomodernism. The Breakthrough Institute, an independent research

organization (and home to Shellenberger and Nordhaus), offers the best formulation of ecomodernism. Ecomoderns argue that green capitalism will not arise automatically through the "invisible hand." Environmental criteria must be built into a redesigned system through conscious and coordinated intervention. Ideally, businesses will cooperate with this restructuring, because they see money in it for them. They might, for example, see savings from the prevention of pollution or recognize that solving a problem now will be less expensive than handling it in the future. However, this requires that businesses first pay for pollution (rather than treating water or air as a free dump), that they acknowledge problems exist, and that they are far-sighted enough to see past quarterly profits.

This is obviously not always the case, however, which is why ecomoderns often turn to regulations, subsidies, taxes, and other government interventions as important levers for moving society toward sustainability or decoupling. The Breakthrough Institute's "Ecomodernist Manifesto" (2015), for example, argues that adequately responding to climate change will require rapid energy transitions, which in turn requires "sustained public support for the development and deployment of clean energy technologies" (p. 24). Decarbonizing the human economy, ecomodernists argue, must and can be done through a mix of government and market mechanisms.

In contrast, the second Promethean camp is skeptical and often openly hostile to government regulations. We might call it the neoliberal Promethean camp insofar as it promotes a kind of free market fundamentalism where markets are seen as the only legitimate social organizing principle compatible with human freedom. The founder of this camp is the economist Julian Simon, who argued that the human mind is the "ultimate resource," that technology makes natural resources more (not less) abundant, and that trends in the growth of human material affluence can continue as long as free markets reign (see Simon, 1981).

Simon's brand of thinking had a profound impact on the administration of Ronald Reagan in the 1980s. The neoliberal Promethean discourse was used to justify broad swaths of environmental deregulation. Reagan appointed James Watt as his Secretary of the Interior and Anne Gorsuch (later Burford) as his EPA Administrator. Dryzek notes that both "were essentially hostile to most of the legislation they were supposed to be administering" (pp. 64-65). Watt pushed for opening up federal lands for resource extraction. Gorsuch Burford "turned policy making over to the polluters the EPA was supposed to regulate" (p. 65). The Reagan administration withdrew the US from a great deal of international environmental governance.

The similarities to the Trump administration with Ryan Zinke as Secretary of the Interior, Scott Pruitt as head of the EPA (until he resigned in the

midst of growing scandals), and Rick Perry as Head of the Department of Energy (DOE) are readily apparent. Zinke has overseen the largest reduction in federal lands protection in the nation's history, Pruitt sued the EPA 14 times (often working closely with the oil and gas industry) when he was Attorney General of Oklahoma, and in his own bid for President, Perry vowed to abolish the DOE. Andrew Wheeler, who took over the EPA after Pruitt's resignation, was a lobbyist for the coal producer Murray Energy. Once again the highest level government officials are openly hostile to government, especially when it comes to environmental regulations. And, we now show, a very similar Promethean discourse is at work.

4. Energy Dominance and Environmental Discourse: Two Case Studies

We now offer two case studies to illustrate how the neoliberal Promethean discourse is used by the Trump administration to frame the energy dominance policy agenda. First, we analyze discourse from the Heartland Institute's "America First Energy Conference" held in November 2017 in Houston, Texas.[1] The Heartland Institute is one of the most influential right-wing think tanks on energy and the environment, and their energy conferences feature Trump administration officials, Republican members of Congress, as well as policy entrepreneurs and thought leaders. Next, we analyze the keynote address on the "New Energy Realism" delivered by Department of Energy Secretary Rick Perry at the Cambridge Energy Research Associates Week (CERAWeek) forum on March 7, 2018.[2] CERAWeek is the world's premier forum on energy policy and politics, attracting representatives from leading energy corporations as well as energy ministers from dozens of nations.

4.1 The Heartland Institute's America First Energy Conference

In this section, we draw from several of the speakers at the conference to indicate the ways in which a Promethean discourse was mobilized to describe and justify energy dominance.

Perhaps the most straightforward articulation of the Promethean discourse came from Todd Myers, Director of the Center for the Environment at the Washington Policy Center. He used the Kuznet's Curve to frame his talk. Modern technology, he argued, causes environmental problems but also solves them as long as the free market is allowed to operate. Myron Ebell, who headed the Trump Administration's EPA transition team, repeated the same basic story. He noted the horrible air quality in Pittsburgh in 1960 and the burning Cuyahoga River in Cleveland around the

[1] One of us (Briggle) attended the conference. Videos of all the presentations from the conference are available here: http://americafirstenergy.org/videos/.

[2] The transcript and video of his speech are available here: https://www.energy.gov/articles/new-energy-realism-secretary-perry-remarks-cera-week-prepared-delivery.

same time. He then noted that environmental conditions have vastly improved as the economies of those areas (and the nation) continued to grow. It was time now, he said, to "right size" (drastically cut) the EPA and environmental regulations. To continue on the trajectory of regulations under the Obama and other previous administrations would be like an anorexic person intensifying their caloric restriction.

Jay Lehr, Science Director for Heartland with a Hydrology Ph.D. from Princeton, described climate change as simply "insane" and promulgated by "hysterical" people on the left. In his speech, he advised the audience members to carry CO_2 monitors in their pockets to show people that elevated carbon levels indoors are common and no cause for alarm. "We are so fortunate that we have driven up atmospheric levels of CO_2," he said, "and I pray that you all will live to see the day when it stands at 600 ppm." Increased carbon is greening the Sahara desert and generally making the planet more hospitable for humans, he argued. Similarly, Fred Palmer, Senior VP at the major coal company Peabody Energy, said that, "Coal is electricity. Electricity is life. Life is green…Coal is green." And Joseph Bast, President and CEO of the Heartland Institute, asked the audience in his concluding remarks: "Can you believe what they have done to language…*carbon pollution*?!" He couldn't comprehend a worldview (or discourse) that would picture carbon as a problem.

This was one of two views on climate change at the conference, namely, that increased carbon is a net positive. The other view, as articulated by two climate scientists on a morning panel, is that there are too many uncertainties around the climate to draw any conclusions, especially to warrant any regulations that could hinder economic growth. At the conference, the Heartland Institute handed out free copies of their report *Why Scientists Disagree about Global Warming* by the Non-governmental International Panel on Climate Change (NIPCC 2017). The report casts doubt on climate science, seeks to discredit the IPCC and other climate science organizations, and argues that the climate change agenda is an attempt by big government to gain greater control over the lives of Americans.

The most popular panel was about overturning the endangerment finding made on December 7, 2009. This, one panelist said, was "a day that shall live in infamy," because that was the day the Obama administration succeeded in getting CO_2 listed as a threat to the "public health and welfare of current and future generations." The panelists described the endangerment finding as "monument to regulatory onanism." After all, carbon is either not a problem or a net benefit…why list it as a public health threat? Panelists proposed a "red-team, blue-team" exercise to "get honest science in there." There was a sense of urgency in the room that the "California model" of draconian regulations (such as the Clean Power Plan and the

endangerment finding) was threatening the livelihoods of Americans, even portending "Third World conditions."

In one of the last panels, Heath Lovell, Vice President of Public Affairs at Alliance Coal, expressed optimism that coal had a bright future. He said that reductions in the coal fleet were due less to automation and market forces than to unfair regulations promulgated by the Obama administration. Coal is now set for a resurgence and its primary market is not at home, but abroad. "We have a moral obligation," Mr. Lovell said, "to help the rest of the world live like we do." Over one billion people don't have electricity. Through coal exports, we won't just keep our mines open, more importantly we will fulfill our ethical duty toward the world's poor to increase their material well-being. Not just Americans, but "all the people of the world deserve the lowest cost energy."

Mr. Lovell cited *The Moral Case for Fossil Fuels* by Alex Epstein (2014), a book that was frequently touted at the conference and serves as a key intellectual touchstone for the policy entrepreneurs behind the energy dominance agenda. Epstein borrows heavily from Julian Simon's basic discourse to argue that fossil fuels have dramatically increased human material welfare and that continuing advances in technology have successfully mitigated the environmental costs of this growing affluence. Epstein further argues that fossil fuels have actually made the climate less dangerous. By enabling the construction of resilient infrastructures, fossil fuels have shielded people from natural disasters. As a result, deaths caused by floods, droughts, hurricanes, and other natural disasters have precipitously dropped over the last several decades.

In short, the America First Energy Conference was steeped in the optimistic rhetoric of the Promethean discourse. Human ingenuity has unlocked massive stores of energy, which have made possible tremendous gains in the standard of living. Regulations threaten to strangle the creative engine of the free market that works to incentivize entrepreneurs and combine their ideas into innovations that bring further gains in human welfare. As prosperity increases, so does concern for the environment, and that concern is translated into reduced impacts thanks to technological advances.

However, the conference also indicated why it is not accurate to call this a neoliberal or free market version of Promethean discourse. A truly neoliberal Promethean discourse would be agnostic about types of energy. It would advocate for whichever energy source is the cheapest under fair market conditions – the winner in a competition on a level playing field. It is increasingly obvious that solar and wind power often simply outcompete coal under existing market conditions. Yet, no one at the conference ever had a positive word to say about renewable energy. Indeed, the conference was soaked in disdain and mockery when it came to solar and wind power.

A good example is the opening speech by Joe Leimkuhler, Vice President of drilling for LLOG Exploration and former head of Shell's Gulf of Mexico operations. He analyzed all major energy sources to ask the question: "Can we be energy dominant in these fields?' For oil, coal, and natural gas, he argued that the answer is "yes" by looking at data on reserves, production, and technological trends. For "renewables" (his quotes) or what he called subsidy energy, the answer was "no." Indeed, it was for him and the audience literally laughable. When he talked about renewables, the logic of the analysis changed. For coal, oil, and gas, he never mentioned a single negative or downside. But for renewables, the downsides were his entire focus. His first slide on renewables left the engineering realm of charts (used to discuss fossil fuels) to show a picture of a wind turbine menacing a bird. The hypoxic dead zone in the Gulf of Mexico from agricultural runoff was, he argued, the fault of ethanol (a renewable energy). He even told a personal story about his disappointing experience with solar panels on his roof…a story that drew howls of laughter from the audience. It was a stunningly biased presentation by someone who purported to supply facts from a position of engineering expertise.

Another way to put the point is that the "moral case" Epstein is making is not for fossil fuels but for any energy that is abundant, cheap, and reliable (a point he acknowledges: Epstein 2014, p. 34). Yet when renewable forms of energy surpass fossil fuels by those measures, they are dismissed rather than embraced. And efforts are taken to "correct" the market to favor fossil fuels. For example, the Trump Administration proposed a grid resilience subsidy for coal (an idea that had first been floated at the conference), which obviously runs counter to a neoliberal agenda where subsidies constitute market distortions.

In short, the energy dominance agenda is not really a neoliberal form of Promethean discourse, because free markets are favored only when fossil fuels come out on top. Further, the many existing subsidies for fossil fuels are treated as purely neutral market conditions. This is what happens when energy is conflated with fossil fuels. One industry has been given privileged status as standing in for an entire sector of the economy. This is a far cry from the principles of free markets and fair competition, which raises questions about what's really driving the energy dominance agenda. We return to these in the discussion.

4.2 Rick Perry and the New Energy Realism

Mr. Perry began his address to CERA by touting the new liquefied natural gas (LNG) export facilities that had just become operational. This, he said, was part of an optimistic age in energy where new innovations are harnessing new resources. The "new energy realism" signifies this age of abundance. It is in contrast to the old energy realism of the 1970s when

President Jimmy Carter and others claimed that "the days of energy abundance were over." The old realism postulated fundamental limits to resources and assumed that new technologies would bring greater environmental harms. The solution they offered, Perry said, was "draconian regulation of energy." But,

> These so-called realists could not have been more mistaken. Truth be told, we had no shortage of energy. What we had was a shortage of imagination and a loss of confidence in our ability to innovate.

How did we move from "perceived energy scarcity" to unprecedented abundance? "…taxes were cut and regulations kept simple and transparent, giving people both the freedom and the incentive to innovate." Supplies rose, costs fell, and "Our environment did not become worse. By nearly any measure, it became better, even as our economy expanded and energy development reached new heights."

Perry summarized things in a perfect expression of the Promethean discourse:

> We don't have to choose between growing our economy and caring for our environment. By embracing innovation over regulation, we can benefit both.
>
> And THAT is the heart of our New Energy Realism.

He then put this picture in the moral framework of sharing. President Trump, "would like to share our energy bounty with the world and let the spirit of competition benefit consumers by providing more choices in the marketplace…Already we are sharing our natural gas…" LNG and coal and technology exports will "help developing countries…create their own energy renaissance and harness more energy to improve the lives of their citizens."

Unlike the group at the America First Energy Conference, Perry praised renewables. But he qualified that praise by arguing that renewables will remain marginal until at least 2040, and

> What are we supposed to do in the mean time? What are the people without electricity supposed to do? Remember what we have done through technology…..we have not only produced more fossil energy with it; we've made that energy cleaner. Since we're making coal cleaner and since our technology can affordably extract massive amounts of lower-emissions natural gas, we're likely to continue to reduce the overall emissions of our fossil fuels.

"Thanks to the amazing power of human ingenuity and innovation," Perry said, "we don't have to accept hideous

sacrifices that harm the poorest among us." Noticeably absent from his speech was any mention of climate change, which is an enormous omission given his role in promulgating policies that increase fossil fuel use. He simply ignores the elephant in the room. Whereas the ecomodern Prometheans accept climate change as a problem to be tackled through innovation, the Trump administration does not. It is worth wondering if this is best understood as a different interpretation of the same reality or as two different realities altogether.

5. Discussion and Assessment

Above, we discussed two camps of Prometheans: the ecomoderns and the neoliberals. Both argue that the path to sustainability is innovation, not limitation. And both argue that although modernization or industrialism has been environmentally destructive, it is also the key to protecting the environment. We suggested that the difference between the two camps was in their attitude toward regulations or government more generally. Ecomoderns often embrace a carbon tax, for example, as a legitimate climate change policy lever. The other camp recoils at the thought of a carbon tax, preferring purely market-based solutions.

But what about a camp that doesn't see a problem to begin with and, thus, no need for a solution? In this section, we consider the possibility that energy dominance is not the product of a neoliberal Promethean discourse and perhaps not best understood in terms of a discourse at all.

As our case studies showed, energy dominance is about fossil fuels more than free markets. Recall the claim by Mr. Palmer that "coal is electricity." In fact, coal is not electricity. It is one primary fuel from which the secondary fuel of electricity can be derived. Solar panels and wind turbines are alternative ways to generate electricity. And recall Mr. Perry's embrace of innovation and technology. So too, fossil fuels are not modern technology. It is true that fossil fuels drive our economy. But unlike, say, the iPhone, nobody actually wants coal, oil, or natural gas. A lump of coal in your Christmas stocking is not the ideal gift.

People want the commodities that fossil fuels provide, the power, heat, light, and cool air. Those commodities can, however, be provided in other ways. That's the thing about modern technology in a capitalist society. The ends (commodities) will be provided through whatever means are cheapest and most efficient. Thus, because they are peddling mere means, the fossil fuel industries are remarkably vulnerable despite all their power. And what they are vulnerable to is the very thing they so often praise: the free market. The kind of capitalism they claim to support is as blind as justice – it has no favored sons, not even fossil fuels. If energy dominance was about free markets, then why would the administration fight market forces in various attempts to prop up the coal

industry? And why would they remain silent on the enormous implicit subsidy provided to oil by the US military (see SAFE 2018), not to mention the even larger subsidy of treating the atmosphere as a free dump for greenhouse gasses?

This introduces a darker reading of the situation, that is, a hermeneutics of suspicion. Maybe the Trump Administration policies are not motivated by an underlying, consistent ideal of free markets, ingenuity, and human freedom. It could be far simpler than that: this is about money and power. It is about the entrenched power of the wealthiest industry the world has ever seen, a political system wide open to corporate influence, and a political party that has repackaged "conservatism" as an all-out resource grab.

According to this reading, the Promethean discourse from the Trump Administration, with its overtones of neoliberalism, is just a smoke screen. Administration officials might say they are not picking winners and losers but, of course, they are. It's just that they are not making their picks on the basis of a coherent discourse with some defensible notion of the common good. Rather, the administration is making its picks on the basis of political expedience – to favor the fossil fuel companies that funded their campaign and the industries that gave them a ticket to Electoral College success.

Indeed, a strong case can be made that the notion of an unbiased, free market in energy is nonsensical. As even Perry noted, "Government's picking winners and losers everyday" (Roberts 2018). In his speech, he said that under the old energy realism, "the government used one thumb to promote a favorite technology and the other hand to regulate those they didn't like." The same thing is happening under energy dominance or the new energy realism, it's just that technologies for fossil fuel exploitation are now the favorites. It is not that the market is somehow operating freely of any government influence. The market is inevitably structured by government policies – that is, decisions about which values will be reflected in market prices and to what extent. There is no neutrality to be had. Choices must be made, so as Perry noted the task is to "pick good."

"Picking good" ideally means choosing energy pathways that serve public values. In the face of climate change, it is increasingly difficult to argue that fossil fuels are the right choice for governments to pick (see Roberts 2018). Renewable energy sources reduce carbon emissions and air pollution – common goods that are not captured well by the market and thus provide good reasons for government support. In this reading, then the Promethean discourse provides a plausible story about public values for what is in reality an agenda driven by private interests. By selectively focusing on just the positive impacts of fossil fuels and dismissing climate change altogether, the Trump administration is able to provide a legitimizing patina to a reckless environmental agenda.

Dryzek calls this "greenwashing" and notes how public relations departments at corporations often spin

their destructive activities in ways that look environmentally benign (see p. 13). But we think there is something much larger and systemic going on here than the behavior of PR firms. The rise of climate denial is tangled with changes in media and the erosion of democratic norms. How can we think through this tangle?

We could recast the distinction between camps of Prometheans. We could call ecomodernism a "good faith" Promethean discourse, that is, one intentionally and consistently pursuing a path to sustainability through innovation. The same could be said of a truly neoliberal Promethean discourse that was agnostic about types of energy and only sought those that won the competition on a level playing field (however that might be defined). One can, of course, argue with the wisdom or soundness of these discourses, but the point here is that they are sincere in their efforts to decouple environmental harm from economic growth. By contrast, we could call the Trump administration's brand a "bad faith" Promethean discourse. It takes, what are in reality, baldly political preferences for one industry and, in order to offer a public justification of the resulting policies, it cloaks them in a language of tech-fix modernization and human wellbeing.

The Promethean discourse, as one that pictures the compatibility of economic growth and environmentalism, is easily abused. It offers the rhetorical tools to greenwash just about any pro-business agenda. This entails a great deal of contortions. And eventually what has happened is that the Prometheans, those ultimate defenders of modernity, have twisted themselves into a peculiar and dangerous anti-modern position.

We are referring to climate change denial, which has become the bad faith Promethean strategy. Across the past two decades, right-wing American think tanks such as the Heritage Foundation and the Heartland Institute partnered with Koch Industries, Exxon Mobile, and other fossil fuel corporations to launch a campaign of doubt (see Oreskes and Conway 2010). They have successfully captured the Republican Party and polarized the issue of climate on partisan lines. Whereas good faith Prometheans acknowledge the reality of climate change but optimistically proffer solutions, the bad faith Prometheans simply deny the problem. If climate change is granted reality, then it spells ultimate doom for the fossil fuel industry. "Thus," Dryzek notes, "climate change cannot be allowed to exist" (p. 68).

A good illustration of the bad faith arguments behind the energy dominance agenda can be found in the Draft Environmental Impact Statement for the proposed cuts to fuel efficiency standards (NHTSA 2018). Remarkably, this Trump administration document predicts that global temperatures will be four degrees higher by 2100 on current development trajectories. The IPCC notes that at those temperatures, major coastal cities will be underwater, freshwater resources will be severely stressed, and extreme weather events will increase in frequency. Yet the

report concludes that rather than cut emissions in an effort to reduce future warming, we should loosen restrictions on fuel efficiency, even though that will result in an additional 8 billion tons of carbon dioxide in the atmosphere by 2100.

The report justifies this conclusion by arguing that fuel efficiency standards alone would not be enough to meet carbon budget goals. That would require "substantial increases in technology innovation and adoption compared to today's levels and would require the economy and the vehicle fleet to substantially move away from the use of fossil fuels, which is not currently technologically feasible or economically practicable" (NHTSA 2018, p. 5-30). In other words, since one rule to improve fuel efficiency won't solve the entire climate problem, it is not worth doing. This is not a good-faith argument. And it is not true to the Promethean spirit – that defining optimism of modernity – with its defeatist view about *currently* feasible technology. Indeed, key to Julian Simon's original Promethean view is a faith that future technologies (not currently feasible or even yet known) will come to the rescue. Indeed, regulations can play a central role even in Simon's view of the Promethean discourse, because they (like scarcity) can increase costs in ways that spur innovation and improvements.

Dryzek called the climate-denial wing of the Prometheans "an extreme postmodernism" where truth and reason become just other names for power. This postmodernism is not best understood as itself another kind of discourse. Rather, it represents the abdication of the core, unifying values enabling dialogue between discourses: civility, rationality, good-faith, and evidenced-based arguments. In other words, energy dominance may best be understood not as the articulation of a coherent worldview or one among several rationally defensible environmental discourses. Rather, it may be another case study in the power of the corporate elite and the right-wing media universe to generate public opinions among loyal followers, opinions with little basis in reality (see Levitz, 2018).

The Promethean discourse may give a plausible patina to a program of smash-and-grab exploitation. But if significant parts of society drift further from the core values and institutions of democracy, not even the patina will be necessary. All that will be needed is a strong leader, a clear and comforting message, and an echo chamber.

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Youth Corner

Energy Efficient Aquaponics

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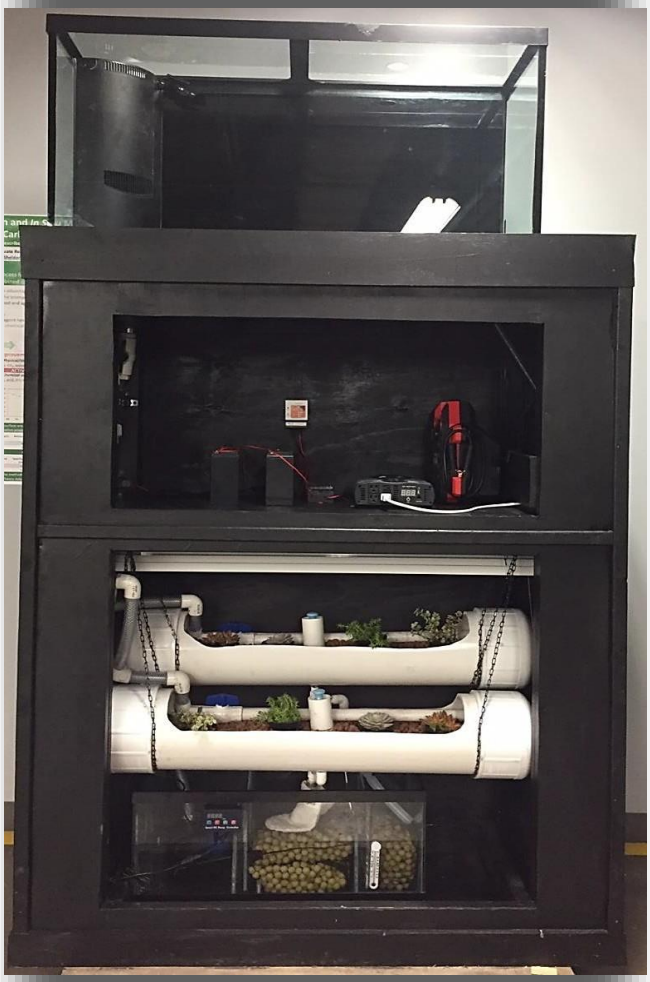
This project is centered around the fundamental concept of aquaponics which is a sustainable symbiotic system that consists of raising both fish and vegetables. Conventional aquaponics system energy usage in the range from 70% to 92% less than a conventional farm which typically use fuel or petrochemical-intensive fertilizers; therefore, it is our objective to decrease this energy usage even more in our aquaponics system.



To achieve this objective, we will be integrating energy efficient applications such as a micro Kaplan turbine, overflow weir system, LED lighting, automatic bell siphon, and energy efficient materials to increase the overall system energy efficiency. This aquaponics system will be for indoor applications which permits control over various pests, harsh weather conditions, and food to be grown year-round in areas which otherwise might not be able to produce any food crops.

We came together as a team with a desire to design an energy efficient system that integrates both the understanding of mechanical and energy engineering with that of nature and its biological processes. Our inspiration was derived from assisting families

with the ability to produce fish and vegetable during anytime of the year. There are many motivations to improve energy efficiency within our aquaponics system. Reducing energy use reduces energy costs and may result in a financial cost saving to consumers.

Youth Corner

Ethiopia

Brook Lakew Tilahun

Ethiopia with its geographical location in the horn of Africa with neighboring countries in the east Djibouti and Somaliland, with the republic of Somalia in the south east, republic of Kenya in the south and the republic of the Sudan and south Sudan in the west, with Eritrea in the north. The country has an area of 420,000sq mi. Ethiopia with its capital Addis Ababa is a country with tri-color flag of green, yellow and red horizontal stripes with a total population of 105,534,882million.

Ethiopia is a land of geographical contrasts varying from as much as 380ft below sea level in the Danakil depression to more than 15,000ft above sea in the mountainous region. Ras Dashen with an altitude of some 15,180ft is the fourth highest pick in Africa. The most distinctive feature is the northern part of the Great Rift Valley, which runs thru the entire length of the country in a northeast-southwest direction. Ethiopia's largest lake Tana is the source of the famous Blue Nile River which winds around in a great arc before merging with the White Nile in the Sudan in the east and travels thru the great canyons reaching depths of more than 4000ft.

Human like fossils have been found in the Danakil depression dating back 3.5million years in1981. The 4million year old fossil bones of a direct ancestor of Homo sapiens were discovered in the Awash River valley. Homer refers to the Ethiopians as an innocent race, and Herodotus claims that they were known in his time as the most just men to the Greeks. However Ethiopia was a mix of somehow clear/unclear historical background that did not exactly correspond to the modem country. Ethiopia first appeared in written history as the Aksumite Empire, which was probably established around the beginning of the Christian era. Although national tradition attributes to the foundation of the empire to Menelik I the son of King Solomon and the Queen of Sheba with Christianity introduced in the 4th century.

Coming to farm lands, over grazing, deforestation and poor agricultural practices have contributed to soil erosion, particularly to the Tigray and Eritrean regions that sizable areas of farmland have been lost to cultivation. As of 1994 about 600,000 acres of arable land washed away each year. The combined effects of severe drought and 17yrs civil war has also added to Ethiopia's environmental problems. Due to its geographical location the central plateau, the west and south west of the country is enjoying a unique climatic conditions suitable for its habitats and the famous coffee plant from which its very name has derived from the province of Kaffa in the

south west fertile region. Generally the climate of Ethiopia varies according to the topographical regions. The minimum during the coldest season is about 40F while the mean max rarely exceed 76F. The red sea coastal areas is extreme going as high as 140F. Heavy rainfall takes place between June and September while light rains known as Belg occurs between Dec and Feb.

The transport sector has been estimated that more than half of Ethiopia's produce is transported by pack animals reflecting the shortage of the country's road network and the rugged terrain. The number of passenger cars in use in 2003 was about 65,000 and the number of commercial vehicles was around 50,000. Bus services link provincial centers with the capital. A narrow rail gauge line from Djibouti to Addis the capital is 547miles long of which 423 miles is in Ethiopia and is owned by Ethiopia and Djibouti. Up until 2005 there were about 83 airports of which only 14 are paved runways. However as of end of 2018, the airline has emerged to become a leader of African aviation and still with expanding routes to Asia, the Far East, south and North America, Europe and throughout the continent of Africa.

As Ethiopia has several ethnic groups, at least 77 different languages are spoken of which mostly belong to the Semetic, Cushitic and Omotic divisions of the Afro-Asiatic linguistic family. Amharic being the official language is a Se metic tongue. English is the principal second language taught in schools Orthodox Christian is the official religion of the country up to 1994 until the emperor was deposed by the military junta. Islam is practiced by about 45% of the population most of whom inhabit the Somali and Oromia region of the country. About 10% of the population is evangelical or Pentecostal Protestants a fast growing religion. The country is a mix of more than 77 ethnic groups and languages of which the Oromo constitute 40% followed by 32% of the Amhara and Tigreans. The rest are mainly of the southern regions of Sidamo, Wolita. The Falasha known as Bete Israel a.k.a black Jews live in northern Ethiopia were victims of economic discrimination before the 1974 revolution. Some 14,000 were secretly flown to Israel under the operation code "Moses" organized by the Israelites

The foregoing is an abridge description of Ethiopia which has more than 3000yrs history which would take a lot more than what I have written. I hope it will serve as a starter to encourage historians to make research and visit the place whenever convenient to do so.

Youth Corner

Majete

More than Family

Brucktawit Endashaw
Majete High school

Majete "Mother's home" is a place where you can feel home. Everything is shared and people live supporting one another. "Mother's home" is defined as a welcoming and safe home for any resident and guest. In the town of Majete, Christians, Muslims, young, old, small, and big people live in peace and harmony. Majete is found 310km from the capital of the East African country Ethiopia and is located in Semien (northern) Shewa. There are small villages surrounding Majete, six of which are Abelanba, Deranba, Agela, Ankar, kubkub, and Wolabuye. Moreover, there are different churches and mosques where people thank their Lord and pray.

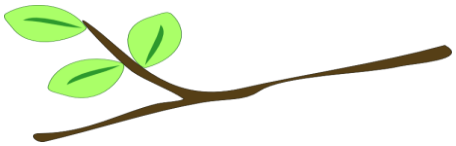
People in Majete gather to celebrate holidays. The extensive and fascinating holiday celebrated on January is Epiphany baptism of Jesus. During this time of day, tabot is carried by priests, and people gather with respect and generosity. Epiphany is one of the biggest holiday celebrated but; nonetheless, there are more holidays four of which are, New year, Christmas, Easter, and Meskel. Eid al-adha is a holiday celebrated by Muslims, and during this time schools and most businesses are closed, which means a day off for most people. Furthermore, people in Majete are welcoming in a way that makes people feel they are home and never want to leave. They are also known for their hard work and for being an expert on investing. Most Majete people focus on Agriculture. Majete has strong and wise entrepreneurs, that started from a capital of fourteen birr (Ethiopian currency) being two quarters which is equal to 0.50 cents. Now, these hard-working investors have moved to the capital city, Addis Ababa, but still, are helping and supporting young entrepreneurs and are trying to make Majete a tourist attraction town as it must be. In addition, outstanding investors in Majete are Yirga Tefera, Shewaye weldemaryam, Mungste Belete, Meketa Kebede, and so many other successful business owners.

The school and the environment of Majete is sustainable and viewed as a school that supports and help students, but with more aid. The elementary school in Majete is for kids that are three years or older. The school educates kids and helps them step or

pass to upper- level classes. The school strives to help educate a student in a very mannered way. Nevertheless, in the learning and teaching environment, there is a problem with English compared to the Urban area. Majority of people in the urban speak fluent English but in the rural area, it's not that satisfactory. Even though English is taught, students are not as fluent and find the language to be difficult. It would be best if people evaluate this problem for students in Majete. Furthermore, teachers are best known for their encouraging words, "you are the future, you are the next generation" and sayings to inspire and motivate students. In Majete High School, there are different organizations, most of which are there to better our environment. Students form different groups and plant trees, flower for the environment, and add beauty to the school. Also, the organizations help students fulfill school needs, by giving books, pencils, pens, and other school expenses for students who seek help.

In conclusion, Majete is a town with strong entrepreneurs that still benefit and invest in their town that led them to be the wise and sophisticated business owners they are today. Majete is a town that welcomes tourists and makes them feel home. Majete is a town where all live as a big happy family and one supports another.

Acknowledge: this essay is translated and edited by Melat Yirga Tefera. And, the writer of this essay was a former student at Majete High school Brucktawit Endashaw. Moreover, I would like to thank Mr. Stan Ingman.



Youth Corner

The Effect of Three Different Plants: Scindapsus Aureus, Chlorophytum Comosum, and Philodendron Indoor Air Quality

Samara Amin
Plano East Senior High School, Plano, TX

Prior research has shown that air quality indoors can be worse than air quality outdoors. House plants have been found to reduce toxic chemicals such as Benzene, Acetone, and Formaldehyde. The objective of this experiment was to examine which houseplants improve the quality of indoor air. The three different species of plants tested were Philodendron, Scindapsus aureus (money plant), and Chlorophytum comosum (spider plant). It was hypothesized that if the Philodendron is used as a houseplant, then the indoor air quality will be better. The three different species of plants tested were Philodendron, Scindapsus aureus (money plant), and Chlorophytum comosum (spider plant).

It was hypothesized that if the Philodendron is used as a houseplant, then the indoor air quality will be better. Then, the device measured air quality with each type of plants for three days. The results indicate that plants decrease the indoor PM10 and PM2.5 and carbon monoxide levels.

When there were plants in the room, these levels were lower compared to having no plants. However, among the three species, Chlorophytum comosum (spider plant) was the most effective purifier. When Chlorophytum comosum was used the average of both PM10 and PM2.5 was 30.05 μg/m3, when Philodendron was used the PM10 and PM2.5 averaged at 31.4 μg/m3. Therefore, the hypothesis was not supported. This study shows that plants are natural purifiers within indoor environments, specifically Chlorophytum comosum. People who stay indoors can benefit having houseplants if they are concerned about respiratory health. Further research can focus on the impact of plant size on air quality and the dimensions of the room.