Freie Universität Berlin

UNIVERSITY ALLIANCE FOR SUSTAINABILITY SPRING CAMPUS 2016 CONFERENCE PROCEEDINGS

Freie Universität Berlin
University Alliance for Sustainability (UAS)
Working Paper Series No. 1 • 11.–15. April, 2016

Coordinated and edited by Ira Shefer

University Alliance for Sustainability

The UAS Working Paper Series serves to disseminate first results of ongoing research about sustainability issues and questions.

All papers are either peer-reviewed internally or have been reviewed by other project partners. They are published online and can be downloaded free of charge from the Document Server of Freie Universität. Through publishing first results in this online paper series we aim to encourage the exchange of ideas. Inclusion of a paper in the UAS Working Paper Series should not limit publication in any other work. The copyright remains with the authors. All affiliations relate to April 2016.

Further information at:
http://www.fu-berlin.de/en/sites/uas/uas-pool/uas-working-papers/index.html

University Alliance for Sustainability
Unit for Sustainability and Energy Management
Freie Universität Berlin
Schwendenerstraße 17
14195 Berlin
Email: sustainablility@fu-berlin.de

CONTENTS

Preface

Ira Shefer[1]

Universities are at the forefront of tackling climate change and progressing sustainability measures. Campuses around the world address these issues from various perspectives: empirical and theoretical studies, developing interdisciplinary fields and serving as experimentation hubs[2]. More and more universities are engaged in networks, both with the public and private stakeholders and other higher education institutes.

The University Alliance for Sustainability (UAS) exists for these purposes. The UAS is a network of five leading universities from different continents: Freie Universität Berlin (Germany), The Hebrew University of Jerusalem (Israel), Peking University (China), St. Petersburg University (Russia) and the University of British Columbia (Canada). The network aims to exchange and spread research and knowledge on broad aspects of sustainability, as well as engaging in on-campus sustainability measures[3].

Under the theme "do universities matter?" the UAS first Spring Campus event took place in 2016 at the Freie Universität Berlin. Representatives from the Alliance's universities presented their ongoing research in three focus areas: climate governance, education for sustainable development and sustainable watershed management. The spring campus event also held a PhD students conference, in which early career researchers from the five universities presented their research projects.

This publication gathers 12 contributions presented in the spring campus "Workshop I: Climate Governance in International Comparison"[4], and in the PhD students' conference. Other than providing conference proceedings, this publication fulfils one more goal: sampling several trends in climate change and sustainability research taking place at these five top universities. Presenting a mix of works from different fields and disciplines by experienced and early career researchers enables a unique and fresh outlook on these trends and hints at several future fields of interests. Reading through these papers also points to how, and why, universities matter.

The first three publications examine major actors in global climate negotiation and policies,

---

[1] Ira Shefer is a PhD candidate, Environmental Policy Research Center (FFU), Freie Universität Berlin; shefer.ira.mail@gmail.com

[2] See for instance selected publications in the *Journal of Environmental Studies and Sciences 2016, 6* (2).

[3] http://www.fu-berlin.de/en/sites/uas/about-us/index.html

[4] Organized by Prof. Miranda Schreurs (Head of the Environmental Policy Research Center [FFU] at the Freie Universität Berlin, until October 2016)

addressing mainly state-level (national) and international aspects: Prof. Qingzhi Huan (Peking University) examines the new position of China regarding global climate action. He claims that the up-to-date development of China's global climate policy, especially its active participation in reaching and approving the Paris Agreement, is both situational and stage-making. In other words, China is now becoming an active player in global climate politics, but is unlikely to accept a role as a world-leader in the foreseeable future. Accordingly, he finds that China will gradually shift its profile in global climate governance from moral responsibility to political and legal ones. Dr. Irina Shmeleva (ITMO University and Institute of Sustainable Development Strategy [ANO], Saint Petersburg) presents highlights of Russia's climate policies as they are reflected in the media. She finds that climate change issues are framed mainly in scientific topics rather than political ones, with changing patterns of public interest in this issue. Next is Dr. Dörte Ohlhorst (Freie Universität Berlin), who examines Germany's energy transition under a multi-level governance approach and identifies specific aspects of a successful energy transition.

Jan Beermann and Dr. Kerstin Tews (Freie Universität Berlin) explore the domestic sphere in greater detail: they analyse the role of and potential for decentralised experimentation in the German energy transition, and in particular the acceptance and implementation of renewable energy projects at the sub-national level in Germany.

The next three publications go deeper into the local, municipal level. Dr. Nikolai Bobylev (St. Petersburg State University) examines possible conflicts between climate adaptation, resilience and sustainability concepts in urban (infrastructure) development, which affects urban climate governance. He finds that while these conflicts do exist, possibilities for synergies are available. The following contributor, Gloria Amoruso (Freie Universität Berlin), tests the notion of Berlin as an urban climate leader, confronting climate policies developed and adopted in the city against low performances in reducing GHG emissions. She concludes by identifying several factors that, nevertheless, point to the existing potential for urban leadership by the city. The last contributors focusing on the local level are Nicole Mahlkow and Tobias Kalt (Freie Universität Berlin), who critically assess Berlin's urban heat discourses. They find, among other things, that Berlin's adaptation policies maintain a status quo rather than striving for more structural social acceptance of climate change adaptation. Within this process, for example, some local groups are marginalized and some ideas and policies are presented as preferable over other, deeper solutions.

From the local contributions we move to cross-national, regional frames: The European Union (EU) and the Association of East Asian Nations (ASEAN). Tina Schivatcheva (Freie Universität Berlin) reviews the role of the EU's institutions and legislation in the successful

development and implementation of pan-European conservation initiatives, particularly the Natura2000 initiative. She discusses opportunities and tensions embedded within both the internal and external facets of the union, perceiving them as complementary in the achievement of the desired conservation goals. Dian Parluhutan (Freie Universität Berlin) looks at energy law in ASEAN countries, while reflecting on the EU's energy laws.

The last three contributions present just a fraction of the UAS universities' research in the natural sciences and in-campus sustainability practices. Nurit Eliash (and colleague authors; the Hebrew University of Jerusalem) presents a solution to mite infestation in bees in a way that does not harm the bees or the mites, thus reducing the harmful effects of chemical pesticides. Donghai Wu (Peking University) presents ongoing research on improving the assessment of deforestation, using the South-Western American territory as a case study. He finds that improved assessments of deforestation could provide scientists with a better picture to present to policy makers when trying to articulate sustainable forestry methods. Dr. Susan Gerofsky (University of British Columbia) concludes this publication with a presentation and assessment of case studies of in-campus sustainability projects that, she claims, provide a more holistic, comprehensive and – importantly – realistic frame to research and progress sustainability. Despite not being part of "Workshop I", her presentation provides a living example of what universities can do in order to connect sustainability to students, researchers and the surrounding communities.

China's participation in global climate governance: Reflections and prospects

Qingzhi Huan[1]

Theoretically, the following three factors will jointly determine whether and how China is to take a more active role in global climate policy. First, China's total amount of greenhouse gas (GHG) emissions, which have evident negative impacts domestically and globally. Second, demonstration effects of the industrial countries, who convincingly and fruitfully implement the related international conventions and make their own other efforts. Third, the ever-enhancing national eco-awareness, which will reach a point strong enough to cause a comprehensive policy-reorientation (Tian 2014; Bo 2013). Based on such a general understanding, this article will offer a brief review of China's participation in global climate governance by focusing on the following three questions: How to conceptualize China's participation in global climate governance, its policy as well as ethical dimensions; How to interpret the heritage of the Copenhagen Summit regarding China, and; How to evaluate China's recent efforts in moving towards a new stage of climate governance participation considering its share in negotiation and signature on the Paris Agreement.

Conceptualizing China's participation in global climate governance

If defining a country's participation in global climate governance as a process of combining moral, political and legal responsibilities or obligations, we can divide China's involvement in the UN-led climate governance system into the following three stages: 1972-1992, 1992-2015 and 2015-#2030 (Xu and Chen 2013; Niu and Wang 2013). In every stage, China presents itself as a different, separate actor or 'responsibility-undertaker'.

During 1972-1992, though the Chinese government participated in numerous international activities coping with global environmental issues (including the first global summit on environment in Stockholm in 1972), China was largely regarded as an 'outsider participant' in the sense that there was not much to blame on, politically and legally in particular. In other words, China's economic development or poverty eradication was a commonly recognized priority comparing with its contribution to global environmental protection.

In comparison, from 1992 to 2015, China as a developing country has only non-binding

[1] Dr. Qingzhi Huan is a professor of comparative politics at Peking University, China. He was a visiting scholar of 2002/2003 at the Harvard-Yenching Institute, Harvard University, a Humboldt Research Fellow of 2005/2006 at MZES, University of Mannheim and a CSC high visiting scholar at ANU, among others. His major research interests are environmental politics, European politics and left politics; qzhuan@pku.edu.cn

obligations in industrial emission reduction according to the Kyoto Protocol, while as a rising new economic entity it experienced an ever-increasing international pressure throughout this period to show some active engagement or undertaking of responsibility. In these double senses, China was a passive participant in global climate governance system, bearing both moral and political responsibilities.

Before and after 2015, with reflecting the frustrating result of the Copenhagen Summit as a turning point and together with the spilling-over effects of domestic politics, it seems that China intends to replace the strategy of rejecting any obligation-binding international treaty with a new strategy: to be an enthusiastic participant in constructing a post-Kyoto global system, including taking some binding obligations or full responsibilities (moral, political and legal).

Unsurprisingly, dealing with the heritage of the Copenhagen Summit appropriately is the first step moving forward for China, constituting the division line between the second and the third stages of China's participation in global climate governance (Zhang X. 2014; Xiao and Liu 2010).

Table 1: The major stages of China's participation in global climate governance*

1972-1992	1992-2015	2015-2030
participation as an outsider; no obligations (Moral resp.)	passive participation; non-binding obligations (M/Political)	active participation; binding obligations (M/P/Legal)

* created by the author himself.

Heritage of the Copenhagen Summit for China

China's major policy claims at the Copenhagen Summit in 2009 can be summarized as follows (Zhang H. 2009; Zhuang 2009). First, maintaining Kyoto Protocol's two-track system rather than replacing it with a single-track system in international negotiation for industrial emissions reduction, which can be justified by the related items of the protocol and by the principle of 'common but differentiated responsibilities' adopted at the Rio Summit in 1992. For China, at least in the period of 2012-2020 at which the Copenhagen Summit was targeting, merging the two tracks is out of the question.

Second, the developed countries should undertake the major responsibilities in global

allocation of emissions reduction quota and provide the developing countries with substantial aids in clean technologies and financial resources. A key claim is that the advanced West should fulfill their commitments to reduce their absolute emissions by 25%~40% by 2020 and by 80% by 2050 compare to the 1990 levels, while gradually increase their financial aid to the developing or ecologically fragile countries up to 0.5%~1% of their GDP.

Third, adopting relative emission cut in per GDP unit instead of reduction in absolute or per capita amount, which can only be carried out voluntarily. In other words, China refuses to provide a clear road-map regarding how long time it still needs to become a net-contributor for global emission reduction, and rejects any calls for inspecting and supervising over its efforts in emissions reduction by Western or international organizations.

At the final stage of negotiations in Copenhagen, there did appear some notable signs showing that China may moderate its policy claims at the last minute (*Reference Daily*, 15 December 2009). Unfortunately, these policy suggestions calling for undertaking some 'concrete' responsibilities were not fully developed and incorporated in negotiations.

Among the academics, Angang Hu, a well-known Chinese economist, wrote an open letter to the Chinese top leaders, appealing that China should immediately take a leading role in global climate governance by offering some kind of quantified road-map of emission reduction (Hu 2009a). Unsurprisingly, this letter did not win much credit for him among the Chinese government and academics. He was accused of being a political mouthpiece for the West and criticized for his (little) knowledge regarding the Copenhagen negotiations[2]. In addition, it is another famous Chinese economist, Yushi Mao, who pointed out that economic crisis should not be an excuse for China's rejection of its global responsibility in emissions reduction. For him, assuming appropriate global responsibility is, first, a moral rather than just an economic issue, and there is no unconquerable difficulty for China to do so (Mao 2009).

According to Angang Hu (2009b), in order to promote a global consensus on climate change and help produce binding targets for emissions reduction worldwide, two new principles should be introduced. First, all the nations should be assigned to one of the four categories in terms of their Human Development Index (HDI) ranking, rather than classified simply as developed or developing countries. Second, major GHG emitters should bear greater responsibility for emissions reduction. Taking these principles as the basis, he argues, China will become a member of High HDI group (above 0.8) around 2010 and then should be considered a non-conditional reducer of GHG emissions.

[2] The author's interviews with the vice editor-in-chief of *Green Leaf* (Beijing) on 15 March 2010 and Prof. Haibin Zhang (Peking University) on 27 April 2010.

Accordingly, a road-map of China's emission reduction should look like this: Emissions of carbon dioxide will peak by 2020, and the total emission will be reduced to less than 2.2 billion tonnes by 2030 and further to 1.1 billion tonnes by 2050, half of the 1990 level.

By comparison, the academic proposition dominating China's negotiation at Copenhagen is that Chinese government should not make any internationally binding commitment of emissions reduction in 2012-2020. According to Jiahua Pan (2009a), a leading policy consultant in this field from the Chinese Academy of Social Science (CASS), this is because, first, climate change is also an issue of development rather than just an issue of environment; second, China is still not capable of cutting emissions dramatically; third, Western countries will unlikely provide technological and financial help to China for developing low-carbon economy and achieving emissions reduction. Consequently, he suggests, China should carry on a position in global climate negotiation retaining its own independence (Pan 2009b) or, in other words, 'using the West-dominated slogan to serve China's sustainable development' (*yiwoweizhu*) (Ding 2009).

Therefore, China's policy position at Copenhagen can be best explained from a clearly-defined Chinese perspective within a specific international context. What underlies the intense dispute between China and the West is a special Chinese version of understanding of the relations between global environment and development: Climate change mitigation and adaptation is becoming another field of international competition, and there are probably no so-called 'win-win' results. For China, what at stake is not only ecological security of the globe, but also its historical rights of development and long-term economic competitiveness in a globalizing world. As a result, together with other developing countries, China staunchly defended the conventional rights of development and development discourse, showing its greatly increased strength as a world economic power, while neglecting its rapidly highlighting mission of leading the protection of ecological public or global 'good' (Huan 2013).

Thus, it is understandable that the primary reflections on the results of the Copenhagen Summit as well as China's role in it focus on the following two questions. First, is the Copenhagen Accord a good enough achievement? Shortly after the summit, Premier Jiabao Wen said (2009) that the Copenhagen Accord is a good agreement in the sense that it was the result of arduous efforts made by many countries and it reconfirms the established basic goals and principles in global climate governance. At the same time, he also acknowledged that this agreement is far from being strong enough in terms of the necessity to reverse the trend of global climate change. Among the academics and the public, however, a popular view is that the Copenhagen Accord only means more than nothing.

Second, did China do something incorrect or failed to do something right at Copenhagen? According to an official speech of Premier Wen, Chinese delegation has expounded China's national policy of 'voluntary but determinate emissions reduction' and made its greatest efforts to promote arriving at a global agreement. In this sense, China did nothing wrong at Copenhagen. From another speech of him at the press conference after the 2010 session of National People' Congress (NPC) (2010), though, one may conjecture that China might make more comprises at the last moment if it had been treated more equally and politely.

If looking at the opinions among the academics, what we can find is quite divergent. In general, except for a few scholars like Prof. Angang Hu (2009a), there are little comments saying that China should dramatically reshape its position declared at Copenhagen, though a discernible convergence is that more 'right doings' on the global stage are both necessary and desirable (Qin 2010).

In this context, China's policy position towards global climate governance in the first years after Copenhagen can be generalized as follows. China promises to support the implementation of the Copenhagen Accord and to adopt ever-stricter policy measures to realize national targets of energy saving and emissions reduction; while there is no consensus regarding whether and how China should assume any binding obligation of cutting emissions in the targeted period of 2012-2020 or thereafter. The point at issue is not the exact year that China should peak its emission but when China will determine to join an international system based on the 'MRV' (measuring, reporting and verification) principles. And, it is in this regard which is problematic for both China and the West: The latter is eagerly to realize such an integration but the former very reluctantly to do so.

Thus, it seemed that the majority of Chinese society needs a much longer time to digest the clear message raised in Copenhagen (Huan 2013; Cao 2010; Wong 2010; Zhang S. 2010): Given China's new identities - replacing the US as the largest country of GHG emissions in the world, a rising economic and political power and a rapidly industrializing developing country - saying 'to make our own backyard cleaner' is definitely no longer good enough.

Moving towards a new stage of climate governance participation

From a viewpoint of environmental politics, the 'Copenhagen heritage' for China is in double sense (Huan 2013; Conrad 2012; Wang J. 2009): China knows better that it can defend its conventional interests in a conventional manner, while the country also knows better that it has to figure out a new strategy dealing with new (global) politics such as climate change.

Thus, one can imagine that, for a short time, China is unlikely to reshape dramatically its current international strategy and profile and to be an enthusiastic promoter for a stern system of global climate governance, especially in 2012-2020. Over a long run, however, there is a great potential for China to re-orient its position in global climate governance.

Why? Domestically, Chinese governments are facing an ever-stronger pressure to resolve the deteriorating environmental problems effectively by improving the coordination of national and international policy. Otherwise, local governments might continue to carry out a similar 'dual strategy and tactic' in implementing national environmental laws and regulations; sacrificing the quality of ecological environments in order to maintain economic growth, because they have been for a long time believing that economic growth receives first priority. Internationally, confronting with a more divergent world, China increasingly realizes that a better way to protect its own interests is to maintain or even speed up the on-going negotiations of a post-Kyoto plan as a UN-led regime rather than a West-dominated one.

In retrospective, the above tendency is to a large extent confirmed by the evolution of China's climate policy over the past years. At the domestic level, the Chinese governments start to adopt more ambitious policy guidelines against the ever-worsening environmental problems, such as fog and haze, though the discourse or strategy of eco-civilization construction is still far from fully committed or implemented (Huan et al. 2014 and 2013; Lu 2013).

At the international level, owing to a weakening pressure from the Western side caused by the economic and financial crises, the Chinese government managed to avoid, on the one hand, any substantial challenges at COP meetings after Copenhagen (Cancun, Durban, Doha and Warsaw), with no binding agreements to be reached or signed. On the other hand, though insisting on extending the Kyoto Protocol into its second stage and allocating the major obligations for the advanced countries, China - as the leader of the BRICS group[3]- principally supported establishing the Durban Platform, which would eventually lead to a post-2020 targeted global agreement in 2015.

Thus, there was no surprise to hear on June 3rd 2014, one day after the Obama administration's declaration that the US will introduce a stricter policy restricting emissions from coal power production (reducing 30% from 2005 levels by 2030), the Chinese side also disclosed that it is considering to set up a timetable for reducing its total amount of emissions during the 13th national plan of 2016-2020.

In June 2015, China announced its policy offer for the coming Paris Summit: peaking its total

[3] BRICS countries are the world's largest newly industrialized countries: Brazil, Russia, India, China and South Africa.

emissions by 2030 and reducing the emissions per GDP unit in 60%-65% by 2030 (comparing with 2005 levels). Later, President Jinping Xi attended the 2015 global summit on sustainable development at New York and the Paris Summit, showing that China will play a more active role in reaching and implementing the Paris Agreement.

Nevertheless, one should not over-interpret the above progress to say that China is making a U-turn in its international negotiation and governance regarding climate change. In my point of view, just like the 'two track system' of Kyoto Accord, the element most interested China in the Paris Agreement is the agreement's nature of 'nationally determined contribution' (Wang 2016). Thus, there will still be some obstacles or disputes regarding how to inspect its implementation in the years to come.

Concluding remarks

The up-to-date development of China's global climate policy - especially its active engagement in reaching and approving the Paris Agreement - is both *situational* (short-term consideration based), not the least to liquidate the negative heritage from the unsuccessful Copenhagen conference, and *stage-making*, to find a positive way to be involved in creating an effective system of global climate governance.

Owing to various reasons, like the three ones outlined at the beginning of this article (its total amount of GHG emissions, demonstration effects of the developed countries and the ever-enhancing national eco-awareness), China is indeed becoming an active player in global climate politics, though it is unlikely to accept a role of world-leader in the foreseeable future. In other words, China will surely be more and more active, but not unconditional[4]. Core elements of a China-favored global climate governance system include an updated version of 'common but differentiated responsibility' principle; a UN-led real global regime rather than national - or regional -dominated regime; a responsibility sharing and allocation mechanism that fully considers and respects the capacity differences among the nations as well as eco-regions, among others. Accordingly, China will gradually shift its profile in global climate governance from a moral responsibility-undertaker to a political and legal one. Though, in order to be politically and legally 'responsible', it is necessary and helpful for China to deepen and broaden its moral basis as an internationally responsible actor (albite fulfilling the political and legal obligations can be said to be a moral responsibility) (Huan

[4] In the long run, China aims to reconstruct both the actual structure and the dominant discourse of global climate politics. Therefore, a Chinese version of global climate governance system as well as its world leadership is very different from that of today (Huan 2016).

2013).

Undoubtedly, such a policy and cognition adjustments for China will be a complicated and time-consuming process. Both the internal 'pull' impetus and the external 'push' impetus are necessary and desirable for a comprehensive shift; though, the greening of domestic politics is always a more influential factor and any input from the international side should be reciprocal or mutually learning-inspired, rather than single-dimensional.

References

Bo, Y. (2013). Cooperation willingness and cooperation capacity: A new framework for analyzing China's participation in global climate governance. *World Economy and Politics*, *1*, 135-155.

Cao, H. (2010). When "China" said "no". *Chinadialogue, 16*, 4-7.

Conrad, B. (2012). China in Copenhagen: Reconciling the "Beijing climate revolution" and the "Copenhagen climate obstinacy". *The China Quarterly, 210*, 453-455.

Ding, Y. (2009). China must stick to its own policy position in coping with global climate change. *Green Leaf*, *3*, 41-45.

Hu, A. (2009a). 'I openly call for emissions cuts'. *Chinadialogue, 14*, 4-13.

Hu, A. (2009b). 'A new approach at Copenhagen'. *Chinadialogue, 12*, 4-15.

Huan Q. (2016). A critical analysis of the eco-imperialist logic in "carbon politics" and beyond. *Social Science in China, 3,* 24-41.

Huan, Q., Li, H. & Lin, Z. (2014). *Ten Lectures on Eco-civilization Construction*. Beijing: The Commercial Press.

Huan, Q., Gao X. & Zhong, Y. (2013). *Green Development and Eco-civilization Construction*. Changsha: Hunan People's Press.

Huan, Q. (2013). Reinterpretations to the "common but differentiated responsibilities" principle and the predicaments in its implementation. *International Social Science Journal*, 2 (30), pp. 76-85.

Lu, F. (2013). *New Thoughts on Eco-civilization*. Beijing: China Science and Technology Press.

Mao, Y. (2009). Economic crisis should not affect China to undertake its responsibility in emission reduction. *Green Leaf,* 5, 44-47.

Niu, S. and Wang, J. (2013). Global climate governance organizations and China's role. *China Soft Science*, 5, 10-17.

Pan, J. (2009a). China should adopt an independent road in coping with climate change. *Green Leaf*, 3, 50-56.

Pan, J. (2009b). Tough challenges for China. *Chinadialogue*, 13, 24-31.

Qin, X. (2010). Time for a plan. *Chinadialogue*, 16, 8-11. *Reference Daily* (2009). 15 December. MAYBE THIS: http://en.people.cn/90001/90776/90883/6841927.html

Tian, H. (2014). The triangular predicament of China's participation in global climate governance. *The Journal of North-East Normal University*, 6, 91-96.

Wang, J. (2009). Climate change and China's national strategy. *International Politics Quarterly*, 4, 71-81.

Wang, X. (2016). The Paris Agreement and its implementation: A Chinese perspective. Paper presented at the Research Workshop Climate Policy in International Perspective, Berlin, 12-13 April.

Wen, J. (2009). Premier Wen's remarks on the Copenhagen Conference of climate change. Retrieved from <http://www.weather.com.cn/static/html/article/20091228/170907.shtml> [Accessed 28 December 2009].

Wen, J. (2010). Premier Wen's once again remarks on the Copenhagen Conference of climate change. Retrieved from <http://www.china.com.cn/zhuanti/2010lh/2010-03/14/content_19605406.htm> [Accessed 14 March 2010].

Wong, S. (2010). Copenhagen in Chinese: What did the Official Version say and how did the Civil Society and Media act?. *EU-China Civil Society Forum,* 1, 22 January.

Xiao, Y. and Liu, S. (2010). China's carbon diplomacy at the post-Copenhagen era. *Modern International Relations*, 9, 53-56.

Xu, L. and Chen, Y. (2013). Global climate governance and China's strategic choice. *World Economy and Politics*, 1, 116-134.

Zhang, H. (2009). Some key issues at the coming Copenhagen Conference. *Green Leaf,* 10, 75-85.

Zhang, S. (2010). Why China cannot sign the Copenhagen Accord?. *Green Leaf*, 1, 80-89.

Zhang, X. (2014). *The Internal Disputes among the 77 Group in Global Climate Negotiation in a Post-Copenhagen Era and China's Strategy*. Beijing: University of International Business and Economics.

Zhuang, G. (2009). Rethinking the climate gamble at Copenhagen and the role of China. *Diplomacy Review,* 6, 13-21.

Russian climate politics in light of the Paris Conference

Irina A. Shmeleva[1]

Russian science has a long history of addressing climate change starting from the middle of the 19th century, especially due to Mikail Budyko and Kirill Kondratiev, the renowned 20th century climatologists. In 2003, Alexander Bedritsky, the head of Roshydromet[2], was appointed as the head of the World Meteorological Organization. Traditionally in Russia there has been a significant discussion in the scientific community concerning the role of the natural and anthropogenic causes of climate change. On the other hand, the anthropogenic causes of climate change and the role of CO_2 emissions gained more support during the discussions concerning the Kyoto Protocol ratification by Russia in 2004 and were supported by political statements of the Russian Federation on Climate change starting from 2008 (Shmeleva & Shmelev, 2012).

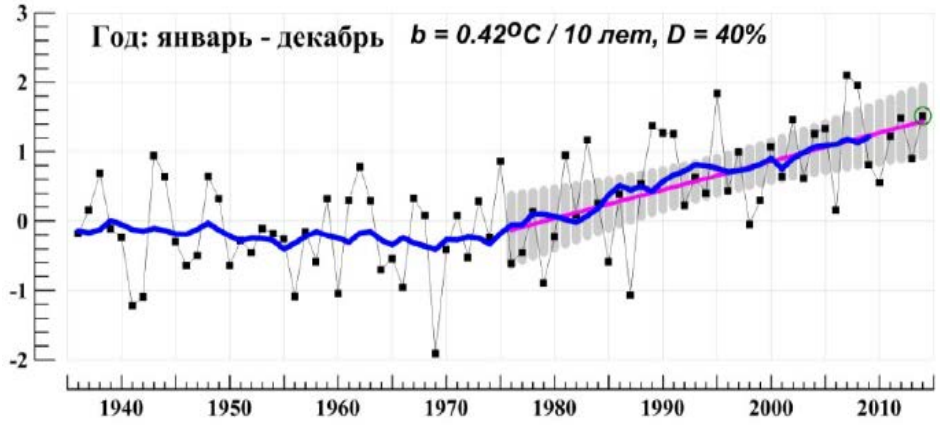

Figure 1. Average surface temperature in Russia, 1936-2014, deviations from the mean of 1961-1990 (source Roshydromet (2015). Report on the Peculiarities of Climate on the Territory of the Russian Federation in 2014, Moscow).

According to the Russian Climate Assessment Report (Roshydromet 2015), there is a tendency for the average surface temperature in Russia to increase (Figure 1). Later on in 2015, the data on the average area covered by sea ice in the (Russian) Arctic region based on observations in September (that year) was published, that demonstrated the tendency for its rapid decline (Figure 2) along with the number of dangerous meteorological events increasing.

[1] Dr. Irina Shmeleva, Institute of Sustainable Development Strategy (ANO), Saint Petersburg;
ITMO University, Saint Petersburg; irina_shmeleva@hotmail.com

[2] The Federal Service for Hydrometeorology and Environmental Monitoring in the Ministry of Natural Resources and Environment.

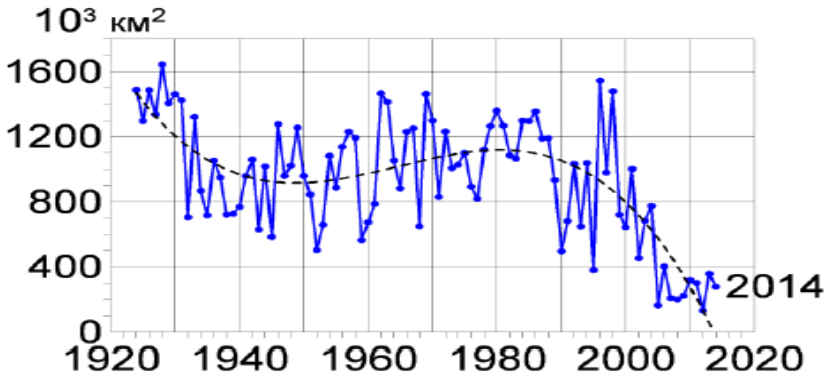

Figure 2. Average surface of sea ice in the Russian Arctic, 1924-2014 (source Roshydromet (2015). Report on the Peculiarities of Climate on the Territory of the Russian Federation in 2014, Moscow).

Along with events mentioned above, significant temperature anomalies in various regions of the Russian Federation were observed in 2014: the strongest warming was observed during Spring: from +1.76'C in the Caucasus to +4.74 C' in Central Siberia, compared to the average temperatures for 1961-1990. Precipitation levels have been increasing since early 1970s, but the occurrence of precipitation anomalies has also been spatially uneven across various regions in Russia. The frequency of extreme events in Russia has also grown since 1990s (Roshydromet, 2015).

There was and still is a lot of uncertainty over the estimation of the future changes in climatic variables in the Russian Federation. According to the data, climatic changes are very uneven in different regions. For example, for North-West, North of Urals, North and East Siberia and parts of Far East, the moderate increases in winter temperature and much smaller summer temperature increases were predicted for the period of 2011-2030 (Roshydromet, 2008). For the future periods of 2041 -2060 much more substantial increases in winter temperatures are predicted in North-West, North of the Urals and North Siberia along with summer temperature increases in the Central Volga, Southern North-West, Urals and Siberia regions.

The most climatically-vulnerable regions now are the Arctic regions of Russia, inhabited by indigenous people, practicing traditional activities such as reindeer herding, hunting and gathering. At the same time, oil and gas companies have a great interest in fossil fuels extraction in these regions. Systemic view on the problem and its consequences is needed from the political, economic and humanitarian point of view. Along with some economic benefits of climate change in the Arctic like opening the Northern Arctic marine route, there will be a lots of dangerous impacts on infrastructure. Examples include damage to the roads and settlements located on permafrost soils that started to melt; changing vegetation periods and impacts on biodiversity; bacteria emerging from melting permafrost soils that could influence on human health.

According to the Report on Peculiarities of Climate on the Territory of Russian Federations for 2014 (Roshydromet, 2015), the concentration of CO2 reached the maximum of 403.2 ppm in 2014 and Methane concentrations were going up. All in all, there were 412 dangerous hydro-meteorological events with damages and loss of life. Forest fires covered 1.3 million hectares of the territory of the Russian Federation. The authors of the report articulate that Russian Federation is responsible for 5,3% of global CO2 emissions, 75% of which results from energy generation from coal, gas and oil. 25 % of the country's greenhouse gas (GHG) emissions can be absorbed by forests, but forests' capacity is declining.

There is still a very low awareness of the climate change problems and actions needed among the Russian citizens, including business and municipalities, and a lot of climate sceptics among policy makers. But at the same time, at the scientific level, climate change research is of high quality and is distributed among research institutes of the Academy of Sciences, Hydro-meteorological institutes, Arctic and Polar Research Institutes, Universities, Economic Research Institute and even the institutions of city planning, such as Saint Petersburg Institute of General Plan.

The milestones of the Russian Climate Policy 1994-2014 are outlined below.

- In 1994 a Federal law on the ratification of the united Nations Framework Convention on Climate Change (UNFCCC) was passed by the Russian Parliament (Gosduma RF 1994); after ratification of the UNFCCC the Interdepartmental committee of the Russian Federation on climate change issues was created;
- In 1995 the first National Communication of the Russian Federation to UNFCCC was submitted;
- In 1996 the Federal Goal Programme "Mitigation of the Dangerous Changes in Climate and their Negative Consequences" was adopted;
- In 1998 the Second National Communication of the Russian Federation to UNFCCC was submitted;
- In 2000 the Environmental Doctrine of the Russian federation was adopted (Gosdima RF, 2000);
- In 2003 the Third National Communication to UNFCCC was submitted; the Russian Federal Service for Hydrometeorology and Environmental Monitoring (Roshyydromet) was appointed as a responsible body of the administration to support the Russian Federation participation in UNFCCC and Kyoto Protocol; the World Climate Change Conference was held in Moscow;

- In 2004 the Federal Law on Ratification of the Kyoto Protocol was adopted allowing the Kyoto Protocol to enter into Force;
- In 2005 the “Strategic Prediction for the period of up to 2010-2015of climate change expected in Russia and its impact on sectors of the Russian national economy” was published by Roshydromet (Roshydromet 2005); the first “Report on the Peculiarities of Climate in the Russian Federation” came out and became an annual publication by Roshydromet; the Interdepartmental Committee on the problems of implementation of the Kyoto Protocol in the Russian Federation was formed;
- In 2006 the Russian system of evaluation of the anthropogenic source emissions and absorption by the GHG sequesters, not regulated by the Montreal Protocol on the substances destroying the ozone layer was created; the Russian Registry of the Carbon Units was launched; the Fourth National Communication of the Russian Federation to UNFCCC was submitted;
- In 2008 the ‘Evaluation Report on the Climate Change and its consequences in the Russian Federation was published;
- In 2009 First legal acts on the implementation of measures on the Kyoto Protocol’s ‘flexibility mechanisms’; ‘Climatic Doctrine of the Russian Federation’ was adopted; Alexander Bedritsky was appointed councillor of the President of the Russian Federation and a special representative of the President of the Russian Federation on Climate Issues;
- In 2010 Roshydromet was appointed again as a responsible administrative body for securing participation of the Russian Federation in UNFCCC and Kyoto Protocol; Fifth National Communication of the Russian Federation to UNFCCC was submitted; Energy strategy of the Russian Federation was adopted;
- In 2011 the Government of Russian Federation adopts the ‘Complex Plan of Implementation of the Climatic Doctrine of the Russian Federation until 2020;
- In 2012 the interdepartmental working group of the Administration of the President of the Russian Federation on the issues related to climate change and securing sustainable development was created;
- In 2013 President of the Russian Federation signed a Decree No. 752 On the Reductions in GHG Emissions;
- In 2014 the Sixth National Communication of the Russian Federation to UNFCCC was submitted and the Government adopts a Plan of actions to secure a reduction in GHG emissions to the level of 75% of the 1990 levels by 2020;

- In 2015 several reports were produced: On Participation of Russian Federation in realization of the UNFCCC and Report on Peculiarities of Climate on the Territory of Russian Federations for the year 2014 (Roshydromet 2015).

Concerning the Russia's Post-Kyoto climate policy, Alexey Kokorin (WWF Russia) and Anna Korpoo (Fritjof Nansen Institute [FNI]) posed a reasonable question: are all these well designed documents are of real action or are they merely a window dressing (Kokorin & Korpoo 2013)?

According to the Kokorin and Korpoo (2013), Russia considers energy efficiency and technological innovation the first priorities in climate policy. In 2014 Russia joined the World Bank initiative on 'carbon price', which includes: (1) taking into account the future costs of CO_2 emissions in developing investment projects and business plans; (2) standardized reporting on emissions at the level of large enterprises; (3) nationally determined carbon regulation measures, which will lead to the increased deployment of low emission technologies (Kokorin 2016). The new version of the National Biodiversity Conservation Strategy designed by the Ministry of Natural Resources and the Environment of the Russian Federation includes the issues of adaptation by ecosystems to climate change.

According to Kokorin and Korpoo (2014), Russia has two climate policy tasks: 1) development of the new economic incentives for CO_2 emissions reductions, which will lead to tangible co-benefits: air quality improvements and new employment; 2) development of adaptation measures in agriculture, forestry, cities, transport infrastructures and nature protection.

Russia took part in the Paris negotiations in December 2015. At a press conference during the COP21 the Minister of the Natural Resources and the Environment of Russia, Sergei Donskoi, assured the press that climate challenge is a state priority of Russia, and that Russia is supporting the agreement and insists on its legally binding nature. Russian non-government organizations were rather sceptical in their assessments of the climatic efforts of the Russian government. It was argued that the climatic policy in Russia doesn't exist. The NGOs consider effective climate policy to be impossible without the dialogue between civil society and government, which is not taking place at the moment.

The main aspects of the Russian position at the COP21 meeting in Paris could be summarized with the following main points:

- Russia confirmed its intentions to reduce CO2 emissions by 30% of 1990 level to 2030;
- Russian efforts introduced an article on the role of forests in carbon sequestration in the text of the Paris agreement;

- Russia intends to reduce CO2 emissions despite the lack of formal targets in the Paris agreement;
- Russia intends to prepare a Federal Law on the Ratification of the Paris Agreement;
- Russia intends to develop a Low Carbon Development strategy as a part of its Socio-Economic Development Strategy;
- Russia intends to adopt a Federal Law on the State Regulation of GHG Emissions;
- Russia intends to develop policy tools for enterprises to regulate their emissions and stimulate new technologies;
- The strategy will propose a series of measures to stimulate the development of renewable energy.

Russia signed the Paris Agreement on April 22, 2016. At the national level Russia will have to develop new reporting standards for large (by 2016) and medium (by 2018) enterprises; the system of carbon regulation (by 2018), introduction of the Best Available Technologies (by 2018). Russia also aims to develop national and regional adaptation plans. According to the Paris Agreement, by 2020 Russia will have to design a Low Carbon Development Strategy until 2050. Russia has confirmed in Paris that it will be increasing its contributions to UNDP Russia Trust and Green Climate Fund.

Our research on the climate change discourse in the Russian media in 2004-2008 has shown that the major international climate change events were responsible for the local maxima of numbers of newspaper publications devoted to climate change (Figure 3). Policy debates were focused around five major topics: Assessment of the Environmental Effects of Climate Change, Development of the Arctic and Climate Change, Post-Kyoto Negotiations, CO2 Emissions Reductions and Adaptations to Climate Change.

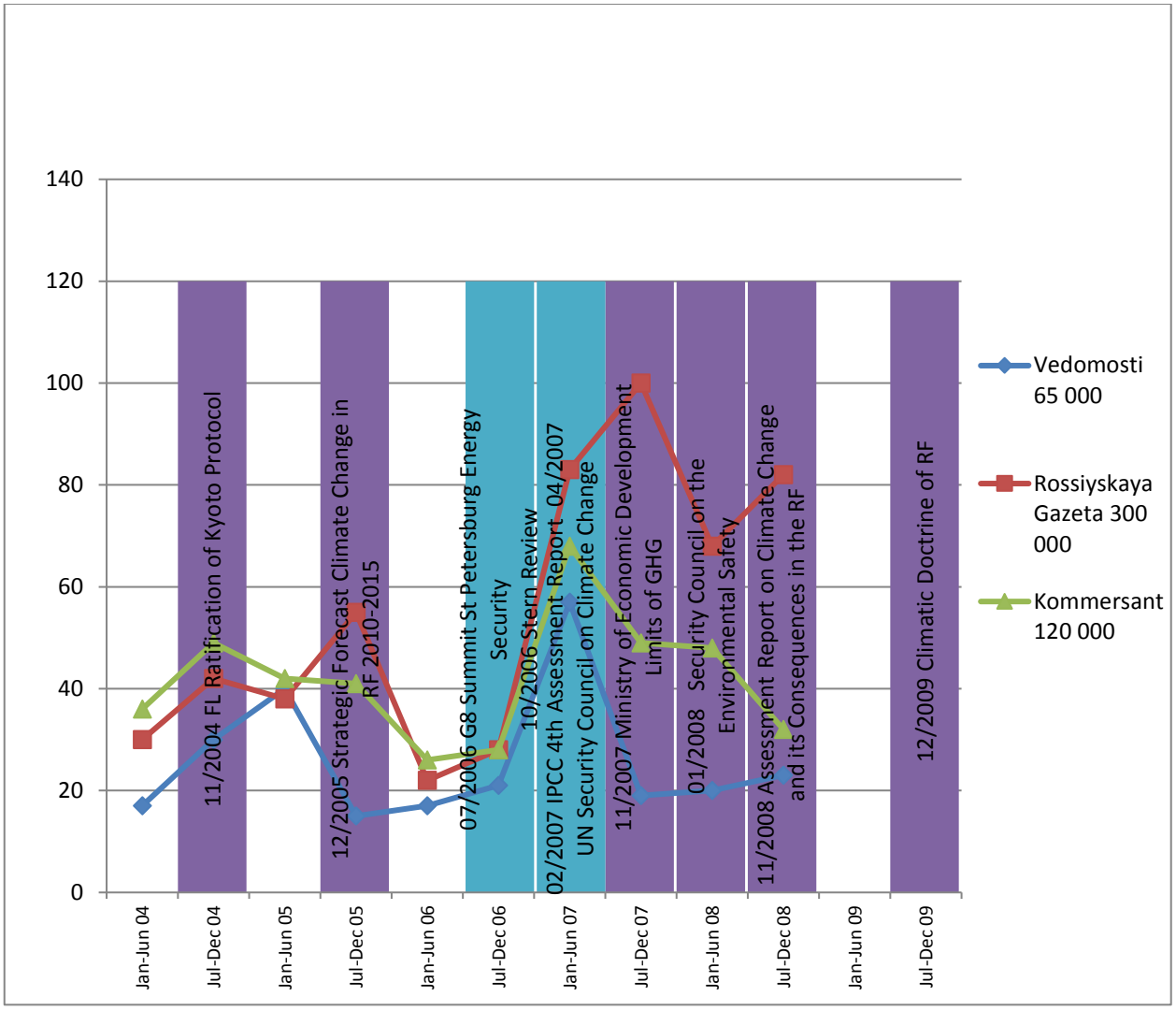

Figure 3. Policy debates on climate change in Russia in 2008 (source: Shmelev & Shmeleva 2012).

The major actors mentioned in the media in this context were: Government of Russia, Federal Hydrometeorological and Environmental Monitoring Service, World Wildlife Fund Russia, European Commission, the United Nations, Federal Forestry Agency, Ministry of Economic Development of the Russian Federation, World Bank, The Ministry of the Russian Federation for Civil Defence, Emergencies and Elimination of Consequences of Natural Disaster, Friends of the Earth Europe, United States House of Representatives, and the UK Parliament[3]. A network of climate change actors and policy debate categories based on 2008 data is presented in Figure 4.

[3] The network analysis of actors and topics of policy debates in climate change in Russia in 2008 could be seen in (Shmeleva & Shmelev, 2012).

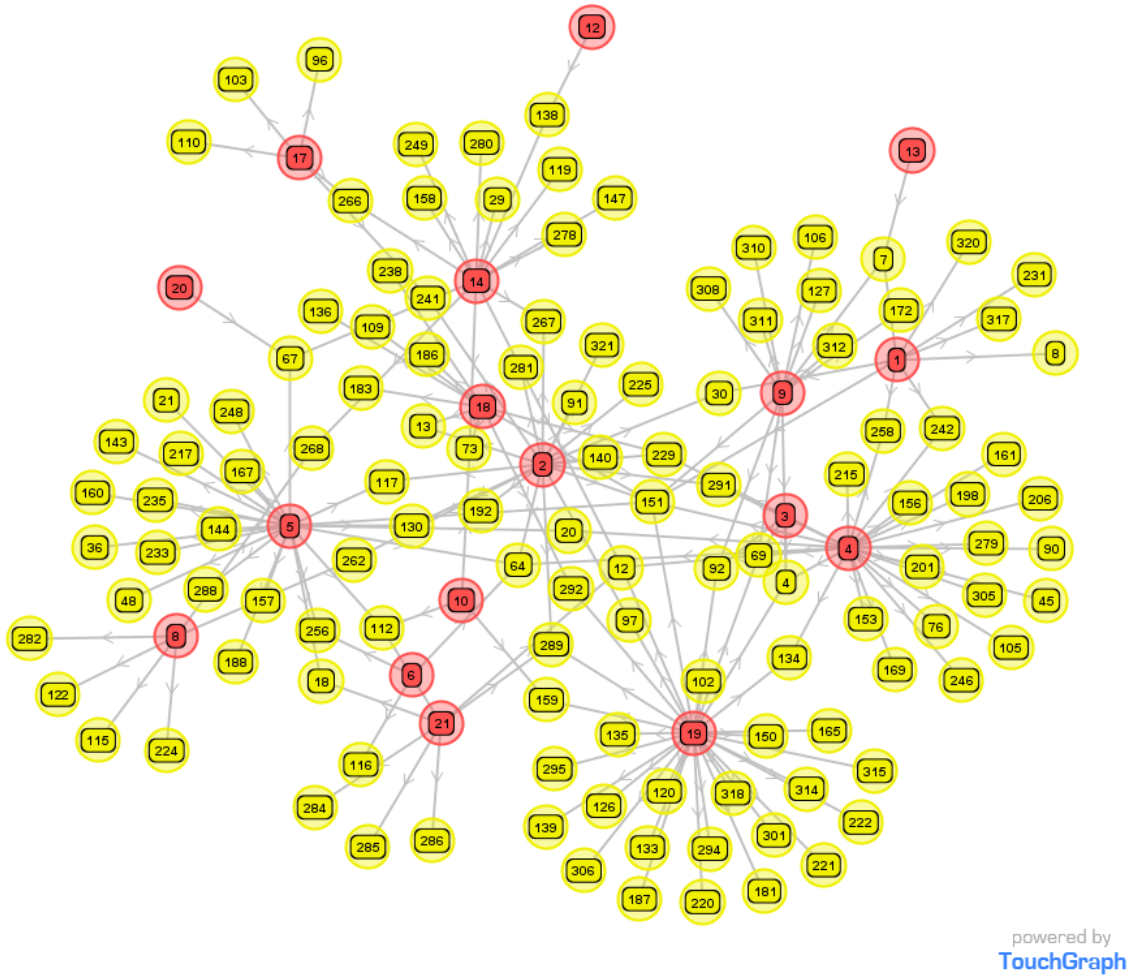

Figure 4. Climate change actors and policy debate categories in Russian media in 2008 (source: Shmeleva & Shmelev 2012).

Our analysis has shown that the most active organizations in the climate policy debates as reflected in the media were the government and scientific institutions, with NGOs and the media involved at a lower scale. It should be added that the amount of attention to economic, energy and policy issues was much higher than to scientific discussions on climate change. The climatic discourse in the Russian media has changed in 2009 due to the fact that journalists started to participate actively in the Conferences of Parties. In 2015-2016 the attention was drawn to the Paris agreement, its ratification, introduction of carbon regulations, wind and solar investments in Russia (USD1.7bln), Russia's carbon trading record, the assessment of regional governance effectiveness by measuring the CO2 intensity of Gross Regional Product and such issue as the opposition to low carbon development from the Ministry of Energy (see also word cloud in figure 5).

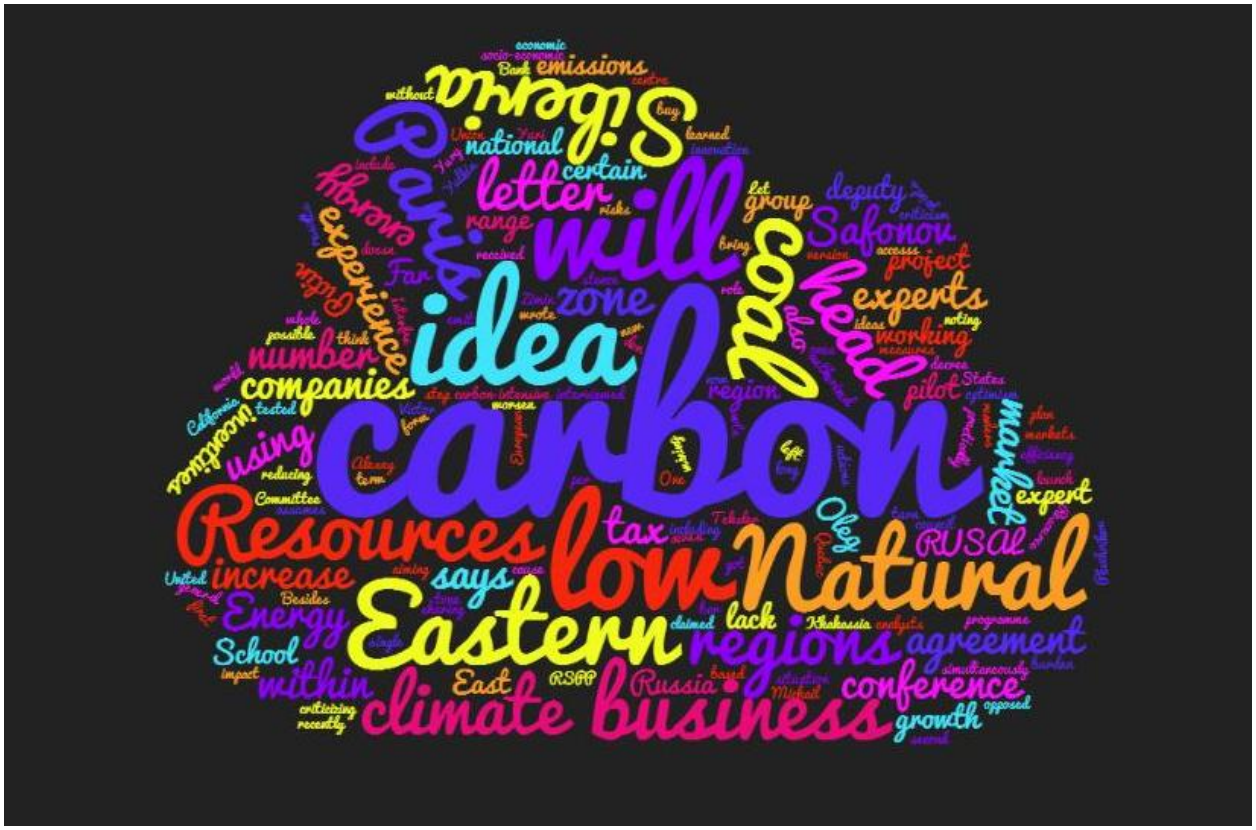

Figure 5: Word cloud base on the article of A. Davydova (2016).

References

Davydova A. (2016). Eastern Siberia will be left without the freedom to emit Ministry of Energy and the coal industry opposed low carbon development, Kommersant, 25.02.2016.

Gosduma of the Russian Federation (1994). Federal Law on United Nations Convention on Climate Change Ratification [In Russian]. Available at: <https://rg.ru/2004/11/09/kiotskiy-doc.html>.

Kokorin A. and Korppoo A. (2013). Russia's Post-Kyoto Climate Policy Real Action or Merely Window-Dressing? FNI Climate Policy Perspectives 10.

Kokorin, A. O., & Korppoo, A. (2014). *Russia's Greenhouse Gas Target 2020: Projections, Trends, and Risks*. Friedrich-Ebert-Stiftung, Department of Central and Eastern Europe. Available at: <http://library.fes.de/pdf-files/id-moe/10632.pdf>.

Kokorin A. (2016). New Factors and Stages in Global and Russian Climate Policy. *Economic Policy,* 11(1), 157-176.

Federal Service for Hydrometeorology and Environmental Monitoring (Roshydromet) (2005), *Strategic* Prediction. Moscow. Available at: <http://climatechange.narod.ru/DOCS/Strat_prediction_Eng.pdf>.

Roshydromet (2008). Evaluation Report on Climate Change and its Consequences in the Russian Federation, Moscow.

Roshydromet (2015). Report on the Peculiarities of Climate on the Territory of the Russian Federation in 2014, Moscow.

Shmeleva I.A. and Shmelev S. E. (2012). Climate Change Discourse Analysis: the Russian Case. In: Shmelev S. E., and Shmeleva I. A. (Eds). *Sustainability Analysis: An Interdisciplinary Approach.* Palgrave. Pp.203-253.

Germanys transition towards a high renewable energy share - transferable challenges?

Dörte Ohlhorst[1]

Introduction

The international responsibility of developed countries for greenhouse gas (GHG) mitigation is of particular importance. The energy transition in Germany contains clear milestones for climate protection, the development of renewable energy, energy efficiency and the nuclear phase out. These goals are generally accepted in the country and thus represent a robust guideline for policy that goes beyond election periods.

In the course of the German energy transition towards a high renewable energy share ('Energiewende') some milestones have already been achieved: One third of the German electricity supply comes from renewables (gross electricity generation; see figure 1).

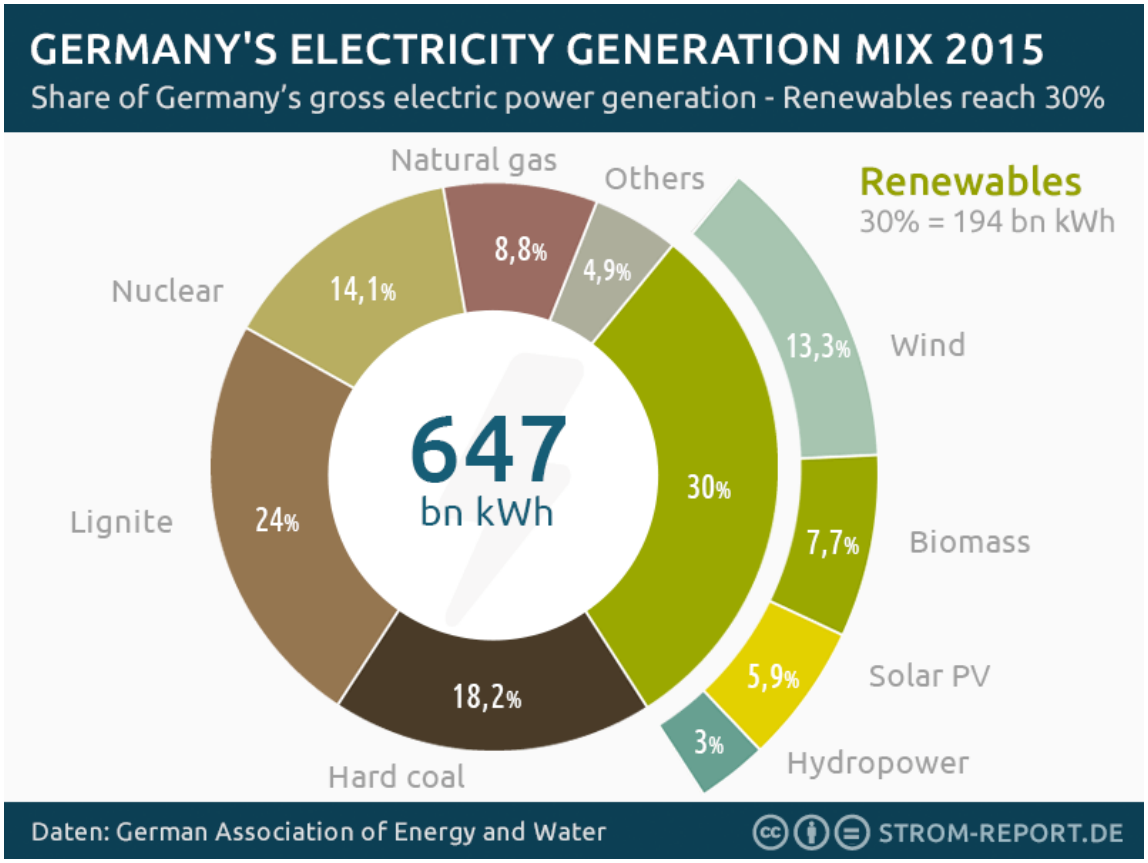

Figure 1: Germany's energy mix in 2015 (source: German association of energy and water).

[1] Dr. Dörte Ohlhorst, Environmental Policy Research Centre (FFU), Freie Universität Berlin; ohlhorst@zedat.fu-berlin.de

However, Germany still faces some challenges in the energy field. The following targets Germany has set in climate and energy policy:

- nuclear phase out by 2022
- 80 - 95% reduction of CO_2 emissions by 2050 (compared to 1990) [2]
- 80 - 95% renewable energy share in gross electricity consumption by 2050 (50% by 2030; 65% by 2040)
- improvement of energy efficiency: reduction of primary energy consumption of 20% by 2020 and of 50% by 2050 (compared to 2008).

Wind and solar power will be the main pillars of the future renewable electricity supply – however, technology and society will be shaped in parallel. Effects of governance unfold in the interaction of heterogeneous factors and contextual conditions. Transition towards a new socio-technical system needs innovation - niches and laboratories that allow experimentation with new technologies and ideas. It involves co-evolution of several inter-connected sub-systems, the interaction of a broad range of societal actors and all levels of governance.

Germany has been successful in advancing its renewable energy policy in recent decades. Only twenty years ago, renewable electricity production was still a small niche in the energy supply system, and the exploitation of renewable energy faced considerable technical and financial challenges. Today, almost 30% of the German electricity supply is met by renewables. However, while this represents a considerable success, the ongoing energy transition continues to face new challenges that require not only infrastructure development but also social adaptations and political adjustments.

Some factors and experiences of the German energy transition seem to be of extraordinary importance to advance GHG mitigation in the energy sector. They might as well play an important role in other countries. The following presents three factors crucial for achieving the desirable targets the German energy transition: the role of subnational actors in policy innovation diffusion, the role of bottom-up initiatives and the role of co-benefits.

[2] It is important to always keep in view the more demanding target of 95%, because possibly the achievement of the international two-degree target can only be secured by achieving this more ambitious aim (SRU 2011, chap. 2). Even the 80% target can only be achieved if the power sector's potential for full decarbonisation is exploited (Matthes 2012; SRU 2011; Öko-Institut and Fraunhofer ISI 2014). In the other sectors, the potential for GHG reduction are lower and the costs are higher (SRU 2013).

Diffusion in the multi-level governance system and policy reinforcement

The scholarly model of multi-level governance distinguishes this form of governance from hierarchical state authority and takes into consideration the multi-level integration of political structures at national, supranational, and subnational levels (Hooghe & Marks 2003; Benz 2007).

The German 'Energiewende' is incorporated in a system of multiple levels. First, Germany is a European Union's member and its energy policy is closely linked to the targets and directives developed at the European level (Vogelpohl et al. 2016). Second, Germany has a significant national strategy and regulatory framework for climate protection and renewable energy promotion in place. The dynamic development of renewables is, to a large extent, driven by financial incentives set at the federal level, and goes along with the influence of market actors. This has been crucial in the dynamic development of renewables in Germany in the past 20 years of innovation (Bruns et al. 2011). Third, the transition process is accompanied by a shift to more decentralization, which leads to an increasing importance of sub-national authorities.

According to Jänicke (2014), multi-level governance in Europe represents a multi-impulse system which fosters interactive learning from best practice and provides opportunity structures for innovation and rapid diffusion. From his perspective, the interplay of instruments at different levels of governance provides the basis of a dynamic multi-level reinforcement. In this multi-level governance system, subnational levels of governance play an increasingly important role. Therefore, the specific role of subnational levels for reinforcing climate action is to be explored not only in Germany but in other countries as well.

Bottom-up engagement and citizen's ownership as a prerequisite for transformation

The German Energiewende was strongly driven from the bottom up. Active communities and regions, citizen initiatives, cooperatives and private owners of wind & solar plants (prosumers) are important actors who promote the transition process. One phenomenon is the growing segment of citizen's energy ('Buergerenergie'): Almost half of Germany's installed eco-power in the electricity sector is owned by citizens and small private investors (apart from offshore wind) (Ohlhorst 2016b). The high private investments strengthen the regional added value of renewables, they remain largely in the local economic cycle, rather than run into global financial flows. In addition, municipal budgets benefit from tax revenues. Economic and social effects of local investments in renewable energy are important especially for rural and structurally weak regions. There is not just a small

number of large companies who are benefiting, but we also observe an effect of democratization and diversification of actors in electricity production in Germany. A high number of actors can share the value added. The influence in the energy market is more broadly diversified – the oligopoly of large corporations in the energy market is broken. Last but not least, the costs of energy produced by citizens are lower than those produced by large companies, because some costs can be avoided through voluntary work.

The dynamic development of citizen's energy production in Germany was based on the (federal) regulatory framework. The central instrument is the Renewable Energy Act (EEG). It gives priority access to the grid and provides differentiated feed-in-tariffs for renewables. Investors in renewables receive sufficient compensation to provide a return on investment - irrespective of electricity prices. This leads to a high level of investment security. Every three to four years, feed-in tariffs are reviewed and the law is amended. A digression of feed-in tariffs brought down the costs of renewables. The instrument was copied worldwide.

However, the last major revision of the EEG in August 2014 provides a shift in the support system from the feed-in system to an auction system with quotas (limited expansion – the share of renewable energy sources [RES] should not exceed 35 to 40% by 2020). This shift aims at lower costs of the energy transition. The instrumental shift to an auction scheme will influence the actor-constellation in the renewable electricity market: it generates higher transaction costs for investors and will diminish the chances for those actors who cannot diversify financial risks. It bears the risk that citizen's energy can no longer participate in the competition.

Business models in the energy sector are highly dependent on the respective national regulatory framework. There are concerns that due to the alteration of the legal framework, the civil commitment for and social acceptance of the energy transition will massively decrease in Germany. The hypothesis is that the legal framework to promote renewable energy in different countries has a strong impact not only on the dynamics of the expansion of renewable energy, but also on participation, democratization, acceptance, diversification and resilience of the national energy supply system.

Highlighting co-benefits of greenhouse gas mitigation strengthens renewable energy policy

If decision makers want to achieve the support of as many actors as possible for a system transition, it seems to be of great importance to highlight co-benefits (win-win effects, synergies) of the implementation of sustainable technologies and to strengthen synergies. Co-benefits are

unintended (not selectively induced) but welcomed positive side effects of a policy action (Maa et al. 2013). They are positive secondary effects of a political intervention that come into operation in addition to the intended effects. The complementary benefits can indirectly strengthen the intended effect or refer to another objective or policy area.

The high relevance of co-benefits for climate protection policy is stressed by the IPCC (IPCC 2001, 2007, 2014a, 2014b) and the World Bank (World Bank o.J.). The IPCC refers to climate protection policies and their positive side effects on adjacent sectors and focuses on the identification, assessment and management of the interactions of climate change policies with other social objectives and the targeted strengthening of climate protection measures. It is assumed that the tracking of multiple targets strengthens the robustness of policy.

Also the literature about positive policy feedbacks points out the coupling of co-benefits to the intended effect of measures (Jordan & Matt 2014; Jacobs & Weaver 2015). The energy sector is identified as the arena with a particular high potential for significant co-benefits (Smith & Haigler 2008). Co-benefits can emerge through the overlap of policy goals. They can strengthen the motivation of states, regions and municipalities to set ambitious targets for the expansion of renewable energy generation, they facilitate political feasibility and stability of decisions and strengthen positive policy feedback. The IPCC report "Mitigation of Climate Change" (IPCC 2014) emphasizes the need for more information on the various co-benefits as well as adverse side-effects[3] and costs that are assigned to alternative policy options.

The term "co-benefits" is often used in terms of business profits. But co-benefits of energy and climate protection policy measures go beyond economic benefits: Political, social and institutional co-benefits relate in regards to participation, cooperation and political stability (Mayrhofer & Gupta 2016, p.25). The IPCC identifies a number of co-benefits of climate change policies, such as clean air impacts – linked with public health impacts, motor for green jobs, resilience, water supply, women empowerment, resource efficiency, economic security, sustainability of ecosystems, protection of biodiversity, economic dynamism, reduced dependence on fossil fuels/energy security (for importing countries), less risks of disruption in power supply and lower risk of economic losses caused by price volatility (Friis Bach 2016; Smith & Haigler 2008). Other highlighted co-benefits are the democratization of energy production, the optimization of energy use and efficiency, the diversification of energy supply and disruption of traditional energy cycles. The IPCC also uses the terms "side benefits", "secondary benefits", "collateral benefits", and

[3] The IPCC / UNFCCC and WHO developed - in conjunction with other international organizations - standard procedures for the scoping of co-benefits of climate and health measures in the context of development projects. Also risk factors with respect to negative effects are considered.

"associated benefits" (IPCC, 2001).

Co-benefits approaches are often referring to developing countries, arguing that co-benefit-based actions have the potential to bridge the gap between necessary climate mitigation efforts and the need to boost economic growth and poverty eradication, that they can help advance climate policies in developing countries due to their potential for economically beneficial climate mitigation actions, and thus can provide for both development and climate mitigation (Dubash 2013; Dubash et al. 2013; Beermann et al. 2016).

Essentially three meanings of the term should be distinguished (Miyatsuka & Zusman (o.J.):

- "Development co-benefits": this is about (local) additional benefits of climate protection measures (e.g. air quality improvement, jobs, substitution of old coal-fired power plants, resilience, self-sufficiency) (intended or non-intended). This definition corresponds to the emphasis of the IPCC.
- "Climate-added value": additional benefits of development plans or sectoral policies. This perspective was developed in light of the assumption that developing countries would always put a greater emphasis on (economic) development than on climate change.
- Co-benefits of GHG mitigation at the individual level: A lifestyle focusing on sufficiency is not only relevant for climate protection goals and energy savings, but also associated to many advantages for consumers, e.g. to time affluence, leisure, enjoyment, health, life satisfaction, comfort, self-determination, mindfulness, resonance, self-esteem and esteem of others, of things and of the environment, social justice (by not consuming goods and services) and possibly also to an increase in jobs. Moreover, stronger local and regional bond and rooting is part of the sufficiency approach.

This paper argues that co-benefits strengthen climate policies not only in developing countries but in developed countries as well. In practice, co-benefits are particularly relevant when social and technical innovations are required for the solution of multidimensional crises. In complex conflict situation the ability to draw attention and support by a broad range of different stakeholders is becoming a key factor for policy choice. Political decisions with the aim to transform the energy supply system are easier to enforce if they are supported by many interests. The here presented hypothesis says that by highlighting co-benefits, a wider support of stakeholders can be achieved for climate protection policies in both developing and industrialized countries.

The question to be explored is under which conditions co-benefits are suitable to reinforce the intended policy effects – do co-benefits only have this effect if they are sufficiently strong, if the respective actor coalition is sufficiently strong, if unintended *negative* effects are controllable and if

benefits occur at different political levels?

Conclusions

This paper aimed at highlighting the relevance of three factors for successful energy transition processes: the role of subnational actors for diffusion of innovative policies and policy reinforcement in the multi-level governance system; the role of bottom-up engagement and citizen's ownership as a prerequisite for transformation and the role of co-benefits for strengthening energy transition processes. The relevance of these factors for energy system transition will be explored in a research project.

References

Beermann, Jan; Damodaran, Appukuttan; Jörgensen, Kirsten; Schreurs, Miranda A. (2016): Climate action in Indian cities: an emerging new research area. Journal of Integrative Environmental Sciencees, 13:1, pp 55-66.

Benz A. (2007): Accountable Multilevel Governance by the Open Method of Coordination? European Law Journal 13(4), 2007, p. 505-522.

Bruns E, Ohlhorst, D, Wenzel, B, Köppel, J. (2011): Renewable Energies in Germany's Electricity Market. A Biography of the Innovation Process. Dordrecht, Heidelberg, London, New York: Springer.

Corning, Peter A. (1995): Synergy and self-organization in the evolution of complex systems. Systems Research and Behavioral Change 12(2): 89–121.

Corning, Peter A. (1998): The Synergism hypothesis: on the concept of synergy and its role in the evolution of complex systems. Journal of Social and Evolutionary Systems 21(2): 133–172.

Duguma, L.A.; Minang, P.A.; van Noordwijk, M. (2014): Climate Change Mitigation and Adaptation in the Land Use Sector: From Complementarity to Synergy. Environmental Management 54 (2014) 420-432.

Fligstein, N., McAdam, D. (2011): Toward a general theory of strategic action fields. Sociological Theory 29 (1), S. 1-26.

Hajer, M. A. (1997): The politics of environmental discourse. Ecological modernization and the policy process. Oxford, New York: Clarendon Press.

Heffner, G.; Campbell, N. (2011): Evaluating the co-benefits of low-income energy-efficiency programmes. Workshop Report. International Energy Agency.

Hooghe L, Marks G. (2003): Unraveling the central state? Types of multi-level governance. American Political Science Review 97(2):233-243.

Howlett, M. (2014): Why are policy innovations rare and so often negative? Blame avoidance and problem denial in climate change policy-making. Global Environmental Change 29, S. 395-403.

IPCC (Intergovernmental Panel on Climate Change) (2014a): Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press.

IPCC (Intergovernmental Panel on Climate Change) (2014b): Climate change 2014: contribution of working groups I, II and III to the fifth assessment report of the intergovernmental panel on climate change. Geneva: IPCC.

IPCC (Intergovernmental Panel on Climate Change) (2007): Climate change 2007: impacts, adaptation and vulnerability working group II contribution to the intergovernmental panel on climate change fourth assessment report summary for policymakers. Geneva: IPCC.

IPCC (Intergovernmental Panel on Climate Change) (2001): Climate change 2001: synthesis report. A contribution of working groups I,II, and III to the third assessment report of the intergovernmental

panel on climate change. Watson, RT, the Core Writing Team, editors. Cambridge: Cambridge University Press. IPCC 2007.

IPCC (Intergovernmental Panel on Climate Change) (Fourth Assessment Report). Climate Change, (2001): Mitigation. B. Metz, O. Davidson, R. Swart. and J. Pan. (eds.) Cambridge: Cambridge University Press, 2001. p. 711.

Jacobs, A. M., Weaver, R. K. (2014): When Policies Undo Themselves: Self-Undermining Feedback as a Source of Policy Change. Governance. First published online. http://onlinelibrary.wiley.com/doi/10.1111/gove.12101/abstract

Jänicke, M. (2014): Multi-Level Reinforcement in Climate Governance. In: A. Brunnengräber, M. R. Di Nucci (Hrsg.), Im Hürdenlauf zur Energiewende, Wiesbaden.

Jordan, A., Matt, E. (2014): Designing policies that intentionally stick: policy feedback in a changing climate. Policy Sciences 47 (3), S. 227-247.

Kirk R. Smith and Evan Haigler (2008): Co-Benefits of Climate Mitigation and Health Protection in Energy Systems: Scoping Methods. In : Annual Review on Public Health 2008. Vol. 29:11–25.

Lah, O.; Krämer, F.; Breithaupt, M.; Capone, C. (2015): Sustainable development synergies and co-benefits of low-carbon transport measures. EcoMobility Dialogues / Technical Paper.

Maa, Z.; Xue, B.; Geng, Y.; Ren, W.; Fujita, T.; Zhang, Z.; Puppim de Oliveira, J.A.; Jacques, D.A.; Xi, F. (2013): Co-benefits analysis on climate change and environmental effects of wind-power: A case study from Xinjiang, China. Renewable Energy 57 (2013) 35-42.

Matthes, F. C. (2012): Einordnung der aktuellen Debatte um den Flankierungsrahmen für die Stromerzeugung aus erneuerbaren Energien. Berlin.

Martinez-Juarez, P.; Chiabai, A.; Quiroga Gómez, S.; Taylor, T. (2015): Ecosystems and human health: towards a conceptual framework for assessing the co-benefits of climate change adaptation. BC3 Working Paper Series 2015-01. Basque Centre for Climate Change (BC3), Bilbao, Spain.

Mayrhofer, Jan P.; Gupta, Joyeeta (2016): The science and politics of co-benefits in climate policy. Environmental Science & Policy 57 (2016) 22–30.

Miyatsuka, A.; Zusman, E. (o.J.): ACP Fact Sheet No.1: What are Co-benefits. Asian Co-benefits Partnership. Retrieved from: http://pub.iges.or.jp/modules/envirolib/upload/3378/attach/acp_factsheet_1_what_co-benefits.pdf.

OECD/IEA (2014): Capturing the Multiple Benefits of Energy Efficiency. International Energy Agency.

Öko-Institut; Fraunhofer ISI (2014): Klimaschutzszenario 2050. Berlin.

Ohlhorst, D. (2016a): Germany's Energy Transition Policy between National Targets and Decentralized Responsibilities. In: Journal of Integrative Environmental Sciences; 12:4, 303-322, Special Issue Subnational Climate Policy. Eds: Kirsten Jörgensen, Anu Jogesh, Arabinda Mishra.

Ohlhorst, D. (2016b): Die Umstellung auf Ausschreibungen im Zuge der EEG-Novelle 2014 – Auswirkungen auf Bürgerbeteiligung und Vielfalt der Akteure in der Energieversorgung. FFU-report 1/2016, Berlin.

Puppim de Oliveira, J.A.; Doll, C.N.H.; Kurniawan, T.A.; Geng, Y.; Kapshe, M.; Huisingh, D. (2013): Promoting win-win situations in climate change mitigation, local environmental quality and development in Asian cities through co-benefits. *Journal of Cleaner Production 58* (2013) 1-6.

Rein, M., Schön, D.A. (1994): Frame Reflection: Resolving Intractable Policy Issues. Basic Books, New York.

Swaffield, S. (1998): Frames of reference: A metaphor for analyzing and interpreting attitudes of environmental policy makers and policy influencers. Environmental Management 22, 495-504. doi:10.1007/s002679900122.

Schmidt, V.A. (2008): Discursive institutionalism: The explanatory power of ideas and discourse. Annual Review of Political Science 11, 303-326. doi: 10.1146/annurev.polisci.11.060606.135342.

Schmidt, V.A. (2012): Discursive institutionalism: Scope, dynamics, and philosophical underpinnings, in: Fischer, F., Gottweis, H. (Eds.), The Argumentative Turn Revisited: Public Policy as Communicative Practice. Duke University Press, Durham, London, pp. 85-113.

Smith, Kirk R.; Haigler, Evan (2008): Co-Benefits of Climate Mitigation and Health Protection in Energy Systems: Scoping Methods. In : Annual Review on Public Health 2008. Vol. 29:11–25.

SRU (Sachverständigenrat für Umweltfragen (2011): Wege zur 100 % erneuerbaren Stromversorgung. Sondergutachten. Sachverständigenrat für Umweltfragen. Berlin.

SRU (Sachverständigenrat für Umweltfragen (2013):Den Strommarkt der Zukunft gestalten. Berlin.

Vogelpohl, T.; Ohlhorst, D.; Bechberger, M., Hirschl, B. (2016 forthcoming): German renewable energy policy –

independent pioneering versus creeping Europeanization? In: Solorio, I., Jörgens, H. (eds.) The EU Renewable Energy Policy: Challenges And Opportunities: Edward Elgar.

Williams, C.; Hasanbeigi, A.; Price, L.; Wu, G. (2012): International Experiences with Quantifying the Co-Benefits of Energy-Efficiency and Greenhouse-Gas Mitigation Programs and Policies. Lawrence Berkeley National Laboratory.

Worldbank (o.J.): Typology of activities with climate co-benefits by WB sector. Available online at: http://www.worldbank.org/content/dam/Worldbank/document/Typology.pdf

Decentralised laboratories in the German energy transition: Empirical evidence from the district of Ahrweiler[1]

Jan Beermann[2], Kerstin Tews[2]

Need for laboratories of innovation in low carbon energy transitions

An energy transition is a complex process of sociotechnical change, which requires destabilising lock-in mechanisms in the existing system, shifts in behavioural patterns of consumers and producers, as well as technological, political, and social innovation (Geels 2010). The scale of an unprecedented transformation such as the German energy transition means that setting up a predefined and all-encompassing "master plan" is neither meaningful nor feasible. Rather, the uncertainties associated with fundamental societal transitions require freedom for constant experimentation and innovation, to explore and test new approaches and to allow for adjustment to dynamic socio-political framework conditions and technological progress (Rotmans et al. 2001). In this paper, we elaborate on the role and potential of decentralised experiments in the German energy transition process.

The role of decentralised laboratories in multi-level governance systems

The role of decentralised initiatives and their capacity to innovate has been increasingly discussed in energy and climate governance research. Laboratory federalism theory suggests that decentralised jurisdictions can function as "laboratories of innovations" (Oates 1999; Saam and Kerber 2013). Under certain conditions, these innovations can subsequently disseminate, triggered by horizontal processes of policy learning and diverse diffusion mechanisms such as regulatory or ideational competition (Kern 2000; Tews et al. 2003; Tews 2005). Literature on policy diffusion pronounces that such bottom-up and decentralised innovation diffusion processes can be perceived as an alternative or complementary mechanism of convergence to hierarchical and (inter)national state-centred negotiation (Busch et al. 2005; Tews 2015).

[1] An extended and updated version of this article has been published in the Journal of Cleaner Production: Beermann, Jan; Tews, Kerstin (2016): Decentralised laboratories in the German energy transition. Why local renewable energy initiatives must reinvent themselves. In: Journal of Cleaner Production. DOI: 10.1016/j.jclepro.2016.08.130. Download: http://www.sciencedirect.com/science/article/pii/S095965261631294X

[2]Dr. Jan Beermann, Dr. Kerstin Tews, Environmental Policy Research Centre (FFU), Freie Universität Berlin; jbeermann@fu-berlin.de, ktews@zedat.fu-berlin.de

Scholars of polycentric governance (e.g. Ostrom 2010) investigate the diverse roles and particularly the *interplay* between the distinct levels in multi-level/-actor governance systems. A key research area of polycentric governance is exploring the challenges of cross-jurisdictional governance of common pool environmental resources, such as the climate system (e.g. Andersson and Ostrom 2008; Jordan et al. 2015). There is a widespread assumption and a positive narrative offered by scholars of polycentric governance that the decentralised, sub-national level provides an adequate space to experiment with innovations (Jordan et al. 2015). Nevertheless, literature on sub-national experimentation generally has a tendency to show over-enthusiasm for the innovation potential of decentral and bottom-up processes (ibid.) and fails to address scaling-up needs.

Research needs: Backing up the positive narrative with empirical evidence

There is a solid basis in empirical reality of decentral experimentation in energy transitions (e.g. 100% Renewable energy regions, transnational energy cities' collaboration, etc.). In Germany, there also exist diverse governmental climate protection programs at the federal level with a specific municipal or regional focus, with the explicit intention to:

a) stimulate the translation of global climate challenges and/or energy transition challenges into local experimentation (scaling down) in order to;
b) develop model solutions for others (scaling up).

Although this approach reflects the potential of decentral *laboratories of innovations* in polycentric governance systems, there is a lack of substantial evaluation of these efforts in order to draw policy lessons, for example in identifying and designing scalable innovations and for planning adequate scale-up-programs (Spicer et al. 2015; MSI 2012).

Without providing an empirical evidence of the decentralised level's real contribution to the management of systemic challenges of energy transformations and global climate change mitigation, we cannot verify the decentralised level's role in polycentric governance systems. Thus, we have to re-shift the research focus to investigate the conditions and mechanisms associated with scaling up/innovation diffusion. In other words, we need more empirically informed research in order to:

1. evaluate efforts at the decentralised level with regard to:

- *governance challenges of systemic relevance* that can be addressed at this level. These governance challenges cannot be restricted to those specific challenges relevant for a

specific decentral jurisdiction but instead for the energy transition processes in general and/or global climate change mitigation, and related to that;

- *the degree of transferability* of decentral innovations and scaling-up mechanisms.

2. clearly assess the *interplay* between the policy levels and the different modes of policy coordination in polycentric governance systems.

Against the backdrop of these theoretical considerations the "real-world laboratory" (Reallabor) project of Ahrweiler, Germany (EnAHRgie) is of specific interest, as within this "decentralised experiment" several of the challenges described above are addressed by an inter- and transdisciplinary project team of eight research institutes and multiple local stakeholders.

Project EnAHRgie: sustainable land use and energy supply at the local level in the model region of Ahrweiler (2015-2019)

The task of the applied research project EnAHRgie[3] is to develop an energy concept for the transformation of Ahrweiler[4] into a 100% Renewable Energy (RE) Region. The tools of this concept are to be designed to be applicable not only to Ahrweiler but also to other regions in Germany.

Ahrweiler challenges the positive narrative of decentral initiatives, such as the 100% RE regions movement, as the nuclei of the German energy transition outlined above. It was deliberately selected as a so-called "deficient" case with regard to its difficult social, political and geographical conditions for a local energy transition. Four years after having introduced the ambitious target of 100% electricity from renewable energy sources (RES) on an annual basis by 2030 in 2011, Ahrweiler produced about 12% RES electricity in 2015, mainly from wind and solar energy (Kreis Ahrweiler, 2015, p.5).

This paper presents three governance challenges that decentralised initiatives, such as Ahrweiler, face in pursuing a local *e*nergy transition.

Governance challenge I: Mismatch between issue areas and territorial borders

The first governance challenge is a challenge typical for regional governance approaches:

[3] The inter- and transdisciplinary project EnAHRgie is funded by the Germany Federal Ministry for Education and Research (BMBF) as part of the Research for Sustainable Development framework FONA (http://www.fona.de/en/framework). For more information about the EnAHRgie project and the partners involved please visit the project's website: http://enahrgie.de/ (in German).

[4] Ahrweiler is a largely rural county ("Landkreis", the jurisdiction above the municipal level) in the Western German state of Rhineland-Palatinate, consisting of 74 municipalities and about 126,000 inhabitants (2013).

issue areas and territorial borders often do not fit (e.g. Fürst 2004). This is exemplified in Ahrweiler. The decision to pursue 100% RES electricity was taken by the county parliament. Many problems as well as potential solutions, however, go beyond the territorial borders and the formal political and administrative influence of the county and demonstrate that the county is not a sufficient spatial focus for a regional energy concept. One example is land use and distributional conflicts arising from renewable energy plants with a wider spatial impact, such as wind turbines. In Ahrweiler, many of the existing and planned wind turbines are located close to the county's border and have a visual and natural impact on neighbouring municipalities and counties. A second example is the heterogeneous regional identities and interests in Ahrweiler. The county-wide perception of shared identity and solidarity is relatively weak among the local population. Most inhabitants consider themselves as belonging to smaller regions that have historically developed according to the utilisation of the diverse habitats within and beyond the county borders (e.g. touristic Rhine valley, wine-growing Ahr valley, agricultural Grafschaft and forested Eifel). A third example is the fact, that due to nature conservation and other legal and political restrictions, it will be impossible (or very expensive) to realise 100% renewable production in Ahrweiler. For the county's long-term target of achieving regional energy independence, Ahrweiler therefore needs to coordinate and exchange fluctuating renewable energy with neighbouring regions that have fewer restrictions.

Governance challenge II: Complex multi-level interplay of spatial planning and other decision-making competencies

A second governance challenge that decentralised energy transition initiatives are confronted with is the distribution of spatial planning and other decision-making competencies beyond several political-administrative levels. In Rhineland-Palatinate, the German subnational state where Ahrweiler is located, a total of five jurisdictional levels are involved in the planning and steering of renewable energies: two levels of municipalities (Orts- and Verbandsgemeinden), the counties, planning regions and the state of Rhineland-Palatinate. The state determines RES expansion targets and principles which are operationalised by the planning regions into regional spatial development plans. The municipalities specify priority and excluded areas for the building of RES plants. The counties have no formal planning and decision-making competencies. They function as approval authorities surveying the compliance of legal requirements in RES projects.

This distribution of competencies beyond multiple political-administrative levels requires extensive coordination and cooperation. The implementation of the local energy transition in

Ahrweiler demonstrates, however, that coordination is often lacking and formal coordination mechanisms are insufficient in allowing for coherent and efficient planning and RES project implementation. Examples of this lack of coordination include the delayed implementation of updated targets and principles of the state into the regional spatial development plans, leading to legal insecurity for the county of Ahrweiler as the approval authority.

Also the coordination between the two levels of municipality, the Ortsgemeinden and Verbandsgemeinden, is often difficult, especially if they pursue different interests. The lower level municipalities, the Ortsgemeinden, have constitutionally guaranteed decision-making competencies of municipal self-rule. They are run by mayors and local councils on an honorary basis and can encompass less than 100 inhabitants. The Verbandsgemeinden, which are federations of several Ortsgemeinden, support the Ortsgemeinden administratively. The Verbandsgemeinden can also decide about priority and exclusion areas for RES plants by setting up land use plans. The county of Ahrweiler consists of a total of 70 Ortsgemeinden, four Verbandsgemeinden, plus four independent cities and municipalities which have conducted RES planning in a largely uncoordinated and fragmented manner. In expert interviews, local stakeholders assess the integration of and the coordination between the municipalities and cities as a key challenge for realising a county-wide energy concept.

We suggest that two strategies should be applied in order to set up and implement an energy concept in inter-municipal cooperation.

Firstly, due to the deficiencies of existing formal coordination mechanisms between the five political-administrative levels involved there is a need to extend informal coordination. Several less formalised inter-municipal platforms already exist. A promising example is a cross-county and cross-state organised working group for development, planning and transport called “Regionaler Arbeitskreis Entwicklung, Planung und Verkehr Bonn/Rhein-Sieg/Ahrweiler” (abbreviation: “:rak”). According to an interviewee from the Ahrweiler county administration, Ahrweiler utilises the :rak regularly for the informal exchange of know-how and good practises in local RES planning with other counties and municipalities. The :rak illustrates that it can be helpful or even necessary for effective regional governance approaches to develop new problem or issue-specific spatial dimensions that may not be based on traditional territorial borders. For the design of an inter-municipal cooperation towards a local energy transition in Ahrweiler it should be considered whether it is possible to make use of platforms such as the :rak as they may be able to complement the existing formal coordination mechanisms and potentially compensate for their deficiencies.

Secondly, the county needs to strengthen its role as an informal inter-municipal mediator and moderator. Having no formal planning authority and very limited decision-making competencies in energy or energy-related policy fields the county needs to convince the municipalities to coordinate their planning activities voluntarily on a subordinate policy level. The fact that the county is the approval authority for local RES plants may facilitate its mediation and moderation role, as the county gathers a lot of information about existing and planned RES activities in its jurisdiction.

Governance challenge III: Adaptation to changing political framework conditions at superior policy levels

Decentralised energy transition initiatives, such as the county of Ahrweiler's energy concept, are highly dependent on the national and European regulatory and support frameworks (Tews 2015; Beermann and Tews 2015). Klagge et al. (2013) point to a duality of economic incentives at the national level versus the spatial planning competencies at the regional and local level and they criticise the fact that a lack of coordination between the political-administrative entities in the German federal political system prevented a resource-efficient, ecological and just expansion of RES.

Data collected in Ahrweiler confirms that local stakeholders, such as the county administration, energy utilities, energy cooperatives and RES project planners consider the dynamic changes and increasing complexity of the political and legal framework conditions as a major barrier to the implementation of decentralised energy transition projects. Several key laws are undergoing major reforms, leading to a perception of a generally instable and insecure investment climate for RES projects by decentralised actors. In particular, the introduction of annual RES extensions caps and a volume-based auction system in the renewable energy support scheme (Erneuerbare Energien Gesetz - EEG), as well as the increasing requirements for flexible demand and supply management in the Energy Industry Act (Energiewirtschaftsgesetz - EnWG) force decentralised actors to re-evaluate and re-invent their business models. A mere focus on adding RES capacity without addressing system demands is not feasible any more. Decentralised actors such as local and citizen-oriented RES initiatives with limited financial and human resources struggle with the increasing risks and transaction costs imposed by the changing framework conditions. In particular, the introduction of auction schemes for RES is considered as an existential threat by many small-scale, decentralised RES initiatives (Tews 2015; Beermann and Tews 2015).

We suggest that Ahrweiler's energy concept should be closely tailored to the changing legal

and political framework conditions. It should incentivise the development of innovative decentralised business models that can be implemented in a profitable manner under the new regulation and support schemes for RES. For example, with regard to the new auction scheme in the EEG there should be an evaluation of which opportunities remain for decentralised actors to successfully bid in auctions, for example by establishing new, collaborative networks of municipalities, local project planners and energy cooperatives that jointly prepare and hand in bids. If Ahrweiler succeeds in promoting such innovative business models that successfully address the changing framework conditions, these models could reach high external visibility and stimulate lesson drawing and their transfer to other regions.

Decentralised energy transition initiatives generally need to shift their previously largely inward-looking focus on merely adding local RES capacity to the grid towards a more system-based perspective (Ohlhorst and Tews 2013). If decentralised initiatives want to maintain a crucial role in the future energy system, they need to start experimenting with feasible models for a regional organisation of energy flows by addressing sector coupling of electricity, heating and transport, demand-and-supply management and regional marketing models.

Conclusions

We suggest the following three conclusions for further discussion in the EnAHRgie research project:

1. Decentralised initiatives such as the 100% RE Region Ahrweiler need to foster vertical and horizontal integration of decentralised RES deployment to provide systemic solutions and strengthen systemic impact. They need to take a broader perspective beyond the individual region to address regional coordination of energy flows and start experimenting with system integration of decentralised RE deployment.
2. Considering the deficiencies of formalised mechanisms of multi-level governance coordination, there is also a need to strengthen informal coordination, within and potentially also beyond formal political administrative borders.
3. Furthermore, decentralised energy transition initiatives need to extend lesson-drawing between decentralised experiments to foster diffusion of good practice. The research project EnAHRgie should therefore address the following questions:
    i. What can Ahrweiler learn from other model regions dealing with similar governance challenges?

ii. How can the energy concept be designed so that its tools and measures can be transferred to other regions?

References

Andersson, K. P. & Ostrom, E. (2008). Analyzing decentralized resource regimes from a polycentric perspective. Policy Sciences, 41(1), 71-93.

Beermann, J. & Tews, K. (2015). Preserving Decentralised Laboratories for Experimentation under Adverse Framework Conditions - Why Local Initiatives as a Driving Force for Germany's Renewable Energy Expansion Must Reinvent Themselves. In: FFU Report 03-2015, Forschungszentrum für Umweltpolitik.

Busch, P.-O., Jörgens, H. & Tews, K. (2005). The Global Diffusion of Regulatory Instruments: The Making of a New International Environmental Regime. The ANNALS of the American Academy of Political and Social Science, 598(1), 146-167.

Fürst, D. (2010). Regional Governance. In: A. Benz (Hrsg.), Governance - Regieren in komplexen Regelsystemen. Eine Einführung (S. 45-64). Wiesbaden: VS Verlag für Sozialwissenschaften.

Geels, F.W. (2010). Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. Research Policy, 39(4), 495–510.

Jordan, A., Huitema, D., Hildén, M., van Asselt, H., Rayner, T. J., Schoenefeld, J.J., Tosun, J., Forster, J. & Boasson, E.L. (2015). Emergence of polycentric climate governance and its future prospects. Nature Climate Change, 5(11), 977–982.

Kern, K. (2000). Die Diffusion von Politikinnovationen. Umweltpolitische Innovationen im Mehrebenensystem der USA. Opladen: Leske+Budrich.

Kreis Ahrweiler (2015). Die Energiewende im Kreis Ahrweiler. Der Kreis auf dem Weg zur 100% Region. 4. Statusbericht. URL: http://www.kreis-ahrweiler.de/pdf/statusbericht2015.pdf.

MSI (2012). Scaling up—from vision to large-scale change: a management framework for practitioners. MSI, second edition, Washington. URL: http://www.msiworldwide.com/wp-content/uploads/Scaling-Up-Framework.pdf.

Oates, W. E. (1999). An essay on fiscal federalism. Journal of Economic Literature, 37(3), 1120–1149.

Ohlhorst, D. & Tews, K. (2013). Deutschland als Laboratorium: Das Experiment Energiewende. Politische Bildung, 2, 26-46.

Ostrom, E. (2010). Beyond Markets and States: Polycentric Governance of Complex Economic Systems. American Economic Review, 100(3), 641-72.

Rotmans, J., Kemp, R. & van Asselt, M. (2001). More evolution than revolution: transition management in public policy. Foresight, 3(1), 15–31.

Saam, N. J. & Kerber, W. (2013). Policy innovation, decentralised experimentation, and laboratory federalism. Journal of Artificial Societies and Social Simulation, 16(1), 7.

Spicer, N., Bhattacharya, D., Dimka, R., Fanta, F., Mangham-Jefferies, L., Schellenberg, J., Tamire-Woldemariam, A., Walt, A. & Wickremasinghe, D. (2014). Scaling-up is a craft not a science: Catalysing scale-up of health innovations in Ethiopia, India and Nigeria. Social Science & Medicine, 121, 30-38.

Tews, K. (2005). The Diffusion of Environmental Policy Innovations: Cornerstones of an Analytical Framework. European Environment, 15(2), 63–79.

Tews, K. (2015). Europeanization of Energy and Climate Policy: The Struggle Between Competing Ideas of Coordinating Energy Transitions. The Journal of Environment & Development, 24(3), 267-291.

Tews, K., Busch, P.-O. & Jörgens, H. (2003). The Diffusion of New Environmental Policy Instruments. European Journal of Political Research, 42(4), 569-600.

Sustainability, resilience, and climate change adaptation: Synergy or conflict in urban development?

Nikolai Bobylev[1]

Introduction

A concept of sustainable development has been challenged by resilience one, the latter is strongly related to a need to consider the climate change in urban and regional development. Indeed, goals of sustainable and resilient development can be conflicting; a challenge of adapting urban infrastructure to climate change can be a good example. While there is a strong need to upgrade existing urban structures and infrastructure to more extreme weather conditions, making urban areas more resilient and safe, there is also a need to do it in a sustainable way. Some of the tradeoffs include: 1) speed versus sustainability of adaptation, 2) safety and reliability versus sustainability and; 3) current needs versus needs of the future generations. In simple terms, sustainable is everything that is light, frugal in resources and energy use, as well as land and space use. Resilience, on the other hand, implies heavy, reliable, solid structures and even a backup infrastructure which could be redundant. This conceptual conflict spreads through physical, as well as social systems, covering governance and management issues of development. The climate change issue exemplifies that conflict: to mitigate climate change urban communities need to be sustainable and to adapt to it they need to be resilient. However, in spite of obvious difference in concepts, there can be potential synergies in sustainability and resilience actions, which this research has been aiming to explore. This paper reports ongoing work and recent findings on this subject, aiming to discuss validity of the research questions and set up agenda and multidisciplinary partnerships for the future research.

Concepts, Definitions, a Research Question

Sustainable development is that which 'meets the needs of the present without compromising the ability of future generations to meet their own needs' (Brundtland report, 1987).

Resilience from a physical and natural sciences perspective implies the 'capacity of a system to absorb, disturbance and reorganize while undergoing change to still retain essentially the same

[1] Dr. Nikolai Bobylev, Head of Chair Environmental Safety and Sustainable Development of Regions, Saint Petersburg State University; n.bobylev@spbu.ru

function, structure, identity, and feedbacks' (Walker et al. 2004, p.1). This is translated into the two essential categories: 'bounce-back-ability' and adaptability (DeVerteuil & Golubchikov, 2016).

Adaptation pertains to the process of decision-making and actions carried out to regulate a system to future shocks, stresses, or additional varying circumstances in a way that preserves critical system functioning (Nelson et al., 2007).

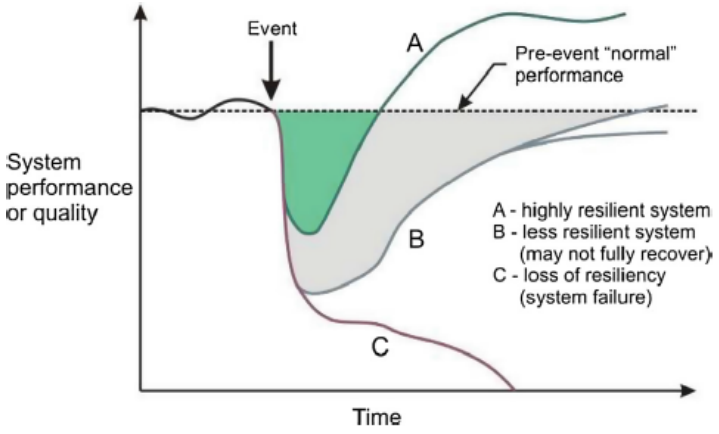

Figure 1. Conceptual definition of resilience – performance response functions (Sterling and Nelson, 2013).

A concept of a **liveable cities**, which includes aspects of 1) wellbeing, 2) resource security (i.e. 'one planet' living) and 3) carbon reduction (Hunt et al. 2016). When considering how a city might be engineered to maximize liveability options, an understanding of 'change' needs to be explored (Hunt et al. 2016). In essence this change could either be adaptive or transformative (Table 1). Table 2 considers conceptual differences between resilience and sustainability.

Table 1. Contrasting elements of adaptation and transformation (Redman, 2014).

Adaptive	Transformative
Incremental change	Major, potentially fundamental, change
Respond to shock	Action in anticipation of major stresses
Maintain previous order	Create new order, open ended
Build adaptive capacity	Reorder system dynamics
Emergent properties guide trajectory	Build agency, leadership, change agents

Table 2. Contrasting elements of resilience and sustainability (Redman, 2014).

Resilience theory approach	Sustainability science approach
Change is normal, multiple stable states	Envision the future, act to make it happen
Experience adaptive cycle gracefully	Utilize transition management approach
Origin in ecology, maintain ecosystem services	Origin in social sciences, society is flawed
Result of change is open needed, emergent	Desired results of change are specified in advance
Concerned with maintaining system dynamics	Focus is on interventions that lead to sustainability
Stakeholder input focused on desirable system dynamics	Stakeholder input focused on desirable outcomes

Table 3. Sustainability and resilience goals (Bobylev, 2016 based on Redman, 2014).

Resilience theory approach	Sustainability science approach
Differences	
Safe, reliable, available now	Minimal consumption, the future goal
Concrete actions to get concrete results	Doing the right things
Utilitarianism to resolve immediate problems	A way of life, a religion (?)
Similarities	
Long term resilience?	Short term (practical) sustainability
Research challenge	
Resilience actions can help or not help future sustainability	Sustainability actions help future resilience

Global Environmental Change are processes that manifest in localities, but with causes and consequences at multiple spatial, temporal and socio-political scales (Adger et al, 2005). Land use and land cover change are among major factors of contemporary Global Environmental Change (GEC). Among other GEC factors are ecosystem changes and loss of biodiversity, climate change, and urbanization.

Governance is an umbrella term to aggregate systems of formal and informal rules, rule-making systems, actor-networks, including government, industry, and civil society. Governance implies that there is no one actor, or institution (e.g. government) that solely influences decision-making in a specific domain, such as in urban development. Governance concept has been studied,

for instance, by Van Kersbergen and Van Waarden (2004) and Adger and Jordan (2008). Governance denotes new forms of regulation that go beyond traditional hierarchical state activity (Biermann et al, 2010). Governance concept has been eminent in addressing and conceptualizing GEC; Ostrom et al (1999) have considered its social and institutional dimensions.

A case of Urban Physical Infrastructure

By infrastructure we mean a set of objects or arrangements that, together, carry out specific functions and provide services (Bobylev & Jefferson, 2014). Infrastructure includes physical and institutional components. For example, flood protection infrastructure would include water barriers, drainage conduits, retainer walls, embankments and other structures as physical infrastructure, and; monitoring, emergency response, public information, contingent plans as institutional infrastructure components (Bobylev, 2013).

Urban Physical Infrastructure (UPI) can be defined as a set of artificial structures, interconnected physically or functionally (Bobylev, 2011). UPI includes physical objects like roads, bridges, sewerage, flood protection schemes, energy networks. Particular physical objects can be parts of several types of infrastructure, for instance, pumping stations can be a part of sewerage, flood management, and electricity infrastructure. UPI is one of the major assets of a city in terms of capital investment, critical services provisioning, and sustainable and resilient urban development.

Globally, UPI is facing increasing challenges in sustaining its services under pressures of urbanization and climate change factors; yet UPI itself can be used as an effective policy tool to govern urban expansion and wider land use (Bobylev & Jefferson, 2014). Thus, UPI exemplifies the above described resilience and sustainability conceptual differences, which translate into a need to optimal urban development policies, including UPI development. The influence of different types of infrastructure has been increasingly going beyond their core functions, which suggests that a broader array of stakeholders should be involved in making decisions on infrastructure development policies - a task that fits well into a Governance concept.

Adaptation versus Mitigation and Resilience versus Sustainability

Flooding and especially urban flooding has been a matter of serious and accelerating concern in the last decades. Here are several facts that are applicable to a vast majority of flooding cases: 1) risk of floods increases as GEC advances, 2) floods result from construction activities and land use which was unsuitable for given affected locations, 3) combating flooding requires a whole

array of physical infrastructure and institutional measures, and; 4) any flood mitigation options require significant investments. A traditional response to flooding has been to construct flood defenses, as it has been done in the metropolitan Tokyo area by constructing G-Cans – one of the world's most spectacular and expensive UPI solutions (G-Cans, 2003) (Picture 2).

However, it is quite clear that such expensive UPI solutions cannot be implemented in all areas that could benefit from them. These huge construction and operational expenses translate into un-sustainability at a several levels: 1) capital costs, which would be a heavy burden on most cites' or even countries' budgets, 2) construction materials used, mostly concrete, are quite energy intensive to produce, thus facilitating climate change by emitting carbon dioxide, 3) the whole construction process, which for such a vast infrastructure requires a lot of land, including excavated materials management (temporary storage, landfill), and 4) finally, operation process that require electricity for pumps. This example of urban flash floods management infrastructure exemplifies a conflict between resilience and sustainability – while surface runoff would occur naturally on undeveloped land, its artificial management continuously requires significant resources, including energy, which is in conflict with climate change mitigation agenda.

Figure 2. Critical infrastructure: G-Cans, Tokyo is an underground infrastructure for prevention of flooding during rainy season (Source: G-Cans project, Tokyo [http://www.g-cans.jp/]).

G-Cans, and similar projects (mainly across Asia, where heavy rainfalls commonly occur), exemplify challenges of urban policies directed at climate change adaptation, mitigation and the challenge of meeting resilience and sustainability needs. Leaving for the moment conceptual differences unresolved, several practical considerations can be made: 1) adapting to floods requires changes in land use, which is a complex task and can be elaborated through the governance processes; 2) UPI solutions would be one of the component, along with policy and land use change measures; 3) UPI has to be implemented in advance of land development (or redevelopment). Such proactive UPI might include artificial floodplains, dykes and canals, land or water lots for flood resilient houses (e.g. floating, semi-floating). Planning, policy, and UPI solutions on the ground should represent a cohesive strategy, since the whole UPI (utilities, roads, bridges etc.) needs to be designed according to chosen solutions for individual housing and transportation options. These approaches are in coordination with sustainability agenda and can meet resilience needs; however, a question of pace of adaptation to climate change remains open, since most of above described solutions are long term ones.

An important observation of urban flooding analysis is that reactive UPI development can hardly be a long term success. Unsustainable land use is the major floods driver in the first place, and any infrastructure solutions can just temporarily alleviate the problem, given that GEC pushing beyond the limits previously thought for flood defenses. Avoiding urban development in flood prone areas is not an option for many regions because there is simply no other space. Hence UPI proactive solutions, where land use is led by planned infrastructure, seems to be an adequate policy option (Bobylev & Jefferson, 2014).

Being vulnerable to climate change impacts (Bobylev, 2013), UPI in its turn can help cities to adapt to climate change in many ways: from traditional civil defense and emergency response facilities to advanced infrastructures for floods (e.g. above mentioned G-Cans project) and urban heat island management.

On a global scale, many large cities which have significant infrastructure assets are located in the coastal, low-lying areas most vulnerable to climate change impacts. Coastal areas generate about 6% of World's Gross Domestic Product on about 1% of the area (Dasgupta et al, 2007). Taking into account manifestations of climate change like sea level rise and increasing occurrence of extreme weather events (IPCC, 2007), it is important to address increasing risks to UPI and reliable provisioning of its services.

In a changing external environment, UPI can be an asset as well as a liability to a city facing climate change impacts. UPI can provide opportunities to mitigate and adapt urban areas to climate

change, however UPI itself often need to be adapted to climate change risks, both situations require significant investments (Bobylev, 2009b). Many UPI networks represent critical infrastructure, which means that functioning of a city as a whole directly depend on uninterrupted provisioning of UPI services. Therefore, UPI adaptation toGEC, in terms of opportunities to a city that it would provide on one hand, and its vulnerability on the other hand, is important in consideration of urban resilience (Bobylev & Jefferson, 2014).

Urban Physical Infrastructure and Governance

The importance of UPI, as one of the major assets, can and should be reflected in land use planning, urban planning, master plans and broader policies, including sustainability policies. Approaches developed in the Governance concept can be helpful to highlight UPI as one of the factors that is shaping cities physically, economically, socially, and environmentally. Bobylev and Jefferson (2014) distinguished two types of UPI interacting with a city (figure 3).

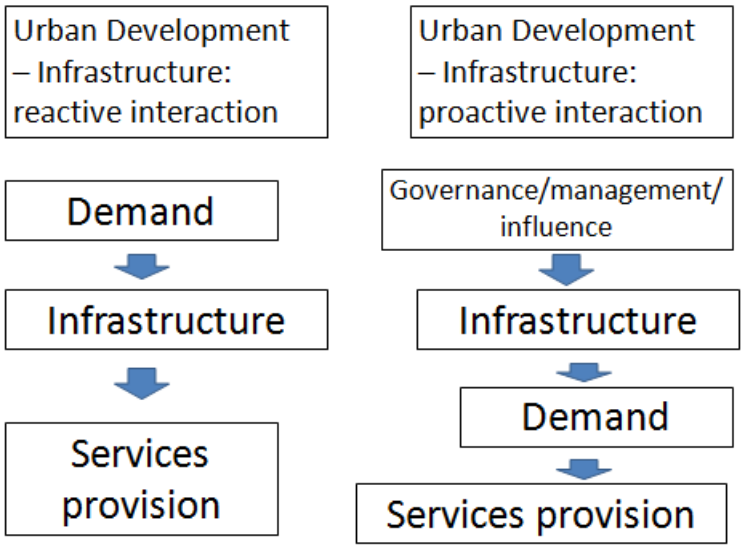

Figure 3. A concept of reactive and proactive interaction of Urban Physical Infrastructure and a city (Bobylev & Jefferson, 2014).

Reactive type of UPI interaction with a city characterizes UPI which was developed as a response to city needs. Examples are: building a new road junction to ease traffic congestion, create a river barrier to prevent flooding, building underground public rail system (metro) to respond to citizens' travel needs (Bobylev & Jefferson, 2014).

Proactive type of UPI interaction with a city represents the opposite concept where UPI is constructed having in mind facilitation certain development which might not be physically in palace

yet (Bobylev & Jefferson, 2014). Examples are: construction of a new road facilitated business on adjacent land lots, public transport infrastructure installed in areas planned for development, flood management infrastructure that has been constructed and land lots for housing that has been planned according to river management requirements (e.g. room for the river program which is under implementation in the Netherlands; see Corvers, 2009, Bobylev, 2010).

Whereas in reactive interaction type UPI follows urban development, in proactive urban development follows UPI. Whereas reactive interaction assumes UPI as a response to already existing urban problems, proactive UPI development assumes response to anticipated problems, or avoiding certain problems altogether by steering urban development. Thus, proactive UPI development makes UPI a component of urban policy, a tool with which development can be steered and policies implemented (Bobylev & Jefferson, 2014).

Central part of a city of Berlin, Germany is an interesting and maybe unique example of how UPI was leading urban development. Hobrecht (1862, as reported by Aust & Stark, 1987) created a Berlin Master Plan, which was based on sewerage plan (figure 4). Street network was developed based on sewers and land lots were available with sewers already in place. This idea was quite new at the time, and reflected new technology and demand for improved services.

Figure 4. City of Berlin Development Plan by Hobrecht, 1862, featuring sewer network corresponding with planned street network and land lots for development (Aust and Stark 1987).

Proactive UPI development can positively contribute towards addressing climate change challenges, however it is obvious that most UPI climate change actions would be reactive, that is we are willing to adapt existing and planned UPI to climate change impacts. Ample climate change

mitigation opportunities exist by developing sustainable UPI (energy efficient, compact, encouraging environmentally friendly lifestyles). Wende et al (2010) describes opportunities for climate change mitigation and adaptation using a variety of compact urban structures, which are a part of UPI, including tree screens, buildings, and artificial landscapes. UPI has its share of influence on land-use practices. Urban sprawl is perhaps the second largest factor in sustained land cover change after agriculture. In many growing and developing regions we can observe a sequence of land occupied by natural ecosystems that has been converted into agricultural land, and then to urban land. UPI plays a significant role in urbanization, and poor or absent UPI would correlate with low density built sprawling urbanized areas, while advanced UPI correlates with high density build urban areas (Bobylev & Jefferson, 2014). UPI arrangement plays an important role in the spatial structure of an urban area, its densities and energy use. Thus UPI ought to be an important issue to consider in urbanization process, cities' spatial structure, sustainable land use, and, on a global scale, GRC research (Bobylev & Jefferson, 2014).

Sustainability and resilience goals in urban development

Table 4 summarizes the above discourse on conflicts and synergies in resilience and sustainability, expanding the considerations beyond UPI and extrapolating the considered approached to urban development in general.

Table 4. Elements of resilience and sustainability related to urban development.

Urban challenges (liveability improvement)	**Resilience**	**Synergy or conflict; strong or moderate**	**Sustainability**
Utility services provisioning	Reliable provisioning of infrastructure services, backup infrastructure	Moderate conflict	Frugal resource use, reduced utility services consumption, saving energy while infrastructure operation
Infrastructure spatial arrangement	Wide, ample space for each infrastructure element to avoid	Strong conflict	Tight, aimed at saving space, energy, and materials

	disturbance in case of the other failure		
Housing	Safe, adapted to withstand disasters	Moderate conflict	Liveable and energy efficient
Public spaces	Designed to have additional capacity for disaster response and reduction	Moderate conflict	Designed to encourage sustainable lifestyles
Transport	Reliable transport links, designed to withstand variety of stresses while maintaining services	Strong conflict	Minimal, aimed at consuming minimal energy
Green and recreational areas	Ample, to adsorb disaster shocks and provide refuge	Strong synergy	Ample, to provide quality of life
Optimal urban form	Polycentric, to diversify risks	Moderate synergy	Compact, to save energy
Society	Coherent and informed	Strong synergy	Coherent and informed
Population and building stock densities	Optimal, not too low to be able to organize common protection (flood management) and not too high to enable disaster response (proximity of emergency services)	Unknown/specific to location	Optimal, not too low to save land and energy and not too high to enable quality of life
Climate change	Increase industrial activities to be able to adapt	Strong conflict	Decrease industrial activities to reduce greenhouse gas emissions (mitigate)

Conclusions

Sustainability and resilience approaches to urban development appeared to be (broadly speaking) conflicting in a short-term perspective and complimentary on a long term one. Urban adaptation to Global Environmental Change will require a complex, comprehensive approach that would include significant changes in land use, UPI, and an inevitable shift towards more sustainable lifestyles while reexamining an array of natural resources use (Bobylev & Jefferson, 2014). Proactive UPI planning and development could significantly contribute towards synergetic approaches towards urban sustainability and resilience policy agendas.

Acknowledgements

The author would like to thank the funding agencies whose grants contributed to the research reported in this paper: European Commission Marie Curie Fellowship (Sustainable Infrastructure for Resilient Urban Environments, 2013-2015); Alexander von Humboldt Foundation (Interplay between ecosystem and infrastructure services in the urban environments, 2015).

References

Adger W. N., Brown K., Hulme M. (2005) Redefining global environmental change. Editorial. Global Environmental Change 15 (2005) 1–4. Elsevier.

Adger, N. W., Jordan, A. J. (Eds.). (2008). Governing sustainability. Cambridge, UK: Cambridge University Press.

Angel, S., Sheppard, S.C., Civco, D.L. (2005) The Dynamics of Global Urban Expansion Washington, D.C.: World Bank, 2005.

Biermann, F., et al (2010) Earth system governance: a research framework. Int Environ Agreements (2010) 10:277–298 DOI 10.1007/s10784-010-9137-3.

Bobylev N., Hunt D.V.L., Jefferson I., Rogers C.D.F., (2013) Sustainable Infrastructure for Resilient Urban Environments. In: Advances in Underground Space Development – Zhou, Cai & Sterling (eds), Copyright 2013 by The Society for Rock Mechanics & Engineering Geology (Singapore). Published by Research Publishing. pp. 906 – 917. ISBN: 978-981-07-3757-3; doi:10.3850/978-981-07-3757-3 RP-107-P219.

Bobylev N., Jefferson I. (2014) Integration of urban physical infrastructure into land use governance: The World Bank - Washington DC, March 24-27, 2014. DOI: 10.13140/2.1.1563.3603 https://www.conftool.com/landandpoverty2014/sessions.php

Bobylev N., Sterling R. (2016) Urban Underground Space: A Growing Imperative. Perspectives and Current Research in Planning and Design for Underground Space Use. Tunnelling and Underground Space Technology, Elsevier. Volume 55, ISSN: 0886-7798. Pages 1 – 5. http://dx.doi.org/10.1016/j.tust.2016.02.022

Bobylev, N. (2006) Strategic environmental assessment of urban underground infrastructure development policies. Tunnelling and Underground Space Technology, Elsevier. Volume 21, Issues 3-4, 2006. ISSN: 0886-7798. Pages 469 – 479. doi:10.1016/j.tust.2005.12.106.

Bobylev, N. (2009a) Mainstreaming Sustainable Development into a City's Master Plan: a Case of Urban Underground Space Use. Land Use Policy, Volume 26, Issue 4, October 2009, Pages 1128-1137. Elsevier. doi:10.1016/j.landusepol.2009.02.003.

Bobylev, N. (2009b) Urban underground infrastructure and climate change: opportunities and threats. 5th Urban Research Symposium, Marseille, France June 28-30, 2009 17p. http://go.worldbank.org/P74DFSRCD0.

Bobylev, N. (2010) Underground Space Use in the Alexanderplatz Area, Berlin: research into the quantification of Urban Underground Space use. Tunnelling and Underground Space Technology, Volume 25, Issue 5, September 2010, Pages 495-507. Elsevier, doi:10.1016/j.tust.2010.02.013.

Bobylev, N. (2011) Comparative analysis of environmental impacts of selected underground construction technologies using analytic network process. Automation in Construction, Elsevier. Volume 20, Issue 8, December 2011, Pages 1030-1040. doi:10.1016/j.autcon.2011.04.004.

Bobylev, N. (2013) Urban physical infrastructure adaptation to climate change. In: J.B. Saulnier and M.D. Varella (eds.), Global Change, Energy Issues and Regulation Policies, Integrated Science & Technology Program 2, DOI 10.1007/978-94-007-6661-7_4, Springer Science+Business Media Dordrecht 2013, pp. 77-102.

Bobylev, N. (2016) Underground Space as an Urban Indicator: Measuring Use of Subsurface. Tunnelling and Underground Space Technology, Elsevier. Volume 55, Special Issue: Urban Underground Space: A Growing Imperative. Perspectives and Current Research in Planning and Design for Underground Space Use. ISSN: 0886-7798. Pages 40 – 52. http://dx.doi.org/10.1016/j.tust.2016.02.022

Bobylev, N. (2010) Ecosystem Services in the Context of Human Development. In: P.H. Liotta et al. (eds.) Achieving Environmental Security: Ecosystem Services and Human Welfare. IOS Press, Amsterdam pp. 183 - 205. ISBN 978-1-60750-578-5.

Cörvers, R.J.M. Vulnerable to Flooding? Nature Development and 'Room for the River': a Governance Perspective (2009), in: Fra Paleo, U. (ed.), Building safer communities. Risk governance, spatial planning, and responses to natural hazards. Amsterdam, IOS Press.

Dasgupta, S., Laplante, B., Meisner, C., Wheeler, D., Yan, J. (2007) The Impact of Sea Level Rise on Developing Countries: A Comparative Analysis. World Bank Policy Research Working Paper 4136, February 2007.

De Groot, R.S. (1992) Functions of Nature: Evaluation of Nature in Environmental Planning, Management and Decision Making. (Wolters-Noordhoff, Groningen.

DeFries, R., Foley J., and Asner G. P. (2004). Land Use Choices: Balancing Human Needs and Ecosystem Function. Frontiers in Ecology and the Environment 2:249-257.

DeVerteuil G. & Golubchikov O. (2016) Can resilience be redeemed? City, 20:1, 143-151, DOI: 10.1080/13604813.2015.1125714

Dutch Ministry of Transport, Public Works and Water Management (2006), Spatial Planning Key Decision Room for the River (http://www.ruimtevoorderivier.nl).

Fussel H.-M. (2007) Adaptation planning for climate change: concepts, assessment approaches, and key lessons. Sustain Sci 2:265–275 DOI 10.1007/s11625-007-0032-y

G-Cans project, Tokyo; http://www.g-cans.jp/ (June 1, 2006); http://www.ktr.mlit.go.jp/edogawa/gaikaku/

Houghton, R. A., Hackler, J. (2001) L ORNL/CDIAC-131, NDP-050/R1 (Oak Ridge National Laboratory, Oak Ridge, TN.

Hunt, D.V.L., et al. Liveable cities and urban underground space. Tunnel. Underg. Space Technol. (2015), http://dx.doi.org/

Intergovernmental Panel on Climate Change (IPCC), (2007) Climate change 2007: impacts, adaptation and vulnerability. Contribution of working group II to the fourth assessment report of the intergovernmental panel on climate change. In: Parry ML, Canziani OF, Palutikof JP, van der Linden PJ, Hanson CE (eds) Cambridge University Press, Cambridge

International Transport Forum (2011). Pedestrian Safety, Urban Space and Health. OECD. OECD Library.

Kalnay, E., Cai, M. (2003) Impact of urbanization and land-use change on climate. Nature, 423 (6939), pp. 528-531.

Millennium Ecosystem Assessment Synthesis Report 2006, http://www.maweb.org/en/index.aspx

Ostrom, E., Burger, J., Field, C.B., Norgaard, R.B., Policansky, D.,1999. Revisiting the commons: local lessons, global challenges. Science 284, 278–282.

Pimm, S.L., Raven, P. (2000) Extinction by numbers. Nature, 403 (6772), pp. 843-845.

Plan Amsterdam no. 8 (2009) Amsterdamse biodiversiteit Van haring tot sijsje. www.dro.amsterdam.nl

Redman, C.L., 2014. Should sustainability and resilience be combined or remain distinct pursuits? Ecol. Soc. 19 (2), 37.

Sterling, R., Admiraal, H., Bobylev, N., Parker, H., Godard, J.P., Vähäaho, I., Rogers, C.D.F., Shi, X., Hanamura T. (2012) Sustainability Issues for Underground Space in Urban Areas. Proceedings of the ICE - Urban Design and Planning, Volume 165, Issue 4, December 2012. pp. 241–254 (14). DOI: 10.1680/udap.10.00020.

Sterling, R., Nelson, P., 2013. City resiliency an underground space use. In: Zhou, Cai, Sterling (Eds.), Advances in Underground Space Development, Copyright 2013 by The Society for Rock Mechanics & Engineering Geology (Singapore). Published by Research Publishing. pp. 56–14. ISBN: 978-981-07-3756-6.

Stockholm City, (2014) City official website: /http://international.stockholm.se/

United Nations Economic Commission for Europe (UNECE) (2015) Country Profiles on Housing and Land Management: Uzbekistan. ECE/HBP/185 Committee on Housing and Land Management. New York and Geneva, 2015. http://www.unece.org/housing/publications.html

United Nations Economic Commission for Europe (UNECE) (2015) Country Profiles on Housing and Land Management: Republic of Moldova. ECE/HBP/181 Committee on Housing and Land Management. New York and Geneva, 2015. http://www.unece.org/housing/publications.html

Vahaaho, I (2013) 0-land use: Underground resources and master plan in Helsinki. In: Advances in Underground Space Development – Zhou, Cai & Sterling (eds), Copyright 2013 by The Society for Rock Mechanics & Engineering Geology (Singapore). Published by Research Publishing. pp. 56 – 14. ISBN: 978-981-07-3756-6.

van Kersbergen, K., & van Waarden, F. (2004). 'Governance' as a bridge between disciplines: Crossdisciplinary inspiration regarding shifts in governance and problems of governability, accountability and legitimacy. European Journal of Political Research, 43, 143–171.

Walker, B., C. Holling, S. Carpenter, and A. Kinzig. 2004. "Resilience, Adaptability and Transformability in Social-ecological Systems." Ecology and Society 9 (2): 5.

Wende, W., Bond, A., Bobylev, N., Stratmann, L. (2012) Climate Change Mitigation and Adaptation in Strategic Environmental Assessment. Environmental Impact Assessment Review, Volume 32, Issue 1, January 2012, Pages 88–93, Elsevier. doi:10.1016/j.eiar.2011.04.003.

Wende, W., Huelsmann, W., Marty, M., Penn-Bressel, G., Bobylev, N. (2010) Climate Protection and Compact Urban Structures in Spatial Planning and Local Construction Plans in Germany. Land Use Policy Volume 27, Issue 3, July 2010, Pages 864-868. Elsevier. doi:10.1016/j.landusepol.2009.11.005.

Governing the energy transition in Berlin: taking the lead in mitigating climate change?

Gloria Amoruso[1]

Framing the problem: cities and climate change and the notion of leadership

Cities and climate change

Cities are responsible for nearly 70% of the world's greenhouse gas emissions (GHG). Due to urbanisation it is estimated that this percentage will grow in the coming decades. (UN DESA 2011; UN Habitat 2011; Reusswig et al. 2014, p.4) Their importance for climate change is also linked to the municipalities' legislative power over some of the most important sectors and infrastructures that are responsible for the emissions. (Bulkeley 2013, p.106) Therefore, it is indispensableto recognise the importance and urgency of action to tackle climate change on the urban level. On the one hand, cities have to develop strategies and instruments to reduce their GHG emissions (*mitigation*). (See e.g. Bulkeley 2013, p.108) On the other hand, cities have to become more resilient to climate change by adapting their infrastructures according to the predicted risks caused by climate change, taking into consideration also the most vulnerable groups and neighbourhoods (*adaptation*) (See e.g. Bulkeley 2013, p.144).

Where international agreements sometimes lacked in effectiveness, range of influence and concrete measures, urban climate change and energy policies have been brought forward successively since the early 1990s. With the formation of the first international cities networks (e.g. *ICLEI*, *Climate Alliance* and *Energie Cités*) to promote and exchange climate change policies – most of them focused on mitigation – climate change concerns were more commonly included in urban political agendas, both in developed and developing countries (Bulkeley 2013,pp.72–73).

The role of urban governments and the notion ofleadership

Urban governments face the challenge of managing not only the horizontal interdependencies of the actors on the local level, but also of balancing them in the framework of the vertical multi-level system. (Bulkeley 2013, p.100; Ohlhorst et al. 2013) In the transition management literature that is often used to analyse low carbon energy transitions (see e.g.

[1] PhD candidate, Environmental Policy Research Centre (FFU), Freie Universität Berlin; gloria.amoruso@fu-berlin.de

Schneidewind & Scheck 2012; Verbong & Geels 2007; Kern 2006), it is stated:

> *"So government can and should assume a leading role in transition management. Not by acting as the great commander, enforcing change, but by inspiring a collective learning process and encouraging other actors to think along and participate."* (Rotmans et al. 2001, p.25).

Rotmans et al., thus, point out that a government should adopt a directing and coordinating role to facilitate change and participation during the transition, understood as a recurrent learning process. This notion is likewise relevant to the urban policies of climate change to explain the modes of governance on the local level to manage the energy transition. In this paper, the urban governance of the energy transition in Berlin, which more in depth is subject to a dissertation project, will be analysed. The question of whether Berlin can be seen as a leader in the urban energy transition or not will be addressed. To assess Berlin's performance Underdal's definition of leadership will be applied, from which three qualifying actions of leadership derive: the pursuit of common good, positive influence and fellowship.

> *"Leadership is an asymmetrical relationship of influence in which one actor guides or directs the behaviour of others toward a certain goal over a certain period of time. (…) For one thing, a leader is supposed to exercise what might be called positive influence, guiding rather than vetoing collective action. Thus, leadership is associated with the collective pursuit of some common good of joint purpose."* (Underdal 1994, p.178)

Case selection: what is interesting about Berlin?

"If Berlin is not able to make it, who else is?"

Germany, as a frontrunner country in the energy transition, is getting a lot of international attention (Weidner 2008). Since cities matter to mitigate climate change, Berlin as a capital of this relatively rich country is under pressure to contribute to the fulfilment of the

1.5-2.0-degree target.[2] In public discussion it is thus often repeated: "if Berlin is not able to realise the energy transition, who else is?" Berlin's socio-economic conditions, which will be introduced in the following section, constitute the city as an interesting case study for urban energy transitions. It could serve as an example or learning laboratory for other cities to govern the energytransition.

Berlin – a diverse and contradictory city

Berlin is not only the capital but also the largest city of Germany in terms of its population and area. Data from December 2014 calculate more than 3.56 Million inhabitants living in an area of 891.7 km^2. (AfS Berlin-Brandenburg 2015b) Among the inhabitants, 13% are foreigners and nearly 29% have a migrational background (AfS Berlin Brandenburg 2015a). This is only one aspect of Berlin being a diverse and sometimes also a contradictorycity.

Berlin is known as one of the "poorest German *Länder*" with a total debt of 70.33 Billion Euros, which is equal to approximately 20,000 Euros per capita (Statistisches Bundesamt 2014)[3]. While Berlin's public budget is lacking in financial resources, it is still the German start-up capital, which attracts a lot of investors (McKinsey&Company 2013). Furthermore, Berlin's Gross Domestic Product has been growing constantly in recent years. With an overall amount of 109.2 Billion Euros in 2013 it reaches an inflation-adjusted growth of 1.2% compared to the previous year. Nevertheless, in total it remains slightly under the German average. (AfS Berlin-Brandenburg 2014b) Berlin's economic development is coherent with being a growing start-up community as well as the increase in population, which is estimated to continue in the coming years. (AfS Berlin-Brandenburg 2015c, p.23; Reusswig et al. 2014, p.29) At the same time studies published in 2014 (AfS Berlin- Brandenburg 2014a) and 2015 (Krause et al. 2014) confirm that the gap between the high- and low-income occupations exacerbates the financial situation of Berlin's citizens. In 2014 21.4% were located under the relative poverty line[4]. 11.7% of Berliners

[2] During the 21st Conference of the Parties (COP21), held in Paris in December 2015, the 1.5-2.0-degree Celsius target has been stipulated as part of the United Nations Framework Convention on Climate Change (UNFCCC). The Conference of the Parties thereby recognised that there is a need to intensify the mitigation efforts in order to hold "the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels" (UNFCCC 2015, p.2).

[3] Concerning the total debt per capita, Berlin is second in the ranking of the German *Länder;* only the city-state Bremen has a higher debt (Statistisches Bundesamt 2014).

[4] Accordingly, to EU-wide calculations the relatively poverty rate is referred to every person in a household whose income lies below 60% of the national average income. These data are necessarily not equal to poverty, but are an applicable indicator for people at risk (Krause et al. 2014, p.2).

were unemployed (AfS Berlin-Brandenburg 2015a), whereas yet 20.7% received public financial support (Krause et al. 2014), which is another indicator for socio-economic vulnerability.

Berlin´s climate change policies in a multi-level system

Berlin in a multi-level system

Berlin is one of three German city states: an urban area which officiates concurrently as one of the German federal administrations, *Länder*. The social structure differs in the different urban areas and neighbourhoods and even among the twelve existing administrative districts within Berlin, therefore a uniform urban development policy seems unsuitable. The districts themselves, each one with a population size that ranges from 220,000 to 367,000 people (AfS Berlin-Brandenburg 2015a), could be treated as small cities. Indeed, they behave as self-governing units without legal personality. Together with the Berlin Senate – that is the Berlin government with five different Senate Departments controlled by the House of Representatives – the twelve districts form a two-tier system.

In 2006, the Berlin Senate additionally introduced a new planning procedure on a smaller scale to differentiate between the various urban living environments and created inter alia 447 so-called "*Lebensweltlich Orientierte Räume = LOR*" (areas based on the living environment). This differentiation makes tailor-made local planning possible on the one hand, but on the other hand it amplifies the complexity and the necessity for co-ordination of urban planning, not to forget also the underlying framework of national and EU legislation (SenStadtUm 2016).

Berlin's climate policy targets

Berlin has been proclaiming its international leadership role for sustainable energy transitions in cities aspiring to act like a best-practice example for several years. This can be found repeatedly in documents and publications by the Berlin Senate and other stakeholders. Mayor Michael Müller, the former Senator for Urban Development and Environment, stated in 2014:

"...more and more cities are searching for ways to provide a local contribution

against climate change. Berlin is one of them and wants to be a role model for other cities." (SenStadtUm 2014, p.3)

The Berlin-specific climate policy targets, certainly, could be classed as ambitious for a city known mainly as an energy consumer. Already in 2009 in the overall concept for energy policy (*Energiepolitisches Leitbild)* and further on in the Energy Plan 2020 (*Energiekonzept 2020*), published in 2011, the overall target of Berlin becoming climate neutral by 2050 has been fixed. Climate neutrality is operationalised as the progressive reduction of CO_2 emissions by about 85% compared to the reference year 1990. That means that the annual CO_2 emissions have to decrease to 4.4 Million tons compared to 29.3 Million tons in 1990 by 2050. 50% of the target should be already reached by 2030. (Berliner Energieagentur (BEA) 2009; Hirschl et al. 2011) These goals have just become legally binding, as, in March 2016, the Berlin Parliament passed the so- called "Energy Turnaround Act" or "Energy Transition Act" (*Energiewendegesetz*) (Abgeordnetenhaus Berlin 2016).

Institutionalisation of Berlin's climate change policies and mainstakeholders

It is a decisive moment in time for Berlin's energy transition in the context of climate change. Berlin has been trying to promote its policies and new approaches of participation and policy design procedures recently. In 2016, the above-mentioned so-called "Energy Turnaround Act" recently came into force and therefore the Berlin Senate has to propose an action plan for energy and climate change to the Berlin Parliament within three months (i.e. by June 2016). Furthermore, there have been several institutional changes since the new local government, formed by the big coalition between the "Social Democratic Party" (SPD) and the "Christian Democratic Party" (CDU), took charge in 2011:

- The restructuring of the administration with the formation of the "Special Unit for Climate Protection and Energy" (*Sonderreferat für Klimaschutz und Energie*)
- The mandate of a scientific consortium to conduct the feasibility study "*Klimaneutrales Berlin 2050*" which attests that meeting the goal of climate neutrality can be fulfilled through different scenarios andmeasures
- The mandate and the publication of a draft for an "Energy and Climate Protection Concept" (*Berliner Energie- und Klimaschutz Konzept = BEK*) in December 2015, and;
- The calling of a "Committee of Enquiry New Energy for Berlin" (*Enquete- Kommisson "Neue Energie für Berlin"*) by the Berlin Parliament that adopted their final report in

October 2015.

With the "Special Unit for Climate Protection and Energy" a new actor within the Berlin Senate was brought to life, in order to facilitate the climate change and energy policy activities among the different departments and the different stakeholders. The "Committee for Enquiry" together with the "Climate Change Advisory Council", on the other hand, function as a consultant. Both for the formulation of the feasibility study and the process for "Berlin's Energy and Climate Protection Concept", co-design methods have been used. Besides politicians and different scientific institutes, private enterprises and umbrella organisations (above all from the energy and building sector), as well as non-governmental organisations (NGOs) have also been involved in stakeholder-workshops and/or offline and online consultations (Hirschl et al. 2015).

As described above the twelve districts also have to be regarded as single actors for Berlin's climate change policies. According to their legal position in Berlin the districts are not given much leeway for climate change related activities, but they are still responsible for implementing the climate change policies locally as well as developing their own district-related goals and monitoring the outcomes. This has been integrated in the "Berlin Energy Turnaround Act". (Abgeordnetenhaus Berlin 2016, para.9) Hence, also on the local level in Berlin, different concepts and levels of implementation of climate change policies can be found. Some districts appear especially active and others do not really deal with the politics of the city's energy transition. Districts of Zehlendorf-Steglitz, Marzahn-Hellersdorf, Lichtenberg, Friedrichshain-Kreuzberg, for instance, have climate commissioners, and sometimes also quite detailed climate policy concepts, whereas Charlottenburg-Wilmersdorf installed a roundtable with different district stakeholders.

Selected policy instruments

Beyond the "Energy Turnaround Act", there have been several instruments to mitigate climate change, which vary from information platforms to concrete projects that have a direct influence on energy savings. An online communication platform for energy efficiency has been established, called "Berliner ImpulsE", which is also responsible for the organisation of the annual "Berlin EnergyDays"[5].

The "Energy Saving Partnerships" (*Energiespartpartnerschaften*), often called

[5] The Berlin Energy Days are considered the biggest conference on energy efficiency in Germany. In 2016, according to the organisers, more than 9,000 participants attended a total of 54 single events held in three days. The Berlin Energy Days 2016 have been the 17th edition (Berlin Energietage 2015).

performance contracting, and running since 1996, are a very concrete instrument. The Berlin Senate, together with other stakeholders, founded the "Berlin Energy Agency" (*Berliner Energieagentur*), which established this hands-on method to foster the installation and investment in energy efficiency technologies for public buildings through public and private partnerships. (Berliner Energieagentur 2015) The method, at the beginning, was motivated by financial shortages, but then became a replicable model. (Bulkeley et al. 2015) This instrument is supplemented by voluntary "Climate Protection Agreements" (*Klimaschutzvereinbarungen*) between the Berlin Senate and the major CO_2-emitters. So far voluntary agreements with eleven partners have been developed, inter alia with the biggest energy providers, a university, associations and umbrella organisations from the building sector, and waste and water services (Land Berlin & Vattenfall Europe AG 2009; Land Berlin & BBU 2011; Land Berlin & GASAG AG 2011; SenStadtUm 2015).

The voluntary climate protection agreements demonstrate how the Berlin Senate tries to stimulate action for mitigating climate change also beyond binding legal obligations, where the local government has lost its policy capacity due to privatisation in the 1990s. (Monstadt 2007)[6] This approach is classified by Kern and Gotelind (2008) as *governing by enabling*.

Additionally, corresponding funding programmes have been put in place, namely the "UEP" (*Umweltentlastungsprogramm*) that has been replaced recently by a very similar programme called BENE, both based on the European Union's Grants Programmes. Moreover, the "Berlin Energy Fund" (*Berliner Energiefonds*), provided by the *Investitionsbank Berlin (IBB),* offers support for the development of innovative technologies for the energy transition (Berliner Energieagentur/IÖW2011).

It is important to point out that, in addition to the top-down approaches of the urban governance of the energy transition, several bottom-up initiatives as well as best practice projects have arisen in recent years. Very prominent among them are the "*Berliner Energietisch" (Berlin Energy Roundtable)* and the "*BürgerEnergie Berlin"* (*Citizen Energy*). Both initiatives foster the creation of a more democratic, social and ecological energy supply[7] (Berliner Energietisch 2012; Berliner Energietisch 2013; Berliner Energietisch 2015).

[6] The 1990s are distinguished by a wave of privatization, where, inter alia, also the energy utilities have been sold gradually to private companies (Monstadt 2007).

[7] The Berliner Energietisch (Berlin Energy Roundtable) led to a referendum in 2013, that failed due to the missed 25% quorum.

Reality check – what has Berlin achieved so far?

To assess the effectiveness of Berlin's energy policies so far it is useful to examine some data on energy consumption and supply as well as their performance in reducing CO_2 emissions. Annual reports on the Berlin-specific balance of energy and CO_2 emissions serve as a monitoring tool. The most recent data are based on the balance year 2012. Still, it is important not to neglect that also in the case of Berlin the correlation between CO_2 emission reductions and the policy instruments in place cannot be verified as satisfactory.

Reduction of CO2 emissions in Berlin

Since 1990 a notable reduction in the use of primary energy and CO_2 emissions can be observed. It is significant that the major alteration occurred between 1990 and 2005. Despite some deviation, there have not been notable changes since then. (AfS Berlin-Brandenburg 2015c, p.23) Moss (2009) argues that the success in the reduction of CO_2 emissions from 1990 to 2005 was caused by the city's reunification, which also implied a reunification of the energy infrastructures of East and West Berlin. Consequently, the energy supply became more efficient only by eliminating the oversupply due to redundancy of two parallel systems (Moss 2013; Moss2009).

Berlin's energy mix

Moving to the development of renewable energies in Berlin, more progress can be traced. Starting with a percentage of only 0.6% of renewables in 1990 in the use of primary energy and 0.5% in the use of end energy, by 2012 the percentage of renewable energy reached 3.6% for primary and 1.7% for end energy use. Additionally, 7.7% of the electricity production in Berlin and 4.0% of the district heating (*Fernwärme*) are based on renewable energy sources. Nonetheless, the overall composition of Berlin's energy use by energy sources in 2012 demonstrates that Berlin's energy supply is still based on a significant majority of fossil fuels with mineral oil, gas and lignite as the most important energy sources (AfS Berlin-Brandenburg 2015c).

Berlin's performance from a comparative perspective

Contrasted with the other German *Länder*, Berlin is lagging behind. It can be found in second to last or last place in all categories in terms of the percentage of renewables for end energy use as well as the production of electricity and district heating. Certainly, a comparison with the largely rural *Länder* is not viable, but even in relation to the other two German city states (Hamburg and Bremen) Berlin's performance is relatively poor. For instance, in Bremen already around 23% of the district heating and in Hamburg more than 11% of electricity production are based on renewables (Diekmann et al. 2014).

In the same comparative study, on the contrary, the leading by example of Berlin's administration has been highlighted as the best practice for the use of renewable energies for public buildings. (Diekmann et al. 2014, p.30) In this regard, it is also testified that Berlin citizens seem to be the greenest consumers, where nearly a third has chosen an eco-electricity provider[8]. (Diekmann et al. 2014, p.31) Furthermore, a recent study indicates that the mobility behaviour of Berlin citizens has become increasingly environmentally friendly (SenStadtUm 2011, pp.15, 16; Ahrens 2014).

Finally, scholars underline Berlin's role as a pioneer in the context of the development of the "Energy Saving Partnerships" (*Energiespartpartnerschaften*), described above. (Bulkeley et al. 2015, p.138) These partnerships have proved apparently to be at least a partial solution to the investment costs related to the energy transition for a city with an overcharged budget.

Conclusion: to lead or not to lead? – Berlin's performance in the energy transition

Berlin demands for itself a leadership role for the urban energy transition to become a positive example for other European cities. Indeed, Berlin has set ambitious goals to contribute to the mitigation of climate change in the global context and therefore follows a pursuit of common good (see Underdal 1994). But its self-perception is opposed to the status quo and it has to be questioned, if the goals are realistic to achieve considering the city's challenges. Energy consumption in Berlin is still based on fossil fuels and previous outcomes concerning the reduction of CO_2 emissions since 1990 are mainly related to the city's reunification. Berlin is not only lagging behind other German cities, but it is far from being a European role model

[8] The percentage of green electricity costumers range from 16 to 28% in the different German *Länder* (Diekmann et al. 2014, p.31).

for energy transition.

Nevertheless, there are some areas where Berlin has potential for leadership. Firstly, its reputation as the start-up capital and the associated incentives for investors could facilitate its reputation as a centre for innovative technologies as part of the energy transition. Secondly, as described above, the "Energy Saving Partnerships" have contributed to realising some of the energy renovation plans for public buildings. This instrument provided a replicable method to promote concrete energy saving measures and has served therefore as a positive example for other cities. (Bulkeley et al. 2015, p.138) According to Underdal's (1994) definition Berlin already got fellowship in this limited area. Additionally, it was a form of leading by example and sample of urban climate change *self-governing* (Kern & Gotelind 2008). Thirdly, despite its poor financial and institutional resources some findings demonstrate that Berlin can build on positive resources relating to social and environmental capital. As stated above, for a third of Berlin's citizens, sustainable energy supply and mobility matter. In this regard, civil society organisations and initiatives, such as the "*Berliner Energietisch"* and *"BürgerEnergie Berlin",* and many other best practice projects, should also not be neglected. These factors could unfold a positive influence (see Underdal 1994) on other cities in the future.

Regarding the leading potential of the local government some efforts to promote participatory approaches as well as stimulate voluntary activities to mitigate climate change beyond the local policy capacity have been initiated. With the "Special Unit for Climate Protection and Energy" a new co-ordinator of the energy transition in Berlin was put in place, which has to fulfil the task of bringing all the stakeholders together to co-design the energy transition. *Governing by enabling* through the voluntary "Climate Protection Agreements" have served in this context as a first attempt; opening the development of the integrated "Berlin Energy and Climate Protection Concept" to the public discussion has been the second.

Altogether Berlin's performance in the energy transition is neither yet sufficient to reach its self-set climate policy targets, nor to act as a real role model for other cities. Still, the potential for future developments towards a climate neutral city is visible though challenging to realise in such a diverse city with several social matters to be addressed. In summary, it can be argued that Berlin is characterised as being a city with many societal challenges and a lack of institutional and financial resources. Where Bulkeley/Broto/Edwards (2015, p.139) state: "(…) Berlin's poverty (both in financial and institutional terms) remains its greatest challenge as it seeks to reposition itself as a green energy leader." But at the same time, Berlin has potential for innovation concerning the start-up community, its appeal for expatriates and

investors as well as an active community.

References

Abgeordnetenhaus Berlin, 2016. *Berliner Energiewendegesetz (EWG Bln) vom 22. März 2016*, Berlin.

AfS Berlin-Brandenburg, 2014a. *Regionaler Sozialbericht Berlin Brandenburg 2013*, Berlin und Potsdam.

AfS Berlin-Brandenburg, 2014b. *Statistischer Bericht P I 1 - j/13. Volkswirtschaftliche Gesamtrechnungen. Bruttoinlandsprodukt und Bruttowertschöpfung im Land Berlin nach Wirtschaftsbereichen 1991 bis 2013*, Berlin und Potsdam.

AfS Berlin-Brandenburg, 2015a. *Statistischer Bericht A I 10 – j/13, A VI 2 –j/13. Ergebnisse des Mikrozensus im Land Berlin 2013. Bevölkerung und Erwerbsfähigkeit*, Berlin und Potsdam.

AfS Berlin-Brandenburg, 2015b. *Statistischer Bericht A I 5 - hj 2/14. Einwohnerinnen und Einwohner im Land Berlin am 31. Dezember 2014*, Berlin und Potsdam.

AfS Berlin-Brandenburg, 2015c. *Statistischer Bericht E IV 4 - j/12. Energie- und CO2- Bilanz in Berlin 2012*, Berlin und Potsdam.

Ahrens, G.-A., 2014. *Tabellenbericht zum Forschungsprojekt „Mobilität in Städten– SrV 2013" in Berlin*, Dresden.

Berliner Energieagentur (BEA), 2009. *Energie für Berlin. Effizient_ Erneuerbar_ Zukunftsfähig. Leitbild für ein Energiekonzept des Landes Berlin*, Berlin.

Berliner Energietage, 2016, *Berliner Energietage 2016. Energietage-Telegramm Abschluss.* Available at: http://www.energietage.de/archiv/mediathek-2016/telegramme/energietage-telegramm-abschluss.html.

Berliner Energietisch, 2012. *Neue Energie für Berlin. Eckpunkte des Gesetzentwurfs für eine demokratische, ökologische und soziale Energieversorgung (Januar 2012)*, Berlin.

Berliner Energietisch, 2013. *Volksbegehren über die Rekommunalisierung der Berliner Energieversorgung*, Berlin.

Berliner Energietisch, 2015. Unser Selbstverständnis. Neue Energie für Berlin– erneuerbar und demokratisch! Available at: http://berliner-energietisch.net/ueber-uns.

Bulkeley, H., 2013. *Cities and climate change*, London and New York.

Bulkeley, H., Broto, V.C. & Edwards, G.A.S., 2015. Realizing the Solar Atlas in Berlin. In H. Bulkeley, V. C. Broto, & G. A. S. Edwards, eds. *An urban politics of climate change. Experimentation and the governing of socio-technical transitions*. London and New York. Pp. 138–156.

Diekmann, J. et al., 2014. *Vergleich der Bundesländer: Analyse der Erfolgsfaktoren für den Ausbau der Erneuerbaren Energien 2014. Indikatoren und Ranking. Endbericht*, Berlin und Stuttgart.

Hirschl, B. et al., 2015. *Für ein klimaneutrales Berlin. Entwurf für ein Berliner Energie- und Klimaschutzprogramm (BEK). Endbericht*, Berlin.

Hirschl, B. et al., 2011. *Potenziale Erneuerbarer Energien in Berlin 2020 und langfristig – Quantifizierung und Maßnahmengenerierung zur Erreichung ambitionierter Ausbauziele. Studie zum Berliner Energiekonzept (Anlage 6)*, Berlin.

Kern, F., 2006. ‚Transition Management' in der holländischen Energiepolitik– Ein Erfolgsmodell für Deutschland?

Kern, K. & Gotelind, A., 2008. Governing climate change in cities: modes of urban climate governance in multi-level systems. In *Competitive cities and climate change. OECD conference proceedings, Milan, Italy, 9-10 October 2008*. Milan, pp. 171–196.

Krause, N.R. et al., 2014. *Die zerklüftete Republik. Bericht zur regionalen Armutsentwicklung in Deutschland 2014* Deutscher Paritätischer Wohlfahrtsverband Gesamtverband e.V., ed., Berlin.

Land Berlin & BBU, 2011. *Klimaschutzvereinbarung 2011 bis 2020 zwischen dem Land Berlin und dem Verband Berlin-Brandenburgischer Wohnungsunternehmen e.V.*, Berlin.

Land Berlin & GASAG AG, 2011. *Klimaschutzvereinbarung 2011-2020 „Berlin verpflichtet",* Berlin.

Land Berlin & Vattenfall Europe AG, 2009. *Klimaschutzvereinbarung zwischen dem Land Berlin und Vattenfall*, Berlin.

McKinsey&Company, 2013. *McKinsey-Studie: Berlin kann führendeStart-up- Metropole Europas werden*, Berlin.

Monstadt, J., 2007. Urban Governance and the transition of energysystems: institutional change and shifting energy and climate policies inBerlin. *International Journal of Urban and Regional Research*, 31(2), pp.326–343.

Moss, T., 2009. Divided city, divided infrastructures: securing energy and water services in postwar Berlin. *Journal of Urban History*, 35(7),pp.923–942.

Moss, T., 2013. Socio-technical change and the politics of urban infrastructure: managing energy in Berlin between dictatorship and democracy. *UrbanStudies*, pp.1–17.

Ohlhorst, D., Tews, K. & Schreurs, M., 2013. Energiewende als Herausforderungder Koordination im Mehrebenensystem. *Technikfolgenabschätzung – Theorie und Praxis*, 22(2), pp.48–55.

Reusswig, F. et al., 2014. *Machbarkeitsstudie Klimaneutrales Berlin 2050*, Potsdam und Berlin.

Rotmans, J., Kemp, R. & Asselt, M. van, 2001. More evolution thanrevolution: transition management in public policy. *foresight*, 3(1), pp.15–31.

Schneidewind, U. & Scheck, H., 2012. Zur Transformation des Energiesektors –ein Blick aus der Perspektive der Transitions-Forschung. In H.-G. Servatius, U. Schneidewind, & D. Rohlfing, eds. *Smart Energy. Wandel zu einem nachhaltigen Energiesystem*. Berlin und Heidelberg, pp.45–61.

Senatsverwaltung für Stadtentwicklung und Umwelt (SenStadtUm),2011. *Stadtentwicklungsplan Verkehr Berlin*, Berlin.

Senatsverwaltung für Stadtentwicklung und Umwelt (SenStadtUm), 2014. *Climate-Neutral Berlin 2050. Results of a feasibility study*, Berlin.

Senatsverwaltung für Stadtentwicklung und Umwelt (SenStadtUm),2015. *Gemeinsam für Klimaschutz in Berlin*, Berlin.

Senatsverwaltung für Stadtentwicklung und Umwelt (SenStadtUm),2016. Stadtwissen und Daten. Lebensweltlich orientierte Räume (LOR) in Berlin. Available at: http://www.stadtentwicklung.berlin.de/planen/basisdaten_stadtentwicklung/lor/ [Accessed April 23, 2016].

Statistisches Bundesamt, 2014. *Finanzen und Steuern. Schulden deröffentlichen Haushalte 2013*, Wiesbaden.

UN DESA, 2011. *World urbanization prospects. The 2011 revision*, Availableat: http://esa.un.org/unpd /wpp/ppt/CSIS/WUP_2011_CSIS_4.pdf _ https://esa.un.org/unpd/wpp/.

UNFCCC 2015, *Conference of the Parties, Twenty-First Session, Paris, 30 November to 11 December 2015. Adoption of the Paris Agreement. Proposal by the President, Draft Decision*, Paris.

UN Habitat, 2011. *Hot cities: battle-ground for climate change*,Nairobi.

Underdal, A., 1994. Leadership theory: rediscovering the arts of management. In G.-O. Faure et al., eds. *International multilateral negotiation: approaches tothe management of complexity*. San Francisco, pp.178–200.

Verbong, G. & Geels, F., 2007. The ongoing energy transition: Lessons from a socio- technical, multi-level analysis of the Dutch electricity system (1960 –2004). *Energy Policy*, 35, pp.1025–1037.

Weidner, H., 2008. *Klimaschutzpolitik: Warum ist Deutschland ein Vorreiterim internationalen Vergleich? Zur Rolle von Handlungskapazitäten und Pfadabhängigkeit*, Berlin.

Transformative heat risk policies? Political discourses and their impacts on implementation – the case of Berlin, Germany

Nicole Mahlkow[1], Tobias Kalt[2]

Even though heat waves occur less frequently in Europe than floods they cause a substantially higher number of deaths (EEA 2010). Some sources estimate that 70,000 people died in the heat wave of 2003 (Robine et al. 2008; Kovats and Ebi 2006). Heat not only causes high mortality rates, morbidity and well-being can be affected likewise.

Age (with very young and very old people prone to suffer more), state of health and the built environment have been identified as factors determining the vulnerability to heat stress. Socio-economic criteria and, not least, the subjective assessment of one's own risk and consequent behaviors also determine the impact of heat on the individual (Großmann et al. 2012). Consequently, vulnerability to heat varies from place to place, building to building and person to person (Klok and Klueck 2015).

Cities concentrate people and critical infrastructure systems in a relatively small space and are at the center of heat risk analysis. The so called urban heat island (UHI) effect can cause certain areas in cities to be up to 12 degrees warmer than the surrounding countryside (Klysik and Fortuniak 1999, Hung et al. 2005). This locally induced climate change (Stone 2012) is down to a specific land-use in cities: lesser vegetation, large shares of dark surfaces, specific arrangements of buildings that trap heat and the concentration of human activities that produce waste heat (Oke 1982). With global climate change the exposure to heat compounds in cities, extreme weather events might get more intense, longer and are likely to happen more frequently (Meehl and Tebaldi 2004). Heat load might also worsen with gradually rising average daily temperatures.

An immense amount of natural science research has focused on risk assessments and measures for heat adaptation and mitigation in cities. When all kinds of impacts and causes of urban heat are considered, a large variety of policy options to tackle risks are conceivable. However, to date, critical social science reflections on political coping strategies with heat risks are not very common. A heat risk policy analysis that focuses on patterns of meaning underlying the local constructions of vulnerability and resilience can give valuable insights into the configuration of policy practice. We try to draw conclusions on barriers to political and administrative action concerning urban heat in mid-latitude cities by studying local discourses in the field of public policy-

[1]PhD candidate, Environmental Policy Research Centre (FFU), Freie Universität Berlin; nicole.mahlkow@fu-berlin.de
[2] M.A. student, Environmental Policy Research Centre (FFU), Freie Universität Berlin; t.kalt@fu-berlin.de

making.

Research approach

Our approach is located in the field of critical adaptation studies. Dietz and Brunnengräber (2016) sum up critical notions of current research and policy-making in the field of climate change adaptation: the creation of adaptation policy is often characterized by a climate deterministic problem definition. It then neglects social conditions that determine how impacts of a changing climate are experienced by social groups. In this regard, the authors claim adaptation to be a policy field that is largely de–politicized. Managerial procedures dominate decision-making processes, political solutions are reduced to technological innovations, infrastructure measures and governance optimization. A common strategy is to execute adaptation policy in a top-down manner. Consultation processes are the main form of including different stakeholder perspectives, thus limiting the localization potentials (i.e. participation, democratic character) of adaptation policies (ibid).

Dietz and Brunnengräber (2013) conclude that the adaptation to climate change as it is often understood in current research and executed in decision-making has not reached a transformative potential but perpetuates social inequities. This view focuses on adaptation practice; especially the power struggles and contested meaning it is embedded in.

Referring to the critical assumptions of Dietz and Brunnengräber (2013, 2016) it shall be hypothesized that local political adaptation discourses do not just influence the transformational or non-transformational character of adaptation. The configuration of political discourses is a critical factor if implementation practice to raise urban adaptive capacity is pursued at all. Analysing the topic of urban heat, it shall be hypothesized that political adaptation discourses are of structural-conservative nature, impeding proactive action instead of incentivizing it.

Urban climate change adaptation is constructed discursively and expresses itself materially. The study focuses on the knowledge that circulates in the policy process and how that knowledge influences implementation prospects. To analyse political discourses, official documents referring to climate change adaptation and urban heat have been analysed. The study included documents that were published between 2007 and 2014; among them political plans, concepts and strategies, protocols of parliament and council meetings. Additionally, interviews with 18 administrative officials have been conducted between 2013 and 2015.

Heat risk policy in mid-latitude cities: the case of Berlin

The city of Berlin, with its moderate climate of warm summers and cold winters (Peel et al. 2007) does not come to mind first when thinking about cities suffering from urban heat. Urban development as well as the urban way of living is not characterized by experience with extreme temperatures. This includes not only local building traditions and the configuration of infrastructure, but also the organization of work and social life. Nevertheless, statistical analysis has demonstrated that the urban heat island effect potentially causes up to 1600 excess deaths in the city per year (Scherer et al. 2013). Climate change projections show a range of rising temperatures of up to 2.5°C with more extreme weather events by 2050 (Lotze-Campen et al. 2009).

Within Berlin authorities the topic of urban heat mainly manifests itself in climate change adaptation discourses. The city is considered a frontrunner concerning policy instrument creation for climate change adaptation with special regards to heat risks (e.g. BBSR 2015), and it is praised for innovative approaches to highly scientifically informed policy-making. An example referred to in that respect is Berlin's climate change adaptation plan (StEP Klima), adopted by the local parliament and published in 2011. The plan conceptualizes urban climate, including urban heat, as an urban development task. It shows the urban heat load for current and future night and daytime situations (2001 to 2010; 2046 to 2055) in a spatially differentiated way for the entire city. Moreover, the plan introduces measures for different urban structure types and it outlines possible governance and planning strategies for their implementation, including an action plan for model projects.

Berlin's climate change adaptation plan has been adopted in the legal form of an urban development plan (SenStadtUm 2011a). Urban planning officials are obliged to examine every planning process whether it conflicts with or confirms to the goals of urban development plans. This is one of the reasons why StEP Klima is considered to be an outstanding instrument for the adaptation to climate change in German planning practice. Another specific of the strategy is its corresponding instrument, the Urban Landscape Strategy. It outlines assets and potentials of urban green in the city (SenStadtUm 2011b).

Regardless of these instruments, interviews with decision-makers on the executive level in Berlin districts revealed that since StEP Klima's launch in 2011, not much has changed in the city with regards to heat risk awareness and prevention. From interviews it can be concluded that concise implementation action for heat risk adaptation has not happened in Berlin.

Results: Berlin authorities' heat risk discourse

Constructions of heat vulnerabilities

O'Brien et al. (2007) identify two main vulnerability constructs in climate change discourses: outcome vulnerability and contextual vulnerability. Whereas outcome vulnerability is a "linear result of projected impacts of climate change on a particular exposure unit" (ibid, p.75), contextual vulnerability refers to the dynamical entwinements between climate variability and changes in political, institutional, economic and social structures. The authors show that within climate change discourses, different framings of vulnerability matter with regards to the produced and prioritized climate change responses.

Hence, the way urban heat risks and vulnerabilities are constructed is decisive for local adaptation or mitigation action. Heat discourses in Berlin policy documents reflect O'Brien et al.'s (2007) outcome vulnerability conception in focusing on localized climatology constructions for the hazard of rising temperatures. Gradually increasing heat load rather than extreme heat waves and associated risks are at the centre of attention. In Berlin, climate change adaptation discourses mark out the configuration of the urban structure as the main risk factor. The exposure to high temperatures in a non-adapted urban fabric is the factor to explain why heat becomes risky for the urban population and fabric. This narrow vulnerability construction excludes sensitivity factors like income, education or behaviour. Critical adaptation research speaks of a "naturalization" of the social (Dietz and Brunnengräber 2016); meaning that the search for an answer to the question why some people are more vulnerable than others often starts with, and mainly refers to, an analysis of climatic conditions.

By largely blending out different kinds of sensitivity factors for heat vulnerability, Berlin's climate change adaptation strategy does not target the most vulnerable. Vulnerability constructions do not focus on human beings at risk; the attention shifts towards the heat exposure of the inanimate entity of the city and its urban structure. Even though heat hubs are localized at the city centre, the resulting risk construction and demands to act remain vague, making it difficult for urban planning officials and stakeholders to feel addressed as responsible.

Constructing heat risk action

The Berlin discourses on dealing with urban heat focus on a catalogue of measures, which is closely connected with the identified vulnerability conception. O'Brien et al. (2007) associate the

'outcome vulnerability' discourse with strategies of reducing exposure through climate change mitigation or developing adaptations to limit negative outcomes. In the case of Berlin this includes heat reduction strategies of urban development like façade and roof greening, and albedo enhancement for different urban structure types. The rather technical focus marginalizes ideas, which focus on different vulnerability constructions - also within the realm of urban development.

In this regard, urban development policies which aim at changing the societal context on the basis of equity and justice (O'Brien 2007) have only marginally been linked with the topic of climate change in Berlin in the research period[3]. Also, behavioural changes incentivized by changing the urban fabric – among them could be governance approaches to ensure short distances to and accessibility of important daily life infrastructure - play no role in the discourse. In relation to this point, a recent study suggests a strong connection between health, fitness and individual heat stress, providing evidence that urban development governance which increases activity levels among citizens decreases their heat sensitivity (Schuster et al. in preparation).

Drinking fountains or cooling centres - urban development measures that would relate more explicitly to disaster risk reduction - also play no role. Moreover, shading amenities have surprisingly little prominence in the discourse on urban heat in Berlin. By not emphasizing urban development approaches that facilitate living with heat and accepting different climatic conditions, climate change adaptation discourses mainly reflect mitigation logics of reducing the climatic impact. Land use change is the preferred strategy focusing on urban green as means to achieve that.

Two discursive strands deal with green as a heat mitigation measure: On the one hand there is a discourse on the qualification of green space with regards to optimizing and qualifying their ecosystem services. On the other hand, a strand that is rooted in the "no regret" concept can be found, a common but ambiguous concept used in scientific and political discourses on climate

[3] The Berlin Environmental Justice map has broadened the risk analysis. However, it has not been integrated into the empirical material, as it was published in 2015. Also the AFOK report (Adaptation to the impacts of climate change), published in 2016, has not been included here. Both documents were "work in progress", but not yet part of the official political discourses in the research period.

change[4]. In Berlin, part of the discourse on urban green space contradicts the idea of an urban planning based approach to qualify urban green. This discursive strand frames urban green as generally good and necessary and shall therefore be labelled “no regret” approach to urban green.

The former strand aims at reducing vulnerabilities to climatic impacts explicitly by providing in depth knowledge on positions of green and selection of types and sorts. This strand seems to be de-politicized and rather technocratic. It confirms findings of critical adaptation research (e.g. Brunnengräber and Dietz 2013; Dietz and Brunnengräber 2015). Possible local frictions that might arise in the course of implementing these measures are not part of the discourse. Conflictive potentials are constricted to clashes with heritage protection, whereas local experiences gained when dealing with other contested urban development policies have not found a way into official climate change adaptation discourses. For instance, the energy orientated modernization of apartment buildings has occasionally led to protests by residents. Especially in socially deprived areas it often raises fears of rising rents (e.g. FuldaWeichsel 2014; Färber 2013). Creating or restoring environmental goods might involve similar distributional dynamics, which could increase social inequity. For example, environmental amenities, like green roofs, facades and parks can drive up property values if public policy does not intervene and potentially leads to “green gentrification” (Gould and Lewis 2012).

Similarly, in Berlin, political discourses on urban green space focus on its potentials to raise the quality of life. Economic consequences of the installation of adaptive greening measures, among them distributional ones, have not been given attention within the political discourses. By blending them out the discourse becomes depoliticized and de-localized, which might counteract the initial intention to raise acceptance and instead decrease legitimacy of heat risk policy. Projects trying to pursue proposed greening measures might face substantial opposition.

However, labelling urban green as “no regret” also has its flaws. It might reduce its heat mitigation and adaptation focus. The “no regrets” concept with regards to urban greening measures seems to refer to the different kinds of ecosystem services they provide for human beings

[4] The “no regrets” concept has an economic background and has originally been applied for “GHG emission reduction options that have negative net costs, because they generate direct or indirect benefits that are large enough to offset the costs of implementing the options” (IPCC 2001). Later it was taken up within the adaptation community, for example by Füssel (2007, p.273) who defines “no regret” options as “actions whose costs in a broad sense are small or even negative under all plausible climate scenarios”. As head of the Metropolis city network, Berlin’s Senate Department of Urban Development and the Environment published the “No regrets” Charter on the urban adaptation to climate change. “No regrets” strategies are explained as being “based on concepts and measures that can begin to be enacted now without being certain about all dimensions of future climate change.(...) Such measures are advisable for future generations, but also relevant to enhancing the living conditions of people in the present. With a ‘no regrets’ strategy, the benefit of these measures to society therefore continues even in the absence of climate change” (SenStadtUm, n.d.).

in an unspecific way. Any kind of green, no matter where and what sort of plants, exerts positive functions, such as air filtration, micro climate regulation, noise reduction, sewage treatment, and recreational and cultural values (Bolund and Hunhammar 1999). Nevertheless, it remains vague who is supposed to have no regrets with regards to the installation of measures. The basic assumption underlying the "no regrets" discourses seems to be an economic one - unprofitable investment shall be avoided. This strand of the Berlin adaptation discourse backs up economic logics of urban development – greening measures are of no regret in the logic of Berlin political discourses if they raise the quality of life in an area, which also implies attracting investors and people at the higher end of the social stratification pyramid. Protecting the most vulnerable is not necessarily intended when referring to "no regret" measures, but reducing exposure in an unspecific way.

Localizing heat adaptation discourses

At first glance the Berlin discourse on measures to mitigate urban heat seems to have no specific link to local traditions, norms and narratives. However, local discourses on climate change adaptation do not ignore local bottom up developments completely. Civil society practices of adopting open spaces for greening purposes, taking various forms like urban gardening or guerrilla gardening, have been harnessed into official urban development discourses. Integrating local cultural trends such as bottom–up greening activities with the urban development agenda of climate change adaptation seems to oppose assumptions of critical climate change adaptation research.

The integration of these local bottom-up strategies into the discourse, however, serves to underline the narrative of the "green city of Berlin". It is a promotional discourse that is used for place marketing and interurban competition, rather than providing and including local knowledge to actively engage civil society actors in urban planning for heat mitigation. Policy documents convey the narrative that Berlin has no deficits regarding the provision of green, but lacks in communicating its green amenities.

The discursive strategy to market Berlin as a green city might undermine demands for action to mitigate and adapt to urban heat. To install further or even preserve urban green as a matter of heat mitigation and adaptation is not perceived necessary in a city that is already very green. Furthermore, urban political discourses absorb civil society niches to raise the city's economic competitiveness and its international attractiveness. Adopting these niches for interurban competitive reasons may create frictions with the logics of these social innovations and may lead

to their co-optation. A similar mobilization of temporary uses in Berlin has been shown within the context of discursive and policy shifts towards “creative city” marketing strategies (Colomb 2012). As Bader and Bialluch (2008, pp.98-99) point out, “reducing interim and small-scale users to being solely a marketing tool for real estate in the city, combined with the lack of any strategy for their support, undermines the development of a proper long-term creative city policy”.

These political discourses might therefore, in the long term, countermand discursively constructed advantages with regards to climate change adaptation and urban heat connected with the narrative of “the green Berlin”. This is especially significant in the more densely populated city-center, where smaller open spaces and green spaces - considered important for heat stress mitigation (Bowler et al. 2010, Chang et al. 2007) - need to give way to re-development projects (Kartschall and Büchner 2015).

Conclusions

Berlin’s climate change adaptation discourses in the research period reflect the latest knowledge in climatologically informed urban planning. Nevertheless, they do not incentivize local actors to actively pursue the adaptation to a changing local climate and society. On the contrary, they seem to be rather preservative of the status quo.

With their unspecific heat risk constructions, the climate change discourses do not include well-defined political targets and demands to act. Referring to “no regret”- strategies in the domain of greening measures while repeatedly trying to confirm that Berlin is already a very green city, hints at the climate change adaptation discourse being made to fit current logics of urban development rather than transforming them. Even though there is a localization strategy, its motive is not to foster heat adaptation by integrating bottom-up initiatives. These initiatives are in fact used to position the city in interurban competitions. Berlin heat adaptation discourses therefore confirm critical adaptation research arguments by showing a strategy that is pursued in a top down manner and lacks a considerable debate on the possible conflicts.

To gain acceptance and incentivize adaptation action, the scientifically informed discourse would benefit from becoming more inclusive. That could, for instance, encompass a better representation of local risk perceptions by negotiating climate change policies within the context of local culture and practice. To fully grasp the diverse construct of vulnerability to heat, sensitivity factors need to be included demanding scientific analysis but local communication processes as well.

Consequently, the climate change strategy could profit from strengthening the role of

smaller scale administrative units – the Berlin districts or even the neighbourhood level. They have not been integrated in the strategy creation and have only been consulted afterwards. These units could trigger and coordinate small scale adaptation discourses and strategies which better meet the needs, the current practices and the support the local population wants.

Acknowledgments

The study was part of the Research Unit 1736 “Urban Climate and Heat Stress in mid-latitude cities in view of climate change” (www.UCaHS.org) funded by the German Research Foundation (DFG) (SCHR 1254/2-1). The authors thank all experts for their willingness to share their knowledge in the expert interviews and workshops.

References

Bader, I., Bialluch, M. (2008). Gentrification and the creative class in Berlin-Kreuzberg. In: Porter, L., Shaw, K. (eds.) Whose urban renaissance? London: Routledge. (93–102).

BBSR - Bundesinstitut für Bau-, Stadt-, und Raumforschung im Bundesamt für Bauwesen und Raumordnung. “Flooding and heat prevention through urban development. Strategies and measures for stormwater management against urban flash floods and overheated cities (Überflutungs- und Hitzevorsorge durch die Stadtentwicklung. Strategien und Maßnahmen zum Regenwassermanagement gegen urbane Sturzfluten und überhitzte Städte.)“ Bonn, 2015. Retreived from http://www.bbsr.bund.de/BBSR/DE/Veroeffentlichungen/Sonderveroeffentlichungen/2015/DL_UeberflutungHitzeVorsorge.pdf?__blob=publicationFile&v=3 [Accessed January 14, 2016].

Bolund, P. and Hunhammar, S. (1999). Ecosystem Services in Urban Areas. *Ecological Economics, 29,* 293–301.

Bowler, D. E., Buyung-Ali, L., Knight, T. M., & Pullin, A. S. (2010). Urban greening to cool towns and cities: A systematic review of the empirical evidence. *Landscape and Urban Planning, 97(3),* 147–155.

Chang, C.-R., Li, M.-H., & Chang, S.-D. (2007). A preliminary study on the local cool-island intensity of Taipei city parks. *Landscape and Urban Planning, 80(4),* 386–395.

Colomb, C. (2012). Pushing the Urban Frontier: temporary use of space, city marketing and the creative city discourse in 2000s Berlin. *Journal of Urban Affairs, 34 (2),* 131-132.

Brunnengräber, A.; Dietz, K. (2013). Transformative, Political, and Normative: Towards a Re- Politicization of Adaptation Research. *Gaia 22(4),* 224 – 227.

Dietz, K., Brunnengräber, A. (2015). Klimaanpassung. In: Bauriedl, S. (Hg.), Wörterbuch Klimadebatte, Bielefeld: Transkript.

European Environment Agency (2010). Mapping the impacts of natural hazards and technological accidents in Europe. An overview of the last decade. EEA Technical Reports 13. Copenhagen.

Färber, M. (2013). Energetische und soziale Problemlagen in Berlin. Eine GIS-gestützte Untersuchung von energieeffizienter Gebäudesanierung im Hinblick auf sozioökonomisch schwache Gebiete. Berlin: Forum Stadt- und Regionalplanung e.V.

FuldaWeichsel (2014). Energetische Modernisierung gegen die Mieter. In: Ein Recht auf Stadt für alle. Zweites Mietenpolitsches Dossier Berlin.16-17.

Füssel, H.-M. (2007). Adaptation planning for climate change: concepts, assessment approaches, and key lessons. *Sustain Sci* 2:265–275.

Gould, K.A., Lewis, T.L. (2012). The Environmental Injustice of Green Gentrification. The Case of Brooklyn's Prospect Park. In: DeSena, J.N.; Shortell, T. (eds.) The World in Brooklyn: Gentrification, Immigration and Ethnics Politics in a Global City. Lexington Books. 113-147.

Großmann, K., Franck, U., Krüger, M., Schlink, U., Schwarz, N., Stark, K. (2012). Soziale Dimensionen von Hitzebelastung in Großstädten. *disP - The Planning Review,* 48(4), 56-68.

Hung, T, Uchihama, D., Ochi, S and Yasuoka, Y. (2006). Assessment with satellite data of the urban heat island effects in Asian mega cities. *International Journal of Applied Earth Observation and Geo-Information*, 8(1), 34–48.

IPCC Third Assessment Report: Climate Change 2001 (TAR). Working Group III: Mitigation. Retrieved from: http://www.ipcc.ch/ipccreports/tar/wg3/index.php?idp=0 [Accessed July 23, 2016].

Kartschall, A. and Büchner, P. (2015, June 25). Die Schattenseiten des Wohnungsbaus. *rbb-online.de*. Retrieved from http://www.rbb-online.de/wirtschaft/thema/2015/thema_mieten_berlin_brandenburg/beitraege/wohnungsbau-berlin-hochhaeuser-nachverdichtung.html [Accessed May 18, 2016].

Klok, L. and Klueck, J. (2015). Reasons to adapt to urban heat (in the Netherlands). Conference Paper. ICUC-9th International Conference on Urban Climate, jointly presented at the 12th Symposium on the Urban Environment.

Klysik K. and Fortuniak K. (1999). Temporal and spatial characteristics of the urban heat island of Lodz, Poland. *Atmospheric Environment, 33,* 3885–3895.

Kovats, R.S. and Ebi, K.L. (2006). Heat waves and public health in Europe. *The European Journal of Public Health,* 16(6), 592-599.

Lotze-Campen, H., Claussen, L., Dosch, A., Noleppa, S., Rock, J., Schuler, J. and Uckert, G. (2009). *Climate change and the cultural landscape of Berlin* (Klimawandel und Kulturlandschaft Berlin). Senate Department for Urban Development Berlin, Berliner Stadtgüter GmbH, Berliner Forsten, Joint Spatial Planning Department Berlin-Brandenburg (eds.) Berlin.

Meehl, G. and Tebaldi, C. (2004). More intense, more frequent, and longer lasting heat waves in the 21st century. *Science, 305,* 994–999.

O'Brien, K., Eriksen, S., Nygaard, L.P. and Schjolden, A. (2007). Why different interpretations of vulnerability matter in climate change discourses. *Climate Policy,* 7(1), 73-88.

Oke, T. R. (1982). The energetic basis of the urban heat island. *Quarterly Journal of the Royal Meteorological Society,* 108(455), 1–24.

Peel, M. C., Finlayson, B. L. and McMahon, T. A. (2007). Updated world map of the Köppen–Geiger climate classification. *Hydrology and Earth System Sciences,* 4, 1633–1644.

Porter, L. and Shaw, K. (eds.) (2008). *Whose urban renaissance?* London : Routledge.

Robine, J.-M., Cheung, S.L.K., LeRo, S., van Oyen, H., Griffith, C., Michel, J.-P. and Herrmann, F. R. (2008). Death toll exceeded 70000 in Europe during the summer of 2003. *Comptes rendus biologies,* 331, 171-178.

Scherer, D., Fehrenbach, U., Lakes, T., Lauf, S., Meier, F. and Schuster, C. (2013). Quantification of heat-stress related mortality hazard, vulnerability and risk in Berlin, Germany. *Die Erde,* 144(3- 4), 238–259.

Schuster, C., Honold, Y., Lauf, S. and Lakes, T. (in preparation). Urban heat stress linked to health and fitness - implications for alternative adaptation strategies.

SenStadtUm- Senate Department for Urban Development and the Environment (n.d.). No Regrets Charter Principles for climate change adaptation in cities. Metropolis initiatives. Retrieved from: http://www.stadtentwicklung.berlin.de/internationales_eu/staedte_regionen/download/projekte/metropolis/no_regrets_charter_en.pdf [Accessed July, 23 2016]

SenStadtUm- Senate Department for Urban Development and the Environment (2011a). City Climate Development Plan (Stadtentwicklungsplan Klima, StEP Klima). Berlin: SenStadtUm. Retrieved from http://www.stadtentwicklung.berlin.de/planen/stadtentwicklungsplanung/download/klima/step_klima_broschuere.pdf [Accessed November 17, 2015]

SenStadtUm - Senate Department for Urban Development and the Environment (2011b).Urban Landscape

Strategy (Strategie Stadtlandschaft). Berlin: SenStadtUm. Retrieved from http://www.stadtentwicklung.berlin.de/umwelt/landschaftsplanung/strategie_stadtlandschaft/download/Strategie-Stadtlandschaft-Berlin.pdf [Accessed May 19, 2016]

Stone, B. (2012). *The City and the Coming Climate. Climate Change in the Places We Live*. Cambridge: University Press.

European conservation legislation: policies and politics in transition

Tina Schivatcheva[1]

The paper focuses on the most significant opportunities and tensions, arising from Natura 2000, the pan-European biodiversity conservation governance regime. Perceiving the internal and external dimensions of the EU's environmental persona as inter-linked, the analysis then seeks to map EU's emergent conservation governance persona onto the existing theoretical constructs.

Introduction

Today globally and in Europe the erosion of biodiversity has become a serious threat. In the EU, only 17 % of the habitats and species and 11% of key ecosystems protected under EU legislation are in a favourable state (EC, 2011). At the same time 60% of the species assessments and 77% of habitat assessments continue to be in unfavourable conservation status (EEA, 2016). The EU has tried to counter this pressing threat by undertaking a commitment to halt biodiversity loss in Europe and help stop global biodiversity loss by 2020 (EC, 2017). In this regard, one of the most important governance innovations, designed by the European Commission (EC) is Natura 2000 (N2000). N2000 is the largest coordinated network of protected areas in the world and it covers 18% of the EU's land area and almost 6% of its marine territory (EC, 2016b). Yet the network is not an example of 'fortress conservation', but it represents a governance innovation: a novel nature-society hybrid (Zimmerer, 2000); one in which people are not seen as inimical to conservation, but as an integral part of it. The novel governance mode of the pan-European governance network actively encourages public participation in the governance process.

The paper uses an analytical perspective informed by theories of European environmental governance, scholarship about the EU as an international environmental actor, and analyses seeking to combine both perspectives. By reflecting on these analytical insights within the concrete policies and politics of N2000 the discussion aims to improve the understanding of the EU's ability to be a successful conservation governance actor, while at the same time wielding influence in the global environmental conservation sphere.

[1] PhD candidate, Environmental Policy Research Centre (FFU), Freie Universität Berlin; tinas@zedat.fu-berlin.de

Theoretical perspectives

In the past the environmental policy instruments employed by the EU have been characterized as belonging to the hierarchical governance mode – i.e. relying on interventionist approaches, with state actors dominating the processes of decision-making, implementation and enforcement (Rehbinder and Stewart, 1985; Holzinger et. al., 2009, 45). Today however, the EU's formerly predominant environmental governance model has been undergoing a process of transformation (Lenschow, 2005, 39). The transformation reflects a global trend – one in which the hierarchical governance models have become increasingly contested and replaced by models, whereby negotiating and jointly-learning set of actors (Mayntz, 2003) use communicating and informational policy instruments (Lenschow, 2005, 40) to achieve the desired policy goals. The EU has increasingly subscribed to a network-style governance model, emphasizing the close cooperation of public and private actors in the formulation and implementation of EU's environmental policy (Holzinger et. al., 2009, 45). Kingston (2013, 7) refer to this new governance mode as multi-level networked environmental governance. The new governance mode is characterized by more open and inclusive governance structures and the adoption of facilitating, cooperative, and consensual, rather than imposing mode of governance (Lenschow, 2005, 38).

Concurrent with the internal governance transformation, the international environmental actorness of the EU has been a subject of much research consideration (Zito, 2005; Damro, 2006; Vogler, 2007; Kelemen, 2010; Zeto, 2011; Delreux, 2014). Notably though, the scholarly focus has been extensively captured by the EU's at one point leadership role in the climate change negotiations (Oberthür and Kelly, 2008; Oberthür, 2011; Bäckstrand and Elgström, 2013; Oberthür and Rabitz, 2014; Fischer and Geden, 2015). EU, as a global conservation governance actor, has eschewed similarly ardent research attention, even though it has emerged as a major source of environmental governance innovation (Scott, 2009).

Furthermore in addition to studies, entirely devoted to an inward or outward-looking analytical angles, a body of EU environmental governance scholarship has emerged, which has sought to explain and theorize the inter-linked aspects of the international and internal dimensions. Zito (2005) theorizes EU's global role in environmental governance by linking EU's internal and external dimensions via the identification of four notable roles: Negotiator, Innovator, Market and Model (to emulate). Although at this point the role of the EU as a Market (for imported goods) is not yet applicable to the biodiversity conservation issues, the other three roles find resonance with the EU's stance. First of all, the role of the EU as Multilateral Negotiator has already

been theorized by Vogler (1999, 36). However, Zeto (2005, 370) expands the analysis by arguing that EU's complex institutional structure, which includes diverse actors and voices may be an advantage in dealing with complex problems, because the variation in perspectives and voices of the EU may be attractive to its negotiating counter-parts. The strength of the EU as an Innovator has also been reflected upon by Weir (Weir, 1992). He submits that since the separate constituent units of the EU follow different learning paths and may even compete to find the best solutions, the EU has an inherent potential for learning and innovation (Weir, 1992, 192-4). Lastly, the role of the EU as a Model, which is to be emulated in an external context could be linked to the extensive literature on EU environmental leadership.

Research has shown that leadership is an essential ingredient for addressing the collective action challenges associated with global environmental problems – e.g. such as climate change or biodiversity conservation. Leadership establishes a "relationship of influence in which one actor guides or directs the behavior of others toward a certain goal" (Underdal 1994, p. 178). Leadership is especially needed when confronting complex transnational problems, which are characterized by a high risk levels and significant cost to all parties involved, so collective action problems can threaten or undermine the effective policy-making (Karlsson et. al., 2012, 46). In this regard two EU leadership concepts, outlined by Delreux (2013, 301) as ''directional leadership'' and ''ideas-based leadership',' provide insightful perspectives. Although initially theorized to explain EU's role in the international climate change regime, the analysis argues that they could also be usefully applied towards understanding EU's impact on global environmental conservation governance.

The concept of credibility is of fundamental importance to studies, which discuss the ''directional leadership'' of the EU, admittedly in the context of its climate change commitment. Elgström (2010) promotes credibility as a key category underscoring the global resonance of the EU policies. He defines credibility as 'an assumption that in order to be a successful leader, the EU's external ambitions as a policy entrepreneur have to be matched by 'domestic' policies that demonstrate that the Union does what it preaches' (Elgström, 2010). Consequently the EU has to 'lead by example' (Elgström, 2010; Fischer and Geden, 2015), and create and implement internally the policies, which it strives to promote internationally. As for ideas-based leadership Delreux (2013, 301) refers to it as the 'ability to impact on international climate policy agendas'. *Idea-based* leadership has been more comprehensively defined as ''problem naming and framing and the promotion of solutions to collective problems. This type of leadership is characterized by agenda setting efforts and includes discovering and proposing joint solutions to collective problems" (Karlsson et. al. 2012).

After introducing the broad theoretical perspectives informing the analysis, the discussion now turns towards elaborating upon the concrete aspects of N2000, exploring in more detail the ways in which the broad analytical constructs could be mapped onto the N2000 governance model.

Natura 2000

Natura 2000 (N2000), ‘’the center piece of EU nature and biodiversity policy‘’ (IUCN 2014), is an environmental protection regime articulated by the EU as a network of protected areas. The network covers over 18% of the EU’s land area (EC, 2016b). The largest coordinated network of protected areas in the world aims to ensure the long-term protection of Europe's most valuable and threatened species and habitats. However, N2000 is not a system of strict nature reserves from which all human activities would be excluded. While it includes strictly protected nature reserves, most of the land remains subject of human activities. The pan-European environmental conservation network represents a novel governance mode: it replaces the outdated adage of the ‘fortress conservation’ approaches ‘’people or nature’’ with an imperative ‘’people and nature’’. Thus, public participation in the governance of the N2000 sites is an indelible component of the N2000 governance approach. The former European Commissioner for the Environment, Margot Wallström has admitted: ‘’To be successful [Natura 2000] requires, in the first instance, the active involvement of the people who live in and depend upon these areas’’. The statement follows from the so-called ‘’Aarhus Convention’’ - the UN/ECE Convention on access to information, public participation in decision-making and access to justice in environmental matters – of which the EU is a signatory since the 25th of June 1998. Linking environmental rights and human the Convention posits that sustainable development can be achieved only through the involvement of all stakeholders.

The legislative kernel of N2000 are the Birds Directive (2009/147/EC) and the Habitats Directive (92/43/EEC). The EU refers to these directives as the “two pillars of EU nature legislation” (EC, 2016a).

The Birds Directive aims to protect all of the 500 wild bird species naturally occurring in the EU. Europe is home to more than 500 wild bird species, yet the conservation status of at least 32% of the EU's bird species is currently unsatisfactory. Member States unanimously adopted the Directive 79/409/EEC in April 1979. It is the oldest piece of EU legislation on the environment and one of its cornerstones. Amended in 2009, it became the Directive 2009/147/EC, designating

Special Protection Areas (SPAs) classified under Article 4 of the birds directive (Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds).

The Habitats Directive ensures the conservation of a wide range of rare, threatened or endemic animal and plant species. Adopted in 1992, the Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements. In order to counter the loss of habitat, the Directive establishes a network of Special Area of Conservation (SAC) sites. Since 1994, all SPAs are included in the N2000 ecological network, set up under the Habitats Directive 92/43/EEC.

From a governance perspective, Natura 2000 integrates scientific, economic, and societal criteria with the aim of overcoming the limitations of traditional, top-down, science-based, and nation state–centred conservation systems (Alphandery and Fortier 2001). This is particularly relevant, as the focus of Natura 2000 is not only on so-called pristine nature but also on semi-natural territories such as farmlands, forests, and grasslands, which are managed in traditional and sustainable ways (EC 2008). Moreover, Natura 2000 refers to the need for consulting affected societal stakeholders for the management of the protected sites. This suggests that Natura 2000 involves multiple rationales and objectives, including science-based conservation and stakeholder participation (Turnhout et. al., 2015, 461). Scholars agree that Natura 2000 has started with a technocratic approach that has privileged conservation experts and marginalised socio-economic stakeholders (Ferranti et. al. 2014, Turnhout et. al., 2015). However, the evolution of the regime has introduced participatory and economic approaches that offer scope for the inclusion of a wider range of stakeholders.

The IUCN reports that the economic benefits of the N2000 network have been estimated at between 200 and 300 billion euros per year, or 2-3% of the EU's Gross Domestic Product (IUCN 2016). Economic activities undertaken in N2000 sites are estimated to have supported about 12 million jobs each year during the period 2006-2008 (i.e. about 6% of total employment in the EU). At the same time the programme has been instrumental in protecting natural environments from short-term economic and political decisions. The IUCN considers it to be "a cause for celebration in Europe and one of the success stories" (IUCN 2014).

N2000: institutional context

N2000 has been introduced into a setting, characterized by a significant institutional complexity. The EU is a complex institutional and political actor, active in a broad range of policy

domains. In conceptual terms, the EU can be defined as a multi-level, multi-actor system of governance involving EU institutions and Member States as constitutive units. The rules and regulations governing European environmental policy bear the imprint of EU's complex institutional structure. Several different actors are involved in environmental policymaking: the Member States, the Council, the European Commission (EC), the European Court of Justice (ECJ), the European Parliament (EP) as well as various civil society and business groups (Afionis 2013). Each important actor within this long policy chain is a veto point, and any actor promoting a particular goal must build consensus and compromise across all the veto points (Weale, 1996). Consequently, the sheer complexity of the EU institutional process limits the influence of less organized and knowledgeable environmental actors (Zito, 2005, 366).

The European institution most directly concerned with the conservation of the European environment is the Environment Directorate General (DG) of the European Commission ('DG Environment'). Established in 1973 DG Environment's broad institutional mandate is ''to protect, preserve and improve the European environment for present and future generations'' (DG Environment, 2015). In the sphere of environmental conservation DG Environment has diverse capacities, ranging from policy-making to assistance in policy implementation and evaluation. Thus, the Commission (as represented by DG Environment) not only proposes policies and legislation that protect natural habitats, but also provides a certain assistance to their legislative and policy implementation as well as monitoring to ensure that the member states apply the EU environmental law correctly. In cases of lack of clarity in the interpretation of the environmental legislation or non-compliance with the agreed-upon legislation, the Commission follows up on complaints from citizens and non-governmental organisations and may bring the matter to the ECJ.

Yet transposing the EU legislation into the 28 different legal realms of its member states is a considerable challenge and inevitably often results in confusion and differences in the interpretation[2]. In case of dispute or diverging views, it rests with the ECJ to provide definitive interpretation of a Directive and the Court's rulings on nature conservation provide an important case-law. Even though the rulings are accessible to the public, already in the year 2006 the ECJ admitted that "their number [of court rulings] is growing and it is sometimes quite complicated to the persons not directly working as lawyers to find and extract the most important parts regarding

[2] Ladislav Miko, a former Director of the Protection of Natural Resources, DG Environment admits: ''From my numerous discussions at various levels of implementation – in national Parliaments, national and regional Governments, but also in daily contacts with concerned stakeholders – landowners, industries, citizens, environmental and other NGO's etc. - it appears that understanding and interpretation of European directives often varies'' (EC, 2006, 4).

specific interpretation of European law" (EC, 2006, 4). Thus, although the goal of the ECJ rulings has been ''foreseen to be a daily tool to clarify the legal basis of EU provisions in the Nature protection area and avoid misunderstandings in their implementation in advance – before the real problem appears'' (EC, 2006, 4), it is becoming too hard and complex to interpret this growing body of rulings outside the legal realm.

Consequently, in the domestic sphere of transposition and implementation of European conservation governance there is an emerging tension between legislative complexity and the necessary democratic accessibility of the law to the public understanding. The complexity of the legislation clearly has a negative impact on the capacity of the regular European citizens to understand and act in accordance with the N2000 legislation, as is illustrated by a review, conducted by the UK Department for Environment, Food & Rural Affairs (DEFRA).

In 2012 DEFRA conducted a review of the implementation of the Habitats and Birds Directives in the UK and of their impact. The review offers a critical perspective of the high complexity of the transposed Directives and the corresponding guidelines, which has resulted in a lack of transparency and understanding by the implementing authorities and regular citizens alike. DEFRA states:

> *"Transposing terrestrial regulations alone covering approximately 134 regulations and 7 schedules over 94 pages, and guidance (EU and National and non-Government) amounts to over 60 documents totalling over 1,600 pages. This can be difficult for competent authorities to navigate and is all the more daunting for developers, large and small. It also reinforces a perception of inconsistency and lack of transparency in the process".* (DEFRA 2012, p.13)

Clearly, legal transparency has been identified as a major concern by DEFRA and considerations of the issues of accessibility and transparency of the N2000 legal framework have become subjects of significant concern.

It is recognized that communication about legislation is itself a complex social and political process. However an improvement in the way in which legislation is presented, made available and explained could dramatically reduce the perception of disproportionate complexity (BRTF, 2015). The European citizens should not experience difficulty in accessing reliable, clear information on their rights and duties, combined with a lack of guidance on the compliance requirements relevant to them and their specific circumstances. Moreover, since N2000 explicitly aims at integrating the European citizens in the design and implementation of the conservation policy and praxis, it is imperative that the legislation is accessible to them.

Consequently, contrary to some legal arguments for more 'classic' legal approaches and 'hard law', the success of such wide-ranging and important pan-European conservation initiatives does not depend on more codification and on the implementation of more stringent practices of enforcement and the administration of justice along the hierarchical command-and-control governance style, but on generating wide levels of social support via the endorsement of a palette of new legislative and non-legislative instruments. Instead of 'more classic regulation', a mix of alternative and less prescriptive legal and non-legal tools in addition to the traditional legal instruments provides room for flexibility as well as speeds up the implementation process. The EU has made efforts to design and implement exactly such flexible and accessible guidelines and explanatory documents. Amongst the most innovative and successful such tools are the N2000 awards.

The N2000 awards: governance innovation and social learning within and beyond the European borders

The European N2000 annual awards are a pan-European recognition of excellence in the management of N2000 sites and conservation achievements (EC, 2016c). The awards trace their beginning to 2012, and the winning entries have been publicly shared since 2014. With the awards the Commission showcases the added value of N2000 for the local economies and at the same time it increases the public awareness about Europe's valuable natural heritage (EC, 2016c).

Communication with the European public about the goals of N2000 is explicitly stated as the primary purpose of the awards – thereby strengthening the Commission's public outreach and educating the public about N2000. The awards recognize 'good practices at Natura 2000 sites in five different categories: Communication, Socio-Economic Benefits, Conservation, Reconciling Interests/Perceptions, and Cross-border Cooperation and Networking. Since 2015 the host of awards also includes a European Citizens' Award, which gives the public a chance to vote directly for their favourite finalist. The Commission aims to attract the widest possible range of stakeholders as applicants to the award: 'anyone directly involved in Natura 2000 – businesses, authorities, NGOs, volunteers, land owners, educational institutions or individuals'. Thus, the award represents a novel attempt to strengthen the capacity of the local stakeholders to develop and implement effective environmental and natural resource management strategies and practices. One of the most prominent goals of the N2000 awards is promoting training activities and exchange experiences of the concepts, methodologies, mechanisms, and tools for effective

environmental management, as well as the development of strategies to promote good environmental governance. The impact of the award is magnified by the additional support provided by the Commission to the award winners in organizing local events and giving them an added opportunity to showcase their achievements.

The awards also raise the profile of the EU as an international biodiversity conservation actor. Although the conditions of the N2000 awards do not allow the direct participation of applicants from non-EU member-states as principal award applicants, states from the European neighbourhood routinely participate in the collaborative awarded projects. The collaborative social learning, which this participation entails, allows spreading of the best conservation practices through the international informal networks of environmental scientists, activists and concerned citizens' groups. Thus, the efforts of the EC to find novel ways of communicating directly with the European citizens reverberate far beyond the formal boundaries of the EU, finding receptive international audiences.

The EU as a successful institutional international conservation actor

Regardless of its internal challenges and complexities, the European Union (EU) is a prominent actor in the institutionalized practices of global sustainable environmental governance (Vogler, 2005; Bretherton and Vogler 2006; Schreurs, and Tiberghien, 2007; Vanden Brande, 2008, Kilian and Elgström, 2010). The analysis will now present the most important international conservation initiatives, which the EU is formally involved with. The presentation will be followed by a discussion, reflecting on the theoretical constructs of the role of the EU as an international biodiversity conservation actor.

The EU is a Party to the United Nations Convention on Biological Diversity (CBD) of 1992, which seeks to ensure the conservation and sustainable use of the global biodiversity. In 2010, CBD Parties adopted a 10-year Strategic Plan to address global biodiversity loss; the plan was accompanied by the setting of 20 concrete targets (the Aichi targets) in order to achieve its overall objective. That same year, the Parties also adopted the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization. The EU has also supported and contributed to the development of the 2015 UN 17 Sustainable Development Goals, and 2030 Agenda for Sustainable Development.

Furthermore, the Council of Europe's Convention on the Conservation of European Wildlife and Natural Habitats, or Bern Convention (1982), was the first international treaty to protect both species and habitats and to bring countries together to decide how to act on nature conservation.

The Bern Convention is a binding international legal instrument, covering most of the natural heritage of the European continent and extending to some States of Africa. Fifty countries and the EU have currently signed up to the Convention and committed to promoting national conservation policies, considering the impact of planning and development on the natural environment, promoting education and information on conservation, and coordinating research.

The EU has also implemented a broad range of other biodiversity-related international agreements such as CITES (the Convention on International Trade in Endangered Species), the Bonn Convention on Migratory Species (CMS), the Bonn Convention on Migratory Species (CMS) as well as the Agreement on international humane trapping standards.

Moreover, the EU has made an important contribution to the challenges of sustainable environmental governance and conservation, as one of the major donors for protected areas overseas through the EU's development aid programmes (IUCN 2014). The European Community and its Member States account for more than half of worldwide Official Development Assistance (ODA).

Evidently the EU's impact on the global biodiversity conservation issues is very significant. Recently, it has become even more pronounced, since the EU has also played an important role in the development of the Emerald Network (COE 2015). The Emerald Network programme was established in 1989 by the Council of Europe as part of its activities in the implementation of the Bern Convention, with the adoption of Recommendation No. 16 (1989) of the Standing Committee to the Convention (CoE, 2012). The Network is based on the same principles as Natura 2000. The Emerald Network represents a de facto N2000 extension to non-EU countries; while in the EU Member States, the Emerald Network is identical to N2000. For EU candidate countries, the network represents the phase of preparation for- and a direct contribution to- the implementation of the N2000 programme. The Council of Europe explicitly states the goal as 'to keep the Emerald and N2000 Networks as coherent as possible' (CoE 2012, p.8).

As demonstrated by the discussion: the EU is not only an active participant in the existing international conservation efforts, but also an initiator in the establishment of new such initiatives. Of the four international environmental governance roles of the EU identified by Zito (2005): Negotiator, Innovator, Market and Model (to emulate), the analysis highlights the ones of the Innovator and Model as most directly applicable to the global influence of the N2000 environmental conservation model. N2000 is a governance innovation, establishing a novel inclusive and participatory biodiversity conservation governance mode. Thus, the EU acts as an Innovator both by adopting this new mode of governance, and by extending efforts to expand the

network internationally – via the Emerald Network initiative. Moreover, very closely inter-linked with the Innovator role of the EU is also the role of the Model (to emulate).

Consequently, N2000 and the Emerald Network also represent an example of EU's directional leadership. EU leads by example in the implementation of N2000 as a policy and governance model, across a range of different political and administrative settings. N2000 also represents an ideas-based leadership, impacting the international policy agendas by extending its governance principles via the Emerald Network, and consequently naming and framing the conservation issues, setting the agenda and discovering and proposing joint solutions to the collective problems.

Conclusions

N2000 does not resolve, but embodies the tensions of the European institutional arrangements, laws and policies. Among the most significant of these tensions is the search for balance between traditional 'classic regulation' and emerging legal and non-legal alternatives. The enforcement of EU legislation is primarily the responsibility of the national institutions, so capacity-building at the national level is essential, yet in itself, without a certain institutional transformation which endorses a wider set of instruments, it would be insufficient to achieve the ambitious conservation objectives. A judicious mix of classic regulation and alternatives would benefit from the advantages of both approaches and carries the potential of enhancing the democratic legitimacy of the EU.

The EU is a complex governance system that poses both challenges and opportunities. However, paradoxically, the internal tensions accompanying EU's governance actions in the sphere of environmental conservation could contribute to its standing as a global environmental leader. EU's current complex institutional system is underpinned by a constant imperative to develop variety of innovative policy responses. The current analysis especially supports the argument that the roles of Innovator and Model, providing directional leadership and ideas-based leadership offer a particularly promising way forward for the achievement of the global conservation objectives.

EU's role as a leader in environmental conservation and sustainable development does not depend on dismissing the tensions attendant to the policies' development and implementation, but on using them as an impetus for continued governance innovation. Only by adopting such stance will the EU be able to face the challenge of inspiring people around the world and across generations to reconnect with nature, 'by demonstrating that genuine sustainable development is

possible' (IUCN 2014).

References

Alphandery, P. and Fortier, A. (2001). Can a territorial policy be based on science alone? The system for creating the Natura 2000 network in France. *Sociologia Ruralis*, 41 (3), 311–328.

Bäckstrand, Karin, and Elgström, Ole (2013). The EU's role in climate change negotiations: from leader to 'leadiator'. *Journal Of European Public Policy*, 20 (10), 1369-1386.

Better Regulation Task Force (BRTF), (2005). Routes to Better Regulation - a guide to alternatives to classic regulation. London. Retrieved from: http://www.eesc.europa.eu/resources/docs/routes_to_better_regulation.pdf.

Bretherton, C. and Vogler, J. (2006). The European Union as a Global Actor. London: Routledge.

Council of Europe COE, (2015). *Emerald Network Reference Portal*. Retrieved from: http://www.coe.int/en/web/bern-convention/emerald-network-reference-portal.

Damro, C. (2006). 'EU–UN environmental relations: shared competence and effective multilateralism' in K. Smith and K. Laatikainen (eds), *Intersecting Multilateralisms. The European Union and the United Nations*, New York: Palgrave Macmillan, pp. 175–92.

Delreux, Tom (2013) The EU as an actor in global environmental politics, In Environmental Policy in the EU: Actors, Institutions and Processes, Andrew Jordan, and Camilla Adelle, London and New York: Routledge, pp. 287-306.

Delreux, Tom (2014). EU actorness, cohesiveness and effectiveness in environmental affairs. *Journal Of European Public Policy,* 21 (7), 1017-1032.

Department for Environment, Food & Rural Affairs (DEFRA), (2012). Report of the Habitats and the Wild Birds Directive Implementation Review. HM Government, March 2012. Retrieved from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69513/pb13724-habitats-review-report.pdf.

DG Environment, (2015). Environment basics. Retrieved from:

Ecologic Institute (EI), (2015). *The implementation of the Natura 2000, Habitats Directive 92/43/ECC and Birds Directive 79/409/ECC*. Preparation for an ex-post territorial impact assessment. London: UCL Centre for Law and the Environment. Retrieved from: http://ecologic.eu/sites/files/publication/2015/2612-05-implementation-natura2000-birds-directive.pdf.

EC, (2006). Nature and biodiversity case ruling of the European Court of Justice. Luxembourg: Office for Official Publications of the European Communities. Retrieved from: http://ec.europa.eu/environment/nature/info/pubs/docs/others/ecj_rulings_en.pdf

EC, (2008). LIFE and Europe's grasslands. Restoring a forgotten habitat. Available from: http://ec.europa.eu/environment/life/publications/lifepublications/lifefocus/documents/grassland.pdf

EC, (2016a). Enlargement and nature law. Retrieved from: http://ec.europa.eu/environment/nature/legislation/enlargement/index_en.htm

EC, (2016b). Natura 2000. Retrieved from: http://ec.europa.eu/environment/nature/natura2000/index_en.htm

EC (2016c). *European Natura 2000 award*. Retrieved from: http://ec.europa.eu/environment/nature/natura2000/awards/the-award/index_en.htm accessed on 01.08.2016.

EC, (2017). Nature and biodiversity. Retrieved from: http://ec.europa.eu/environment/nature/index_en.htm

EEA, European Environment Agency, (2016). Biodiversity, Retrieved from: http://www.eea.europa.eu/soer-2015/europe/biodiversity

Elgström, Ole (2010): EU Leadership in an Emerging New World Order, Paper presented at the 5th Pan-European Conference on EU Politics, Porto, (24-26 June 2010), Retrieved from:

http://www.jhubc.it/ecpr-istanbul/virtualpaperroom/015.pdf

Ferranti, Francesca, Esther Turnhout, Raoul Beunen & Jelle Hendrik Behagel (2014). Shifting nature conservation approaches in Natura 2000 and the implications for the roles of stakeholders, *Journal of Environmental Planning and Management*, 57: (11), 1642-1657.

Fischer Severin and Geden, Oliver, (2015). The Changing Role of International Negotiations in EU Climate Policy, *The International Spectator*, 50 (1), 1-7.

Holzinger, K., Knill, C. and Lenschow, A. (2009), 'Governance in EU environmental policy', In I. Tommel and A. Verdun (eds), Innovative Governance in the European Union, The politics of multilevel policymaking. Boulder, CO: Lynne Rienner Publishers, pp. 45-62.

IUCN, (2014). European Protected Areas of key importance in the global context. Retrieved from: https://www.iucn.org/about/union/secretariat/offices/europe/european_union/key_issues/natura2000europes_protected_areas_network/?18408/European-Protected-Areas-of-key- importance-in-the-global-context

IUCN, (2016). Natura2000: Europe's protected areas network. Retrieved from: https://www.iucn.org/about/union/secretariat/offices/europe/european_union/key_issues/natura2000europes_protected_areas_network/

Karlsson, Christer, Hjerpe, Mattias, Parker, Charles, and Linnér, Björn-Ola (2012). The Legitimacy of Leadership in International Climate Change Negotiations, *Ambio*, 41 (1): 46–55.

Kelemen, D. (2010). 'Globalizing European Union environmental policy', *Journal of European Public Policy* 17(3): 335–49.

Kelemen, R. Daniel and Vogel, David (2010). "Trading Places? The Role of the United States and the European Union in International Environmental Politics," Comparative Political Studies, 43 (4), pp. 427-456.

Kilian, B. and Elgström, O. (2010) '*Still* a *Green Leader*? The *European Union's Role* in *International Climate Negotiations*', CooperationandConflict, 45 (3), 255-273.

Lenschow, A. (2005). "Transformation in European Union environmental governance," in B. Kohler Koch and R. Eisling, (eds.): Transformation of Governance in the European Union, London: Routledge, 37-58.

Mayntz, Renate (2003). „From Government to Governance: The Case of Integrated Product Policy", International Summer Academy September 7-11, 2003, Wuerzburg, Germany.

Oberthür, Sebastian (2011). The European Union's Performance in the International Climate Change Regime, Journal Of European *Integration*, 33 (6), 667-682.

Oberthür, Sebastian and Kelly, Claire Roche (2008). EU Leadership in International Climate Policy: Achievements and Challenges, *The International Spectator*, 43 (3), 35-50.

Oberthür, Sebastian and Rabitz, Florian (2014). On the EU's performance and leadership in global environmental governance: the case of the Nagoya Protocol, Journal Of European Public Policy Vol. 21 , Iss. 1, 39-57.

Rehbinder; Eckard and Stewart, Richard (1985). Environmental protection policy: Integration through law, Berlin: Gruyter.

Schout, A. & Jordan, A. (2003). Coordinated European governance: self-organizing or centrally steered? *Public Administration, 83*(1), 201–220.

Schreurs, M. A. and Tiberghien, Y. (2007) 'Multi-Level Reinforcement: Explaining European Union Leadership in Climate Change Mitigation', Global Environmental Politics 7: 19–46.

Scott, Joanne (2009). Environmental Protection, Oxford: Oxford University Press.

Stavros, A. (2013). Environmental policy in the EU: actors, institutions and processes. *Environmental Politics, 22*(6), 1044-1045.

Turnhout, Esther, Jelle Behagel, Francesca Ferranti & Raoul Beunen (2015). The construction of legitimacy in European nature policy: expertise and participation in the service of cost-effectiveness, Environmental Politics, 24:3, 461-480.

Underdal, A. (1994). Leadership theory: Rediscovering the arts of management. In *International multilateral negotiation: Approaches to the management of complexity*, ed. W.I. Zartman, 178–197. San Francisco: Jossey–Bass Publishers.

Vanden, Brande, E. (2008). 'Green Civilian Power Europe?', In J. Orbie (ed.) Europe's Global Role. External Policies of the European Union, pp. 157–79. Hampshire: Ashgate.

Vogler J. (2005). The European contribution to global environmental governance. *International Affairs*, vol. 81(4), 835-850.

Vogler, John (2007). The European Union as an actor in international environmental politics, Environmental Politics, 8:3, 24-48.

Yearley, S., Baker, S., and Kay, M. (1994). Environmental policy and peripheral regions of the European Union: An introduction. *Regional Politics and Policy, 4* (1), 1-21.

Zimmerer, Karl S. (2000). 'The Reworking of Conservation Geographies: Nonequilibrium Landscapes and Nature-Society Hybrids', Annals of the Association of American Geographers, 90: 2, 356 — 369.

Zito, A.R. (2005). The European Union as an environmental leader in a global environment. *Globalizations, 2* (3), 363-375.

Legal documents

Bern Convention (1982). Details of Treaty No.104, Convention on the Conservation of European Wildlife and Natural Habitats. Retrieved from: http://www.coe.int/en/web/conventions/full-list/-/conventions/treaty/104

Bird Directive, (2009). DIRECTIVE 2009/147/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL. Retrieved from: http://eur-lex.europa.eu/legal- content/EN/TXT/?uri=CELEX:32009L0147.

Council of Europe (CoE), (2012). CONVENTION ON THE CONSERVATION OF EUROPEAN WILDLIFE AND NATURAL HABITATS, Group of Experts on Protected Areas and Ecological Networks, The Emerald Network: A Network of Areas of Special Conservation Interest for Europe. Strassbourg. Retrieved from: https://wcd.coe.int/com.instranet.InstraServlet?command=com.instranet.CmdBlobGet&InstranetImage=2129188&SecMode=1&DocId=1906636&Usage=2.

Habitat Directive, (1992). Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora. Retrieved from: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:31992L0043

European Commission (EC), (2011). COM/2011/0244 final, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Our life insurance, our natural capital: an EU biodiversity strategy to 2020 COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS Our life insurance, our natural capital: an EU biodiversity strategy to 2020, Retrieved from: http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52011DC0244

Role of Energy-Competition Law in accelerating the ASEAN Energy Sustainability 2025

Dian Parluhutan[1]

Introduction

In the year 2015, the leaders of the Association of South East Asian Nations (ASEAN) Member States (AMS) have introduced two new regional cooperation schemes: the ASEAN Economic Community (AEC) Blueprint 2025 and the ASEAN Community Vision 2025.

AEC Blueprint 2025 founded upon five interrelated and mutually reinforcing pillars: First, a highly integrated and cohesive economy. Second, competitive, innovative, and dynamic ASEAN. Third, enhanced connectivity and sectoral cooperation. Fourth, a resilient, inclusive, people-oriented, and people-centred ASEAN, and; fifth, a global ASEAN.

Previously, by virtue of the ASEAN Concord II declared in Bali, Indonesia, in 2003, the ASEAN Countries have agreed to establish AEC by 2015, aiming not only to transform ASEAN into a region with free flow of capital, movement of goods, services, investment and skilled labour, but also to a highly competitive region that is fully integrated with the global economy.

The provision of Article 1(5) of AEC Charter mandates not only the ASEAN single market but also setting the culture of competition. It can be seen from the words "... highly competitive and economically integrated with…". The words "highly competitive" asserts that in carrying out ASEAN single market, a culture of competition must be created. In this regard, Sivalingam is of opinion that there are three principal factors catalysing economic integration under the AEC framework. First, the processes towards a market economy due to the growing integration of ASEAN's economies with global economies and domestic upheavals. Second, the proliferation of Multi-National-Enterprises (MNEs), which engage in generating goods and services and at the same time penetrating the South East Asian markets through their products. Third, institutional consequences of the Membership of ASEAN Countries in the World Trade Organization (WTO)[2].

In 2014, during the ASEAN Ministers Energy Meeting (AMEM), all ten ASEAN states leaders agreed on implementing the new ASEAN Plan of Action for Energy Cooperation (APAEC) for 2016-2015, in the purposes of "Enhancing Energy Connectivity and Market Integration in ASEAN to Achieve Energy Security, Accessibility, Affordability and Sustainability for All" (ASEAN 2015, p.1). Whilst the APAEC envisages six fundamental objective areas, three thereof are primarily important

[1] PhD candidate, Faculty of Law, Freie Universität Berlin; dian.parluhutan@fu-berlin.de

[2] Currently, eight of the ASEAN Countries are WTO members: Indonesia, Singapore, Thailand, the Philippines, Brunei, Malaysia, Cambodia, and Myanmar. The other ASEAN members, Laos and Vietnam, are now negotiating membership. See http://www.wto.org/membership [accessed on 07.03.2016].

in the context of this paper, namely: energy efficiency and conversation, new and renewable energy sources, and regional energy policy and environmental analysis (Ibid).

Nevertheless, in the ASEAN's energy sector, pervasive anticompetitive and unfair business practices have been impending the attainment of the ASEAN's sustainable energy objectives. Specifically, there have been uncompetitive structures under state owned enterprise (SOE) monopoles. Put differently, up to now there are, inter alia, three main obstacles establishing competition in the energy sector in ASEAN countries: structural separation (unbundling), access to essential facilities, and privatization (Wisuttisak 2012).

Objectives

Accordingly, this paper attempts to analyse and provide feasible solutions concerning the role of energy-competition law in creating the competitive market of the energy sector in ASEAN, as well as in accelerating the ASEAN energy sustainability objective's realization abovementioned.

Hence, this paper continues as follows. Following the research background and problems introduced above, the paper describes the energy sustainability objectives of the AMS, envisaged to be realized in the year of 2020-2025. Subsequently, an analysis concerning the roles of energy-competition law in establishing the competitive market of energy sectors and in accelerating the ASEAN energy sustainability objective's realization is provided. The paper continues by discussing the juridical approximation of energy-competition law in the AMS in the light of the AEC's goals and ASEAN energy sustainability objectives. The analysis takes into account the juridical comparative method with the German, United Kingdom (UK) and European Union (EU)'s energy-competition regulations. Eventually, the concluding part endeavours to provide feasible solutions concerning the energy competition's regulatory framework in the light of the AEC's and ASEAN energy sustainability's objectives, taking into account the economic integration in the multilateral sphere (WTO).

Discussion

Principally, the energy law pursues following key objectives, which are: First, the sustainability and reliability of the energy supply, both short-technical and long-term energy supplies. Second, operation of energy supplies shall not counter environmental protection objectives (i.e. every undertaking shall minimalize the occurrences of damages to the environment

as well as to humans' health: CO2 emissions reduction). Third, to eradicate and to prevent restrictive practices to competition in an energy sector, whereas these measures aim to enable every undertaking to set competitive prices for energy supplies (*Konzept des wettbewerbsanalogen Preises; Konzept der Kosten der effizienten Leistungserbringung; billigem Ermessen).* Fourth, providing sophisticated rules concerning contracts of energy supplies between corporations, which are aimed to benefit consumers and achieve compliance with modern equitable competition rules.

Specifically, the energy-competition law focuses upon primary concerns as follows: First, a high energy market concentration especially at the wholesale level. Second, a vertical foreclosure due to an insufficient level of unbundling between network operation vis-à-vis supply and/or generation activities. Third, an insufficient cross-border capacities and different market designs constituting an obstacle of further market integration. Fourth, lacks of efficient and transparent price formation and "information asymmetry between incumbents and market entrants". Fifth, long contract durations and restrictive practices in relation to supply contracts causing foreclosure of downstream markets. Sixth, regarding balancing markets, the energy-competition law addresses the concern of balancing regimes in favour of incumbents and creating barriers to new entrants in the energy sector.

With regard to ASEAN energy sustainability, the energy-competition law consists of an array of rules which are playing two main roles. First, an intrinsic role, which means the eradicating anticompetitive practices and unfair business ones in the energy market. According to Schmidt, there are mainly three types of anticompetitive practices (Schmidt 2005, pp.122-125): First, the negotiating strategy (*Verhandlungsstrategie*), which refers to legal restrictions over competition-relevant conduct and/or decision relating to the one or several action parameters due to the collusive agreements, decisions of association of undertakings and concerted practices (Schmidt 2005, p.121). Second, the obstruction or impediment strategy (*Behinderungsstrategie*). This strategy means *de jure* or *de facto* restraints over competition-relevant conduct and/or decision related to the one or several action parameters due to the obstruction against rival undertakings (competitors) through agreements (tying/coupling contract) or *de facto* market conducts (discrimination, boycott, refusals to supply) (Ibid). Third, the concentration or conglomeration strategy (*Konzentrationsstrategie).* This strategy defined as factual restrictions over competition-relevant conduct and/or decision relating to the one or several action parameters due to the cutting of quantity (numbers) of competition policy's decision makers through external or over proportionally internal corporate growth (Ibid).

The second main role of the ASEAN energy competition law in regard to achieving

sustainability is extrinsic one, which means the law will promote the energy market integration in ASEAN by ensuring the free movement of goods, services, investment, skilled-labour, and freer flow of capital within ASEAN members. According to Mestmäcker and Schweitzer (1974 / 2014), these five freedoms together with a competition law are to be seen as the constituting factors of a market economy in a regional economic integration, such as in the ASEAN.

Nevertheless, according to the World Bank and ASEAN Competition Law scholars there is an urgent necessity to accomplish the legislative convergence of energy-competition laws in AMS. Per definitionem, the convergence of energy-competition rules are the processes whereby several nations or group of nations collectively decide to adopt identical, or at least compatible, rules and normative principles in one or several regulatory areas, notably energy-competition aspect (World Bank 2014). Accordingly, there are two types of law convergence, which are: a "loose" convergence where one or several countries decide to rely upon common normative principle in one regulatory aspect, yet the details on how to achieve compliance are given to national laws. For examples United Nations (UN) Model Laws and the Organisation for Economic Co-operation and Development (OECD)'s Law Recommendation. The second type is "deep" convergence whereas the involved countries decide to approximate divergent legal standards for facilitating free trade arrangements.

Related to these two types and equally important, the World Bank (2014) recommends the following approaches as to legislative convergence of energy-competition laws. First, the regulatory "transplant" form, whereas one of several involved countries decide to transpose in its domestic legal system one or several set(s) of competition rules from another nation. For instance, transposition of the acquis communautaire for acceding countries into the European Union (EU). Second, "approximation", in which concerned countries negotiate a common set of rules and then adjust their domestic competition regulations as to make them compatible with the common (regional) regulations (e.g. implementation of the EU directives [*Richtlinie*]).

Nevertheless, the legislative convergence of energy-competition laws in the ASEAN has been obstructed by certain roadblocks. Evidently, Kokkoris argued that the harmonisation of energy-competition laws in the ASEAN suffers from the following drawbacks: a lack in supranational law-making body for legislating and enforcing community laws; regardless of three decades of close cooperation, the ASEAN governmental leaders have repeatedly refused proposals of supranationality in South East Asia; the Community Law regulating energy-competition, which is truly supranational, has been absent; there has been no community rules which are 'neutral' from cultural sensitivities of the AMS, and; lastly, the legal systems in AMS differ greatly, varying from the common law, civil law and hybrids of the both.

In contrast, Thanadsillapakul argued for another alternative of the harmonisation of energy-competition laws. According to his argument, three options are available: First, the coordinated or the sovereignty model, whereas the AMS can rely upon the coordinated application of national competition laws based on positive agreements. Second, the harmonised model, whereby the AMS can harmonise their energy-competition laws following international guidelines. Third, the supranationality model, which involves the highest degree of collaboration in a form of an agreement on international competition laws. Accordingly, Thanadsillapakul arguably insisted that the harmonised model is the most suitable for the ASEAN countries.

Conclusions

Eventually, embarking upon the discourses abovementioned, key conclusions can be inferred as follows: Firstly, due to prerequisite physical and institutional connectivity, as the first and second pillars of the ASEAN Economic Integration, the existence and optimal implementation of the Energy-Competition Law in ASEAN, accordingly, is of profoundly important. This is in order not only to accelerate the AEC achievement but also to serve as key nexus between physical and institutional ASEAN connectivity, in particular within the sustainable energy policy.

Nevertheless, the construction and implementation of the energy-competition law should take into accounts the macro and micro principles prudently notably related to the sustainability of energy provisions and green (environmentally-friendly) energy such as solar and geothermal sources. Second, a series of substantial provisions should be prudently incorporated into the energy-competition law in ASEAN, most importantly the guarantee of efficient and transparent prices and fees for all stakeholders in the energy provision services. Thirdly, the optimal and substantial implementation of the energy-competition law in ASEAN however requires the common commitment and endeavours of AMS, in order to conduct comprehensive yet accelerated positive integration by means of legislative approximations in the domain of energy provision services. As a matter of fact, all of these envisaged programmes are to foster future challenges and consistent synergies to achieve partnership in dynamic development which will forge closer economic integration within the ASEAN Countries.

References

Association of South-East Asian Nations (ASEAN) (2015). ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025: Phase 1: 2016-2020. ASEAN Centre for Energy (ACE), Jakarta, Indonesia.

Schmidt, I., (2005). *Wettbewerbspolitik und Kartellrecht. Eine interdisziplinäre Einführung*. Lucius; Stuttgart.

Mestmäcker, E. J., & Schweitzer, H. (1974 / 2014). *Europäisches Wettbewerbsrecht* (3 Auflage). CH Beck., München.

Wisuttisak, P (2012). Liberalization of the Thai energy sector: a consideration of competition law and sectoral regulation. *Journal of World Energy Law and Business, 5*(1), 60-77.

A sustainable approach to controling *Varroa* mite, a parasite of honey bees

Nurit Eliash[1] [2], Kumar Nitin Singh [1], Yosef Kamer [1], Ilya Zaidman [1], Erika Plettner[3] and Victoria Soroker [1]

Abstract

Varroa destructor (Acari: Varroidae) is a parasitic mite specific to honey bees (*Apis* sp.) and one of the major threats to apiculture (bees maintenance of hives) today. The chemical control in use is harmful to the bees and accumulates in the hive products. Furthermore, there are growing evidences for inefficiency of *Varroa* control measures due to resistance development. In the light of the recent world pollinator decline, the ecological and economical significance of honey bee health should be of a major concern. Chemical signals from the bees are known to play a major role in the mite's host detection and allows *Varroa* to distinguish between bees from different task groups and prefer a nurse over a forager bee. Our approach is to interfere in the parasite-host interaction via disruption of the mite's host finding behavior. In search for a specific disruptive compound, we developed a method to study the chemosensing of *Varroa*. We tested the effect of potent synthetic compounds on the *Varroa* chemosensory organ located on its foreleg by electrophysiology. The effect of active compounds on *Varroa* host selection behavior was tested in a choice bioassay. The disruptive compounds were further tested for possible toxicity to bees, as these compounds are intended to be used in the hive. We found that in the presence of some compounds, the response of *Varroa* chemosensory organ to honey bee headspace volatiles significantly decreased. This effect was accompanied by a profound change in the mite's host selection behavior. These results open new venues for a sustainable control of this major honey bee pest.

Introduction

Varroa destructor Anderson & Trueman (Acari: Varroidae) is an ectoparasitic mite of honey bees, originally found in the Eastern honey bee *Apis cerana*. A shift to the European honey bee *Apis mellifera*, which lacks the characteristics of its original host, has led to an unbalanced host-

[1] Correspondent author, Department of Entomology, Institute of Plant Protection, Agricultural Research Organization, Volcani Center, Bet Dagan, Israel; norikachan@gmail.com
[2] Institute of Agroecology and Plant Health, Robert H. Smith Faculty of Agriculture, Food and Environment, Hebrew University of Jerusalem, Rehovot, Israel
[3] Department of Chemistry, Simon Fraser University, Burnaby, B. C., Canada

parasite relationship and to devastating damage to honey bee colonies. Today, the *Varroa* has spread almost all over the world and is considered to be the most significant threat to beekeeping (Rosenkranz et al. 2010; Nazzi and Le Conte 2016). Without conventional routine treatments an infested hive will not accumulate adequate amount of honey (Currie and Gatien 2006) and will not effectively pollinate crops. Eventually, the colony will collapse within one-two years without proper treatment (Francis et al. 2013).

The significance of honey bees to both agricultural crop-pollination and nature biodiversity has been widely reviewed. Bees and honey bees in particular, constitute the main pollinating insect worldwide (Kevan & Viana 2003). Out of 115 leading global food commodities, 52 depend on honey bee pollination for fruit or seed set (Klein et al. 2007). Honey bee pollination is beneficial directly or indirectly for 35% of human diet, and its value is estimated at 212 billion US$ (Gallai et al. 2009). In addition to their crucial role as agricultural pollinators, honey bees also are important to biodiversity conservation as they are positively correlated to plant diversity and pollinator diversity (Paudel et al. 2015). These data are of serious weight in the light of the recent decline of honey bees and other pollinating–insects' populations. Worldwide evidences show losses of honey bee colonies in the US (~30%), Europe (1.8-53%), Middle East (10-85%), and Japan (25%) (Carreck and Neumann 2010). It is important to clarify that these losses are not unusual and have been reported a few times in the last century (vanEngelsdorp and Meixner 2010), and that the overall number of honey bee hives have increased by ~45% since 1961; However, the agricultural crops area depending on honey bee pollination is increasing in higher numbers (>300%), leaving an overgrowing gap (Aizen and Harder 2009). *Varroa* mite and its associated viruses is the most dominant factor correlated with these losses (Carreck and Neumann 2010; Le Conte et al. 2010; Dennis and Kemp 2016).

The mite is harming honey bees in many ways both directly and indirectly. It feeds upon the hemolymph ("blood") of the bee, leading to a reduced weight and life span of the emerging adult bee (Bowen-Walker and Gunn 2001). In addition, it was reported to cause neurological damage, reduction in flight ability and non-associative learning (Kralj and Fuchs 2006; Kralj et al. 2007). Moreover, the mite's parasitism weakens the honey bee immune system, increasing its sensitivity to pathogens (Nazzi et al. 2012; Di Prisco et al. 2016). However, the main damage that leads eventually to the collapse of the hive is probably via the viruses that it vectors (Yang and Cox-Foster 2005; De Miranda et al. 2011).

Varroa control is based on chemical pesticides including Pyrethroids and Organic Phosphorus compounds. Not only these chemicals are harming the bees, but also their residues

accumulate in the bees' products, such as bee wax, honey and pollen, which are intensively used for human consumption, medicine and cosmetics (Bogdanov et al. 1999; Tsigouri and Menkissoglu–Spiroudi 2003; Çobanoğlu et al. 2008). Finally, there are worldwide growing evidences for mite's resistance towards these chemicals (Milani 1999; Elzen et al. 2000; Thompson et al. 2003; Strachecka et al. 2015).

It is now understood that, like in other fields of agriculture, also in apiculture in-hive pesticides are not the answer to sustainable honey bee health maintenance. Therefore, an integrated approach to *Varroa* control has been advocated. In spite of a world wide effort to solve *Varroa* problem, efficient remedies are yet to be found. Thus, the objective of our study was to identify new potential *Varroa* control agents, in particular those disrupting bee recognition by the *Varroa* mite.

The *Varroa* life cycle is well synchronized with that of the honey bee and can be generally divided into two main phases: a phoretic phase, in which the *Varroa* parasitizes an adult bee, and a reproductive phase, in which it reproduces within the sealed brood cell (Martin 2001). The invasion into the brood cell is mediated by a nurse bee which carries the mite to the cell entrance (Boot et al. 1995). Nurse bees are the younger bees in the hive which nursing the bee larva inside the hive; while forager bees are older bees which forage outside the hive for nectar and pollen in flowers. As the synchronization between the *Varroa* and the bee life cycles appears to be the key for *Varroa* success (Kraus 1994; Pernal et al. 2005), a specific disruption of the *Varroa* host finding behavior seems as a reasonable approach for its management, without harming the bees. *Varroa* do not have eyes or antennae and their host detection mainly depends on the sense of smell (Rickli 1992; Del Piccolo et al. 2010). The major olfactory organ of the *Varroa* sensing the bee volatiles is concentrated in a pit organ located on each of its forelegs (Eliash et al. 2014).

Materials and Methods

Over twenty chemicals, most of which were originally developed for disruption of sexual communication in Lepidoptera [4] (Akhtar et al. 2007), were tested and evaluated by electrophysiological (EAG) and behavioral bioassays for *Varroa* mite, and toxicity bioassay for honey bees. EAG assay was developed on the isolated foreleg of female *Varroa* mite (figure 1). This unique organ contains sensory organ that consists of nine internal sensilla and nine long hair surrounding sensilla. Some of the sensilla (at least six) are wall-pored sensilla that bear similarity

[4] Order of insects (including, for example, moths and butterflies).

to the olfactory sensilla of other arthropods (figure 1). The foreleg was stimulated by puffs of honeybee odor, or a clean air (control) as shown in Figure 2A and C. The tested chemicals were blown with or without bee odor in the order seen in figure 2B. The response amplitude was recorded for each stimulus (Singh et al. 2014; Eliash et al. 2014).

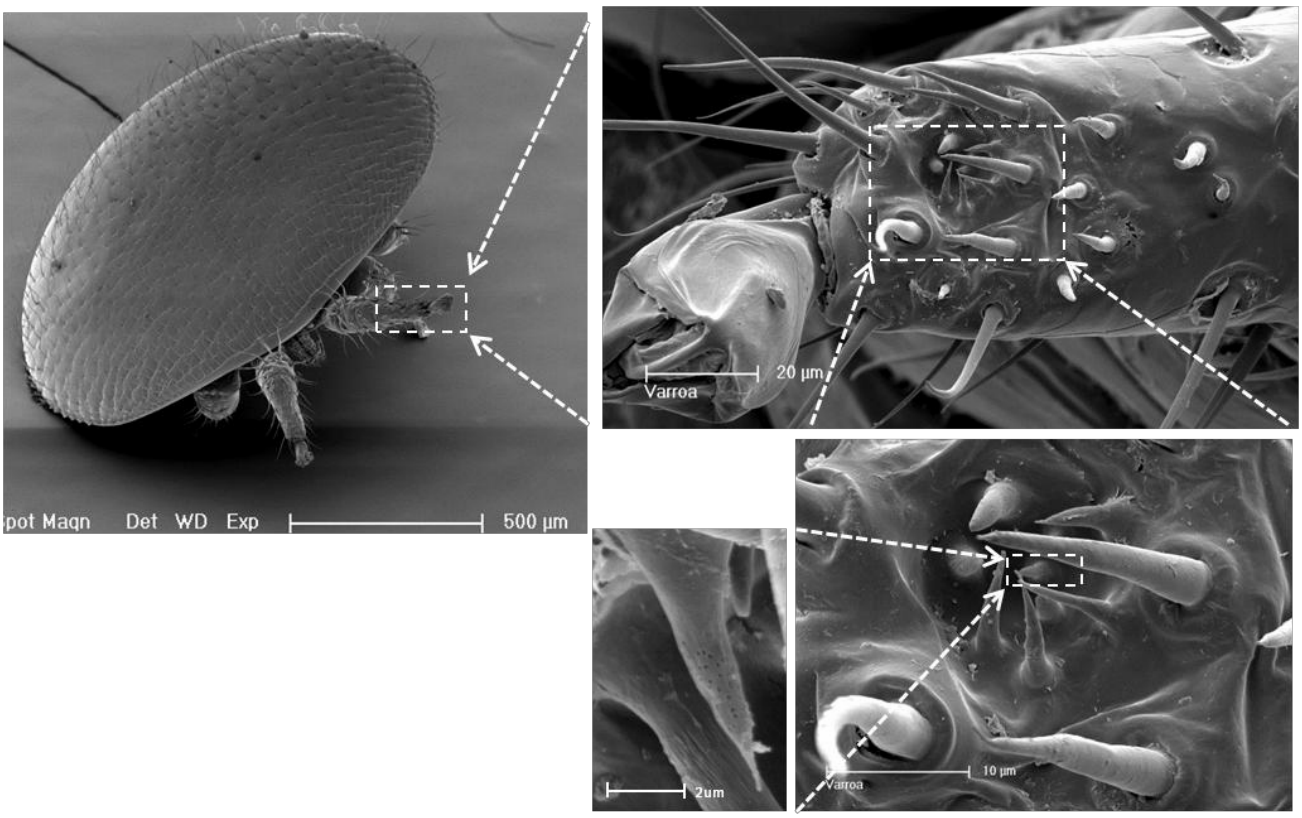

Figure 1. Scanning Electron Microscope (SEM) analysis. The picture shows the *Varroa* olfactory organ on its foreleg, and its wall-pore chemosensilla (source: Eliash 2012).

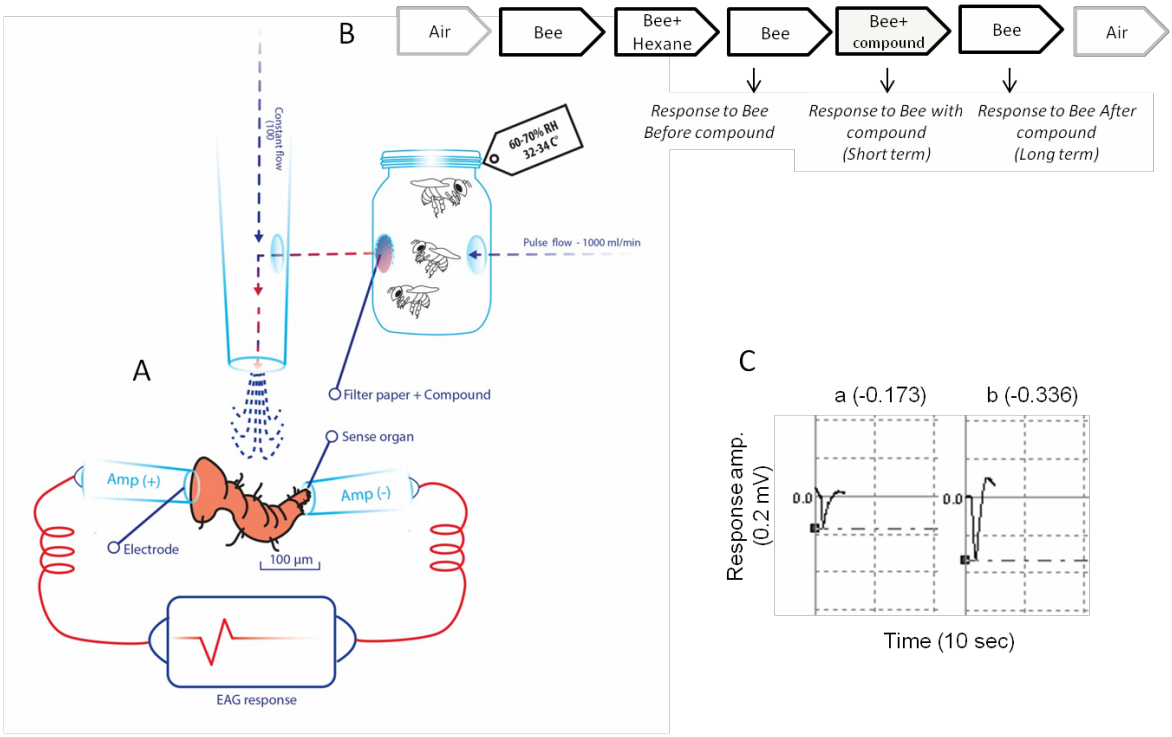

Figure 2. Electrophysiology with the *Varroa* foreleg. A.
EAG setup of an isolated Varroa foreleg that was stimulated with the headspace volatiles of bees in a jar. B. Order of the Varroa foreleg stimulations and terminology used for the corresponding responses. The stimuli were: Air, Headspace of five nurse bees (Bee stimulus), Bee stimulus together with the compound (Bee stimulus + comp) or of the hexane control (Bee stimulus + hexane). C. Typical traces of Varroa foreleg responses to air (left) and honey bee volatiles (right).

The effect of compounds on the behavior of female *Varroa* was tested by a choice assay in a glass arena (Figure 4A; Eliash et al. 2014). Briefly, the mite was given a choice of two bees (a forager and a nurse), in the presence of the tested compound or solvent (Hexane) as control. The *Varroa* host preference was assessed after 3 hours. A possible toxicity of the compounds to honey bees was tested as well. The mortality of adult honey bees was assessed in the presence of the disruptive compound or solvent (Hexane) as control.

Twenty adult bees were kept in a small plastic cage with ventilation openings in controlled environment (28-30C˚, 50-70% RH), supplied with water and sugar candy (Medrzycki et al. 2013; Williams et al. 2013). The number of dead bees was counted each day for 3 days.

Results and Discussion

In this study we were able to show for the first time that the *Varroa* is sensing honey bee odor via its sensory organ located on its foreleg. In addition, the tested compounds inhibit the *Varroa* response to honey bee headspace and alter its host finding behavior. The effect apparently starts at the level of the sensory organ. Two effects were detected by the EAG assay: 1) Short-term inhibition: decrease in responses to honey bee headspace volatiles when the compound was given simultaneously, and 2) Long-term inhibition: decreased in response to the following stimulation by honey bee headspace volatiles. Figure 3 shows the responses acquired with two compounds: Cyclopent-2-en-1-alkoxy diether, **cy**{4*,1*} and a Dialkoxybenzene, **3b**{*2,2*}. Both compounds showed a long term significant effect (Anova repeated measures followed by Tukey-Kramer post hoc tests, $p<0.05$, Fig 3).

Following the EAG assay, a choice bioassay was performed to determine the effect of the compounds on the *Varroa* host selection. The results clearly show that most of the mites prefer a nurse over a forager bee in the control treatment (in the presence of hexane) (Goodness of fit, $p<0.05$, Fig 3). However, in the presence of **cy**{4*,1*} and **3b**{*2,2*} the mites preference reversed, and the mites significantly preferred a forager to a nurse bee (Goodness of fit, $p<0.05$), while the total number of mites reaching a bee remained unchanged (Eliash et al. 2014).

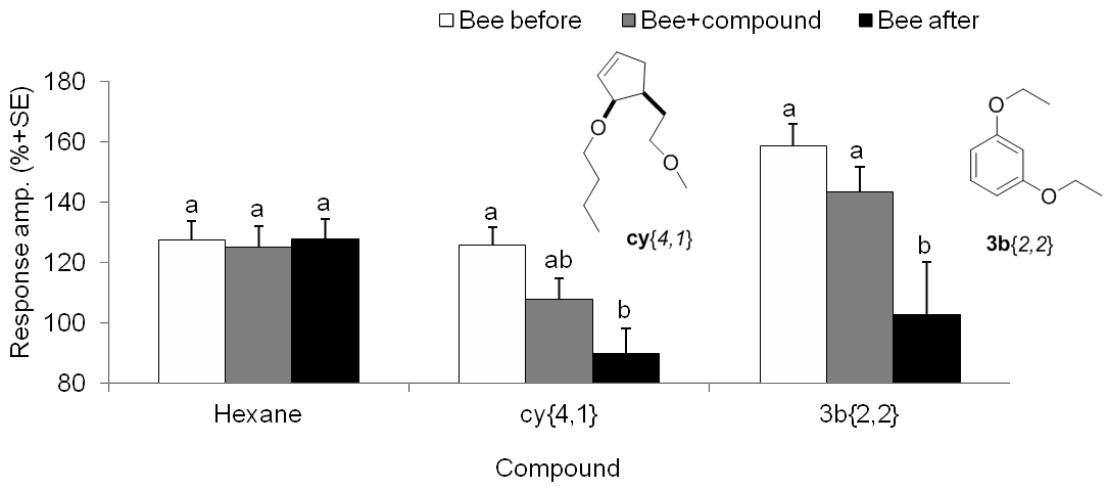

Figure 3. Electrophysiological screening of the compounds. A.
Order of the *Varroa* foreleg stimulations and terminology used for the corresponding responses. The stimuli were: Air, Headspace of five nurse bees (Bee stimulus), Bee stimulus together with the compound (Bee stimulus + comp) or of the hexane control (Bee stimulus + hexane). **B.** The effect of **cy**{4,*1*} and **3b**{*2,2*} on the *Varroa* foreleg EAG response to bee headspace. (Normalized values against the response to air %, average + SE) (n = 10). Anova repeated measures followed by Tukey-Kramer post hoc tests. Bars marked by different letters are significantly different, $p < 0.05$, (n = 7-9).

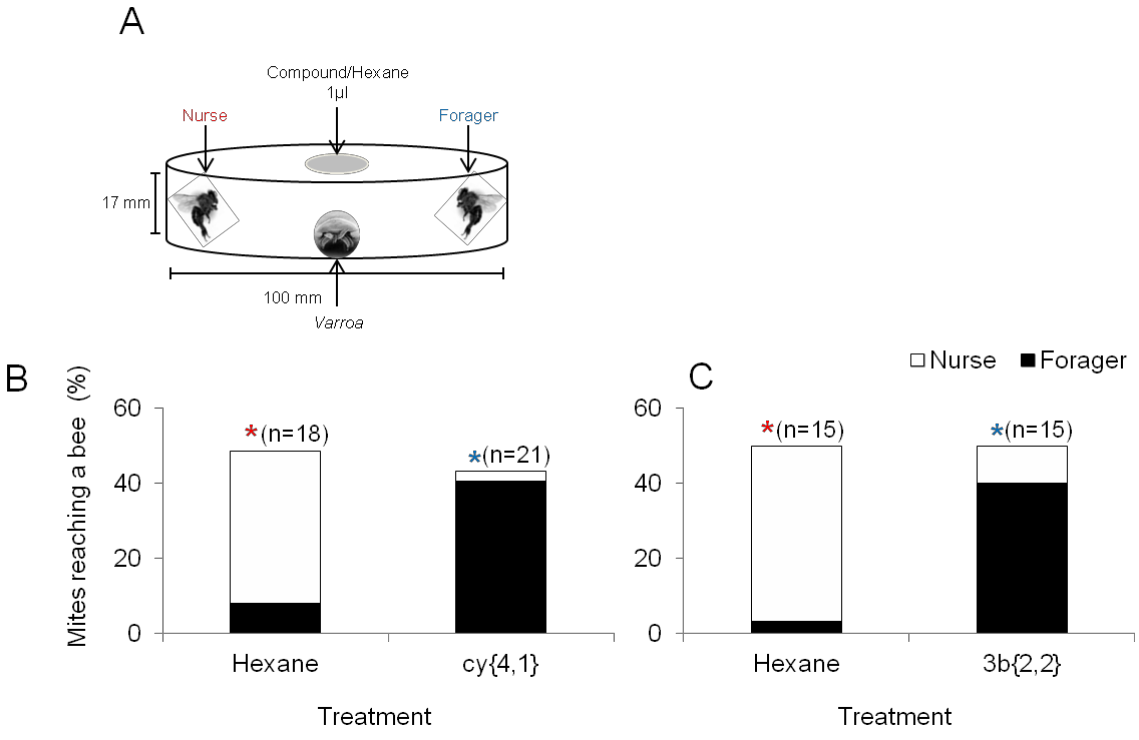

Figure 4. The effect of cy{4,*1*} and **3b**{*2,2*} **on *Varroa* host choice between a nurse and a forager bee.**
A. Experimental setup: One mite was placed between a nurse and forager bees. **B.** Effect of **cy**{*4,1*} and **3b**{*2,2*}: Data are the percentage of viable *Varroa* 180 min from the beginning of the experiment in the presence of hexane (control) or 10ug of the tested compound. Numbers above the bars show

the number of *Varroa* choosing a host. Red *- significant preference for a nurse bee; Blue * - significant preference for a forager bee; Goodness of fit, $p<0.05$.

The EAG and behavioral active compounds were further investigated for a possible effect on bee mortality. No significant bee mortality was found over the course of the experiment for both compound **cy**{4,*1*} (Anova repeated measures, F(1,1) = 0.63, p>0.05) and **3b**{*2,2*} (F(1,1) = 0.64, p>0.05), in comparison to control (Hexane) (Fig 5).

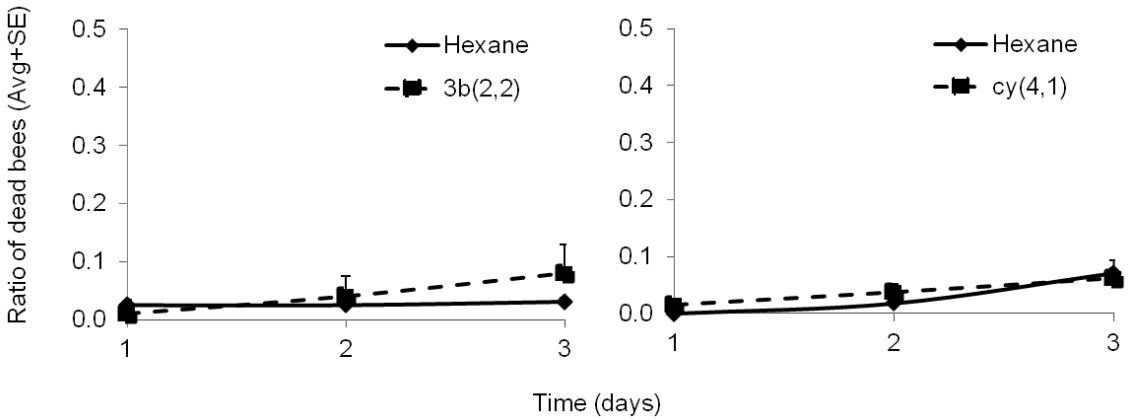

Figure 5. Honey bee mortality in the presence of the disruptive compounds or Hexane (control). The number of dead bees was counted each day for 3 days. Anova repeated measures, p>0.05.

The mode of action of these compounds on the *Varroa* is still unknown, but currently under study in our laboratory. Moreover, not much information exists on the structure and function of olfactory machinery in mites. Theoretically, the EAG inhibiting compounds can interfere with any of the events prior to the activation of a sensory neuron. The first stage at which the compound may interfere is the interaction between the Odorant binding protein and the natural odorant. Such interference has been proposed for similar compounds that slow the EAG recovery rate in gypsy moths (Gong and Plettner 2011). The next stage would be the interaction of the odorant with its respective receptor, along with ion channel opening or closing. The last stage would be the recovery of the system by the action of arrestin (Merrill et al. 2002) and ion pumps (Zimmermann 1992); reviewed by Plettner and Gries (2010).

In summary, the present study provides evidence for disruption of *Varroa* host selection by

inhibiting its host sensing. The synthetic compounds were found to have a specific disruptive effect on *Varroa* mite while no effect on bees' survival, thus making it relatively safe to use in hive. The interference in mite's natural nurse preference could prolong the phoretic phase of the mite, making it more exposed to bees' hygienic behaviour and other "soft chemicals". Therefore, these findings are breakthrough for both basic sciences on mites chemosensing and sustainable apiculture. As the compounds are supposed to be implemented in the hive, a further study of their possible effect on honey bee chemical communication must be evaluated in the future. This study offers an innovative path to confront the mite by breaking the synchronization between the *Varroa* and the bee while not harming the bees. This approach is a promising step towards an integrated and sustainable control over this major apicultural pest.

References

Aizen M.A., Harder L.D. (2009) The Global Stock of Domesticated Honey Bees Is Growing Slower Than Agricultural Demand for Pollination. Curr Biol 19:915–918. doi: 10.1016/j.cub.2009.03.071

Akhtar, Y. Isman M.B., Paduraru P.M., et al (2007) Screening of dialkoxybenzenes and disubstituted cyclopentene derivatives against the cabbage looper, Trichoplusia ni, for the discovery of new feeding and oviposition deterrents. J Agric Food Chem 55:10323–30. doi: 10.1021/jf071636d

Bogdanov S., Kilchenmann V., Imdorf A. (1999) Acaricide residues in honey , beeswax and propolis. 1–11.

Boot W., Schoenmaker J, Calis J, Beetsma J (1995) Invasion of *Varroa jacobsoni* into drone brood cells of the honey bee, *Apis mellifera*. Apidologie 26:109–118.

Bowen-Walker P.L., Gunn A. (2001) The effect of the ectoparasitic mite, Varroa destructor on adult worker honeybee (Apis mellifera) emergence weights, water, protein, carbohydrate, and lipid levels. Entomol Exp Appl 101:207– 217.

Carreck N., Neumann P. (2010) Honey bee colony losses. J Apic Res 49:1. doi: 10.3896/IBRA.1.49.1.01

Çobanoğlu S., Amitraz B., Ka V., et al (2008) Determination of Amitraz (Varroaset) Residue in Honey by High Performance Liquid Chromatography (HPLC)*. 14:169–174.

Currie RW, Gatien P (2006) Timing acaricide treatments to prevent Varroa destructor (Acari: Varroidae) from causing economic damage to honey bee colonies. Can Entomol 138:238–252. doi: 10.4039/n05-024

De Miranda J., Chen Y., Ribiere M., Gauthier L. (2011) Varroa and viruses. In: Carreck N (ed) Varroa, Still a problem in the 21st century? The International Bee Research Association, pp 11–32.

Del Piccolo F., Nazzi F., Della Vedova G., Milani N. (2010) Selection of *Apis mellifera* workers by the parasitic mite *Varroa destructor* using host cuticular hydrocarbons. Parasitology 137:967–73. doi: 10.1017/S0031182009991867

Dennis B., Kemp W.P. (2016) How Hives Collapse: Allee Effects, Ecological Resilience, and the Honey Bee. PLoS One 11:e0150055. doi: 10.1371/journal.pone.0150055

Di Prisco G., Annoscia D., Margiotta M., et al (2016) A mutualistic symbiosis between a parasitic mite and a pathogenic virus undermines honey bee immunity and health. Proc Natl Acad Sci U S A 1523515113–. doi: 10.1073/pnas.1523515113

Eliash, N. (2012). Learning and disrupting the chemical communication of *Varroa destructor* Anderson and Trueman. Robert H. Smith Faculty of Agriculture, Food and Environment of the Hebrew University of Jerusalem, Israel.

Eliash N., Singh N.K., Kamer Y., et al (2014) Can we disrupt the sensing of honey bees by the bee parasite Varroa destructor? PLoS One 9:e106889. doi: 10.1371/journal.pone.0106889

Elzen P.J., Baxter J.R., Spivak M., Wilson W.I. (2000) Control of Varroa jacobsoni Oud. resistant to fluvalinate and amitraz using coumaphos. Apidologie 31:437–441. doi: 10.1051/apido:2000134

Francis R.M., Nielsen S.L., Kryger P. (2013) Varroa-virus interaction in collapsing honey bee colonies. PLoS One 8:e57540. doi: 10.1371/journal.pone.0057540

Gallai N., Salles J.M., Settele J., Vaissière B.E. (2009) Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. Ecol Econ 68:810–821. doi: 10.1016/j.ecolecon.2008.06.014

Gong Y., Plettner E. (2011) Effects of Aromatic Compounds on Antennal Responses and on the Pheromone-Binding Proteins of the Gypsy Moth (*Lymantria dispar*). Chem Senses 36:291–300. doi: 10.1093/chemse/bjq130

Kevan P.G., Viana B.F. (2003) The global decline of pollination services. Biodiversity 4:3–8. doi: 10.1080/14888386.2003.9712703

Klein A.-M., Vaissière B.E., Cane J.H., et al (2007) Importance of pollinators in changing landscapes for world crops. Proc Biol Sci 274:303–13. doi: 10.1098/rspb.2006.3721

Kralj J., Brockmann A., Fuchs S., Tautz J. (2007) The parasitic mite *Varroa destructor* affects non-associative learning in honey bee foragers, *Apis mellifera* L. J Comp Physiol A Neuroethol Sens Neural Behav Physiol 193:363–70. doi: 10.1007/s00359-006-0192-8

Kralj J., Fuchs S. (2006) Parasitic *Varroa destructor* mites influence flight duration and homing ability of infested *Apis mellifera* foragers. Apidologie 37:577–587. doi: 10.1051/apido

Kraus B. (1994) Factors influencing host choice of the honey bee parasite *Varroa jacobsoni* Oud. Exp Appl Acarol 18:435–443.

Le Conte Y., Ellis M., Ritter W. (2010) Varroa mites and honey bee health: can Varroa explain part of the colony losses? Apidologie 41:353–363. doi: 10.1051/apido/2010017

Martin S.J. (2001) Biology and life history of Varroa mites. In: Webster TC, Delaplane KS (eds) Mites of the Honey Bee. Dadant, Sons, Hamilton, pp 131–148.

Medrzycki P., Giffard H., Aupinel P., et al (2013) Standard methods for toxicology research in Apis mellifera. J Apic Res 52:1–60. doi: 10.3896/IBRA.1.52.4.14

Merrill C.E., Riesgo-Escovar J., Pitts R.J., et al (2002) Visual arrestins in olfactory pathways of Drosophila and the malaria vector mosquito Anopheles gambiae. Proc Natl Acad Sci U S A 99:1633–1638. doi: 10.1073/pnas.022505499

Milani N. (1999) The resistance of Varroa jacobsoni Oud . to acaricides. Apidologie. doi: 10.1051/apido:19990211

Nazzi F., Brown S.P., Annoscia D., et al (2012) Synergistic Parasite-Pathogen Interactions Mediated by Host Immunity Can Drive the Collapse of Honeybee Colonies. PLoS Pathog 8:e1002735. doi: 10.1371/journal.ppat.1002735

Nazzi F., Le Conte Y. (2016) Ecology of *Varroa destructor* , the Major Ectoparasite of the Western Honey Bee, *Apis mellifera*. Annu Rev Entomol 61:annurev–ento–010715–023731. doi: 10.1146/annurev-ento-010715023731

Paudel Y.P., Mackereth R., Hanley R., Qin W. (2015) Honey Bees (Apis mellifera L.) and Pollination Issues: Current status, impacts and potential drivers of decline. J Agric Sci 7:93–109. doi: 10.5539/jas.v7n6p93

Pernal S.F., Baird D.S., Birmingham a L., et al (2005) Semiochemicals influencing the host-finding behaviour of *Varroa destructor*. Exp Appl Acarol 37:1–26. doi: 10.1007/s10493-005-1117-x

Plettner E., Gries R. (2010) Agonists and antagonists of antennal responses of gypsy moth (*Lymantria dispar*) to the pheromone (+)-disparlure and other odorants. J Agric Food Chem 58:3708–19. doi: 10.1021/jf904139e

Rickli M. (1992) palmitic acid released from honeybee worker larvae attracts the parasitic mite *Varroa jacobsoni* on servosphere. naturwissenschaften 79:320–322.

Rosenkranz P., Aumeier P. ia, Ziegelmann B. (2010) Biology and control of *Varroa destructor*. J Invertebr Pathol 103:96– 119.

Singh N.K., Eliash N., Kamer Y., et al (2014) The effect of DEET on chemosensing of the honey bee and its parasite Varroa destructor. Apidologie 46:380–391. doi: 10.1007/s13592-014-0330-1

Strachecka A., Borsuk G., Olszewski K., Paleolog J. (2015) A new detection method for a newly revealed mechanism of pyrethroid resistance development in Varroa destructor. Parasitol Res 114:3999–4004. doi: 10.1007/s00436-015- 4627-4

Thompson H., Ball R., Brown M., Medwin B.E.W. (2003) Varroa destructor resistance to pyrethroid treatments in the United Kingdom. Bull Insectology 56:175–181.

Tsigouri A., Menkissoglu–Spiroudi U. (2003) Fluvalinate residues in Greek honey and beeswax. Apiacta 38:50–53.

vanEngelsdorp D., Meixner M.D. (2010) A historical review of managed honey bee populations in Europe and the United States and the factors that may affect them. J Invertebr Pathol 103:S80–S95. doi: 10.1016/j.jip.2009.06.011

Williams G.R., Alaux C., Costa C., et al (2013) Standard methods for maintaining adult Apis mellifera in cages under in vitro laboratory conditions. J Apic Res 52:1–36. doi: 10.3896/IBRA.1.52.1.04

Yang X., Cox-Foster D. (2005) Impact of an ectoparasite on the immunity and pathology of an invertebrate: evidence for host immunosuppression and viral amplification. PNAS 102:7470–7475.

Zimmermann B. (1992) Antennal thermo- and hygrosensitive sensilla in Antheraea pernyi (Lepidoptera, Saturniidae): ultrastructure and immunohistochemical localization of Na+,K+-ATPase. Cell Tissue Res 270:365–376. doi: 10.1007/BF00328020

How to apply "tipping points of a forest ecosystem under severe drought" to ecological sustainability

Donghai Wu[1]

Introduction

The world's forests play a substantial factor in balancing global carbon budget as well as influencing fluxes within other related carbon reservoirs. However, the world's forests are being disappeared at a relatively rapid rate, as consequences of direct deforestation and climate-driven forest degradation (Bonan, 2008). Climate-driven forests decline is widely expected to increase in a warming world (Allen *et al.*, 2010, Zhao & Running, 2010). Physically, this is because hot air can hold more water vapour, increasing atmospheric evaporative demand and duration between consecutive precipitation events. This is likely to lead to increasing severity of floods and droughts. Ecologically, trees suffer heat stresses and potential water deprivation by heat-driven drought as temperature approaches and surpasses certain levels, resulting in drought-induced mortalities. Widespread tree mortality induced by recent heat waves and droughts has been, to this end, well documented with both modelling and observations (Allen *et al.*, 2010, Van Mantgem *et al.*, 2009, Williams *et al.*, 2013, Yi *et al.*, 2010).

Report from Williams et al. (2013) modelling and FLUXNET data (a global network of micrometeorological flux measurement sites for carbon dioxide, water vapour and energy exchanges between biosphere and atmosphere) (Baldocchi *et al.*, 2001) re-analysis is that the rate of transfer of atmospheric CO_2 to soil is expected to decrease, thus resulting in further warming of the atmosphere and drying of forests. Drought-induced tree mortality has been shown to greatly reduce terrestrial carbon uptake (Zhao & Running, 2010). However, the relationship between tree mortality and drought is reported to be more complex than that between grassland production and drought (Yi *et al.*, 2012). This is thought to be mainly due to the greater ability of trees to access water sources at greater depths, leading to lower sensitivity to moisture levels in shallow soil

[1] PhD candidate, College of Urban and Environmental Sciences, Peking University; donghai.wu@pku.edu.cn

horizons. Therefore, quantitative determination of what level of available moisture is sufficient to induce drought-related tree mortality is challenging and critical to understanding the potential positive feedback to greater global warming.

Research methods and results

In this research (Kaicheng *et al.*, 2015), we have evaluated the potential relationships between the level of tree growth and concurrent drought conditions, using the tree growth-related Ring Width Index (RWI) and the meteorological drought-related Standardized Precipitation Evapotranspiration Index (SPEI) (Vicente-Serrano *et al.*, 2013) in the two dominant conifer species (*Pinus edulis* and *Pinus ponderosa*) in South Western United States (SWUS). In this effort, we determined the binned averages of RWI and 11-month SPEI within the month of July within each bin of 30 of RWI in the range of 0-3000. We found a significant correlation between the binned averages of RWI and SPEI at the regional-scale under dryer conditions. The tipping point of forests decline to drought is predicted by the regression model as $SPEI_{tp}$ = -1.64 and RWI_{tp} = 0, that is, persistence of the water deficit (11 month) with intensity of -1.64 leading to negligible growth for the conifer species.

When climate conditions are wetter ($SPEI_{up}$ > 0.35), the correlation between the binned averages of RWI and SPEI is weaker, which we believe is most likely due to soil water and atmospheric moisture levels no longer being the dominant factor limiting tree growth. We also illustrate a potential application of the derived tipping point ($SPEI_{tp}$ = -1.64) through an examination of the 2002 extreme drought event in the SWUS conifer forest regions, where the remote-sensing based NDVI shows significant different anomalies partitioned by the derived tipping point.

In addition, types of forests reported different tipping-points (Kaicheng *et al.*, 2015), albeit the trees might live in the same hydrothermal environment, which mainly accounted for their discrepant resistances to climate forcing (temperature, soil moisture and drought). Thus, the tipping-point values deduced from the empirical relationship between tree-ring and drought index (SPEI) can be used for forest scientific management and risk assessment.

Conclusion and future work

Following are some viewpoints of how to apply tipping points of forest ecosystem under severe droughts to ecological sustainability: (1) Monitoring forest healthy situation based on the present published drought index (SPEI). Forest healthy index will be built based on the tipping points, and latest SPEI products will be applied to generate the given forest healthy report, which may give some suggestions for forest protection under recent climate. (2) Predicting forest healthy situation based on the climate model outputs. As already known, state-of-the-art Coupled Model Intercomparison Project Phase 5 (CMIP5) Earth System Models (ESMS) produced free state-of-the-art multi-model datasets from the beginning of the industrial revolution to the near present (1850-2005), for the past scenery of the world, and; four representative concentration pathways (RCPs) simulations from 2005 to the end of the 21st century (2100) for the future sceneries of the world (Taylor *et al.*, 2012). Therefore, we can assess forest healthy situation based on the developed forest healthy index using future drought index across different RCPs. The anticipated results may represent the forest living conditions in the next decades, and also be applied to scientific management and risk assessment when approaching policy makers.

References

Allen, C.D., Macalady, A.K., Chenchouni, H. et al. (2010). A global overview of drought and heat-induced tree mortality reveals emerging climate change risks for forests. Forest Ecology and Management, 259, 660-684.

Baldocchi, D., Falge, E., Gu, L., Olson, R. (2001). FLUXNET: A new tool to study the temporal and spatial variability of ecosystem-scale carbon dioxide, water vapor, and energy flux densities. Bulletin of the American Meteorological Society, 82, 2415.

Bonan, G.B. (2008). Forests and Climate Change: Forcings, Feedbacks, and the Climate Benefits of Forests. Science, 320, 1444-1449.

Kaicheng. H., Chuixiang, Y., Donghai, W. et al. (2015). Tipping point of a conifer forest ecosystem under severe drought. Environmental Research Letters, 10, 024011.

Taylor, K.E., Stouffer, R.J., Meehl, G.A. (2012). An Overview of CMIP5 and the Experiment Design. Bulletin of the American Meteorological Society, 93, 485-498.

Van Mantgem, P.J., Stephenson, N.L., Byrne, J.C. et al. (2009). Widespread increase of tree mortality rates in the western United States. Science, 323, 521-524.

Vicente-Serrano, S.M., Gouveia, C., Camarero, J.J. et al. (2013). Response of vegetation to drought time-scales across global land biomes. Proceedings of the National Academy of Sciences, 110, 52-57.

Williams, A.P., Allen, C.D., Macalady, A.K. et al. (2013). Temperature as a potent driver of regional forest drought stress and tree mortality. Nature Climate Change, 3, 292-297.

Yi, **C**., Ricciuto, D., Li, R. et al. (2010). Climate control of terrestrial carbon exchange across biomes and continents. Environmental Research Letters, 5, 034007.

Yi C., Rustic, G., Xu, X. et al. (2012). Climate extremes and grassland potential productivity. Environmental Research Letters, 7, 035703.

Zhao M., Running, S.W. (2010). Drought-induced reduction in global terrestrial net primary production from 2000 through 2009. Science, 329, 940-943.

What we have learned from campus teaching and learning gardens: The UBC Orchard Garden and Cultivating Learning Network

Susan Gerofsky[1]

On many university campuses, including the University of British Columbia (UBC) and the Freie Universität, Berlin (FUB), students, faculty and staff have taken up the work of creating, maintaining and programming organic gardens in the context of university teaching, learning and research. This work has arisen as part of an international grassroots movement to create community gardens, urban agriculture projects, guerrilla gardening, artists' gardens and other projects that work on a small, local scale towards much larger global goals. These goals may include:

- cultural, economic and environmental sustainability
- awareness and activism in the face of global climate change
- energy conservation and energy alternatives
- local self-sufficiency and food security
- the promotion of physical and mental health
- community building
- intergenerational and intercultural knowledge building
- valuing Indigenous knowledges and
- a deeper relationship with the more-than-human world.

Accounts of such projects and their implications can be found, for just a few examples, in Gaylie 2009, 2011; Williams and Brown 2011; Waters 2008; Carpenter and Rosenthal 2011; De Zeeuw and Drechsel 2015; Scheub et al. 2016; Kallis 2014.

This grassroots movement to create small-scale local gardens with global issues in mind can be seen as part of the alterglobal movement (Kahn 2010; Pleyers & Touraine 2011), a movement which approaches contemporary globalization with a sense of the potency of personal and local agency, community and coalition-building among diverse social groups, with the aim of creating greater environmental justice and sustainability. The alterglobal movement opposes extremes of

[1] Dr. Susan Gerofsky, Department of Curriculum and Pedagogy, University of British Columbia; susan.gerofsky@ubc.ca

neo-liberal economics and politics in our globalized world in favour of a more democratic, participatory, ecological global system. It is not 'anti-global', but rather adopts the slogan, "Another world is possible", with the aim of a more balanced co-existence among human and greater-than-human ecologies.

Campus teaching and learning gardens have sprung up at many universities over the past ten to fifteen years partly in response to such world-wide movements, but also as part of specific efforts to bring greater sustainability and ecological balance to our institutions of higher learning and research. Often these gardens have been jointly founded by students and faculty members (for example, at UBC Vancouver and Okanagan, the Freie Universität Berlin, the Ecole Normale Supérieur (ENS) in Lyon, Portland State University, the University of Toronto, McGill University, the University of California at Berkeley, and many others), and the collaboration between students and professors has been an important part of an egalitarian, alterglobal ethos guiding these projects. Organic food production is a central activity of many of these campus gardens, but they may also include a variety of other foci, including work with fibre arts, medicinal plants, scent gardens, food forests, Indigenous gardens, building garden structures with natural local materials, establishing sustainable local economic structures like farmers' markets and Community Shared Agriculture (CSA) programs, and much more.

In particular, university campus gardens have focused on issues central to the life of our institutions, including research, teaching and community service. Campus gardens can be seen as distinct from other community and school gardens and urban agriculture projects in that they are embedded in the life and values of the universities, and make use of the special intellectual and practical resources available at universities.

In this paper, I will outline some of the important lessons learned during my first ten years as one of the academic advisors at the UBC Orchard Garden project and Cultivating Learning Network, taking these as particular exemplars of university grassroots teaching and learning gardens worldwide. My hope is that those of us engaged in this hope-full work will be able to learn from one another's experiences, and help establish more sustainable practices as a regenerative element of the life of our universities.

An introduction to the UBC Orchard Garden and Cultivating Learning Network

Three teaching and learning gardens, initiated and led by students and teachers at UBC have joined together to create a new entity called the Cultivating Learning Network: (1) The Intergenerational Landed Learning project at the UBC Farm (henceforth 'Landed Learning'), (2) the UBC Orchard Garden, and (3) Roots on the Roof. Here is an introduction to the three projects, and to the Cultivating Learning Network as a whole.

Landed Learning was established as a project of the UBC Faculty of Education in 2001, when the UBC Farm was founded by students and faculty. Based at the Farm's Children's Garden, it is a program that brings together inner-city elementary school students with Farm Friends (community elders and university students) in an intensive year-long urban farming and science learning program (see Mayer-Smith, Peterat & Bartosh 2006, 2009 for more details). Each year, five elementary schools participate in a program of eleven visits to the UBC Farm, where students work with Farm Friends to grow, harvest, cook and compost their choice of vegetables, and learn about the science of plants, pollinators and organic agriculture in a non-formal outdoor classroom.

The UBC Orchard Garden was established in 2005 and expanded in 2010 as a cross-faculty project by the UBC Faculties of Education (FoE) and Land and Food Systems (LFS), with participation from the School of Architecture and Landscape Architecture (SALA) and the Faculty of Forestry. Based in central campus, a short walk away from indoor classrooms in the participating faculties, it is an experimental space where students learn hands-on about organic food production and marketing, and about teaching across the curriculum in a school garden with the garden as co-teacher[2]. Over 500 students each year are involved in classes, workshops, practica, research projects and seasonal celebrations at The Orchard Garden[3].

Roots on the Roof is a student-run roof garden on the roof of UBC's new Student Union NEST

[2] The concept of 'garden-as-co-teacher' has been developed in the research areas of environmental education and garden-based learning (GBL) in the US, Canada, Sweden, Australia and the UK. See, for example, Ostertag (2015 pp.171-177); Berhan 2008; and the work of researchers like Dilafruz Williams, David Greenwood, Dawn Sanders and Amy Cutter-Mackenzie.

[3] See <theorchardgarden.blogspot.ca>, and short films about garden alumni like https://vimeo.com/78563019

Building on central campus, completed in 2015. As an offshoot project of the Orchard Garden, and a club of the student society, it engages students from LFS and the FoE, along with those from other faculties including Arts, Sciences and Engineering, in experimental projects in organic food production and marketing, teaching and learning across disciplines and cultures, and celebrating seasonal events[4].

The Cultivating Learning Network (CLN) brings together these three projects as a unified network of teaching and learning gardens, and connects them with related projects on campus, in the city and region, and internationally. The CLN has recently established an advisory panel of academics from all departments of the FoE who work in areas of sustainability, environmental education, garden-based/ outdoor learning and Indigenous epistemologies. The new CLN website will include an initial data base of hundreds of lesson ideas for teaching and learning across curricular areas with a garden as co-teacher, and will provide a space for communication among garden-based educators.

All three projects are complementary, and collaborate to:

- Design, maintain and learn about organic food production and sales (CSA boxes, sales to student-led cafés)
- Develop garden-based learning programs and peer teaching
- Initiate and carry out special projects (for example, medieval bread baking, the Chinese Market Garden, Arts in the Garden, Lights on the Roof lantern festival)
- Work with faculty and staff to run courses, conferences, summer camps, and collaborations with schools, community health and arts and environmental groups.

One five-year nationally-funded project, Think&Eat Green@Schools, was based at Orchard Garden and in the CLN. Think&Eat Green@Schools used its 1 million CAD research grant to engage 43 schools and over 35 community agencies to build school gardens. The project was instrumental in establishing the ongoing Vancouver Schools Food Network, based at the Vancouver School Board and involving the municipality of Metropolitan Vancouver, local health authorities, and many NGOs working in areas of health, education, urban agriculture and community-building.

[4] See < http://blogs.ubc.ca/rootsontheroof/about/history/> for further information.

The UBC Orchard Garden (photo: Susan Gerofsky).

Landed Garden (photo: Susan Gerofsky).

Roots on the Roof (photo: Susan Gerofsky).

Best practices we have learned from campus teaching and learning gardens in the Cultivating Learning Network

The course of establishing a thriving network of grassroots, student- and faculty-led teaching and learning gardens on our university campus has not always been a smooth process. Universities, like other large institutions in our societies, have been caught up in neo-liberal politics and economic processes, and the drive to profit from lucrative real estate developments on university lands (condominiums, shopping malls and similar developments) has been a powerful force at UBC as at other universities over the past few decades. Where land is viewed as equivalent to money, even the existence of a small garden closely tied to the academic goals of the university may be seen as an obstacle to 'progress' and profit (Ostertag, Gerofsky & Scott in press).

Aside from questions of land tenure for even a small garden, our projects have required constant fundraising efforts through multiple small grant applications to pay for seeds and tools, workshop materials, and to pay honoraria and small salaries to students who put in many hours of unpaid volunteer time in the gardens as well.

In the years that we have negotiated and sometimes struggled to keep our projects healthy and growing, we have learned some 'best practices' that apply to teaching and learning gardens in any institutional context. They can be summarized in the following three statements:

a) Undertake **multi-level collaboration and integration**, which grounds the project, develops rich content, and makes it flexible and robust.

b) **Show respect for living ecosystems as co-teachers** as essential as a way of modelling empathetic relations with the greater-than-human world.

c) **Do the central work of your institution** with the garden, so that the garden is a valued element of university (or other institutional) programs, rather than a decorative (and dispensable) add-on.

In the following sections, I will elaborate on these three focal areas of best practices.

(a) The importance of multi-level collaboration and integration

CLN garden-based learning projects have undertaken integration across:

- University faculties and ranks, including undergraduate and graduate students, faculty and staff
- Disciplines and faculties, including UBC's Faculties of Education, Land & Food Systems, Forestry, Landscape Architecture, Engineering, Medicine, Arts and Sciences
- Ages, including people of every age from elementary school students to retirees and elders
- Cultures, making links with school gardens in Ghana, Afghanistan, Turkey, Mexico, Belize, Bulgaria, Micronesia, Sweden, Australia, the UK, US and across Canada via connections through international students and faculty colleagues.
- Communities, including collaborations with schools and teachers, environmental groups, Indigenous communities, health agencies, eco-artists, chefs, urban agriculturalists, the city government and parks board, youth groups and others.

Additionally, we have worked to integrate:

- Rational cognition, the senses, emotions, spirituality
- Playful and 'serious' modes of learning
- Pleasure and work
- Indigenous and settler ways of knowing
- Arts and sciences
- Propositional and poetic discourses

Taking an egalitarian, inclusive, multidisciplinary, multicultural, intergenerational and community-oriented approach to our work has enriched the projects of the CLN in innumerable ways. Workshops and studies regularly integrate arts-based and science-based approaches – for just a few examples, we have collaborated with visiting mathematical artists in building functional mathematical sculptures for the Orchard Garden (a hyperboloid gate and Platonic solids wind socks). We have worked with an astrophysicist to develop a workshop on embodied ways to track

the course of the sun through the garden year, and photographed this with 6-month exposure pinhole cameras. Students from programs in agriculture, nutrition, history, landscape design, music education and many other disciplines have collaborated to create interdisciplinary workshops for new teachers, and leading visual and performing artists have worked together to find abundance and arts-based learning resources in the gardens – for example, teaching 'weaving invasive species' in collaboration with traditional First Nations weavers.

By finding ways to be open to diverse ages, disciplines, cultures and knowledges, and acknowledging that we can all teach and learn together, the educational mandate of our campus gardens is greatly enriched. Integrating a variety of modalities gives poetry to programs already well established in scientific discourses, embodying the objectives of STEAM initiatives (Science, Technology, Engineering, Arts and Mathematics – that is, STEM with the addition of the arts) and brings a sense of balance and well-being to our work in promoting sustainability and environmental awareness on campus.

(b) The importance of showing respect for living ecosystems as co-teachers

When we first began to talk to campus planners about creating outdoor classrooms for UBC students, there was a disconnect across our different ways of envisioning these spaces. The planners immediately wanted to know how many seats we needed for a concrete amphitheatre, how many electrical outlets, what sort of sound and projection system, screens and whiteboards were needed, and whether we wanted a roof to protect the classroom from the rain. Their vision of an outdoor classroom was a replication of the existing indoor lecture halls of the university – an amphitheatre with raked seating in which a passive audience focuses on an expert lecturer. While this is one possible way of thinking about outdoor teaching and learning spaces, it is not necessarily one that facilitates new and ecological learning experiences at the university. With its human-made hard surfaces, barriers against contact with the living world (soil, plants, insects and other animals, weather, the sky, etc.), focus on a single human expert teacher and overwhelming emphasis on digital technologies, an outdoor lecture theatre or similar classroom is not very different from an

indoor one.

In our teaching and learning gardens, outdoor classrooms are *not* just indoor classrooms moved outside, and the professor or instructor is not the only teacher. In the outdoor classroom of the garden (or forest, park, seaside, river bank or mountain slope), the living world teaches, inspires and speaks. Learners are in contact with the world of the outdoors using all their senses, and people in the roles of teachers and learners are all also observers at all times, learning from the garden itself - and its soil, insects, earthworms, birds, visiting animals, plants - as a teacher.

In acknowledging the garden as co-teacher, we are concerned with developing empathetic relationships with living ecosystems. The quality of empathetic relationships with the living world is of deep importance in the development of sustainable ways of thinking and living, and plays a strong role in the personal histories of many environmental educators. This 'biophilic' approach to life of all kinds has not necessarily formed an important part of STEM education in the past, but is recognized as essential in contemporary approaches to the sciences, climate change and environmental education (Fawcett 2005; Cutter-Mackenzie et al 2014; Greenwood 2013).

The methods developed in Enlightenment/Modernist sciences and technology involved a distancing and separation of human researchers from the rest of the living world, with an increasing emphasis on logic and rationality and a repression of emotion, spirituality and even respect for other, non-human forms of life (Toulmin & Toulmin 1992). This anthropocentric view of the world as a collection of resources to be exploited and controlled by humans has been taken beyond the limits of sustainability, and has resulted in the environmental and climate crises we now face – catastrophic extinctions of species, global warming and other critical situations. Ecological and systems thinking entails biophilia and empathy with all forms of life, integrated with rationality and logic in the pursuit of scientific understandings. In establishing outdoor classrooms where the living world is respected as co-teacher, we begin to develop alternative educational experiences that counter the human-centric approaches of modernity.

(c) The importance of doing the central work of your institution in the campus teaching and learning garden

When I was a secondary school teacher working to establish a school garden for my high school, I learned an important lesson from the Evergreen Foundation, a Canadian NGO that supports schoolyard greening projects. Evergreen reminded participating teachers that school gardens ought to be doing the central work of the school – that is, teaching the school curriculum – if they were to survive. If school gardens were there for other purposes (for example, to be decorative, or solely to provide food for the school cafeteria, or to be a meditative space for students and staff), they would be in danger of being considered marginal and non-essential to the project of the school, and it would be easy to justify paving them over again.

The same principle applies to campus teaching and learning gardens at universities aiming for greater sustainability and environmental awareness. If campus gardens are doing the central work of the university – that is, contributing to teaching and learning of university curriculum, to academic research, and to community service – then they will be recognized as central to the mission of the university. On the other hand, if a campus garden is *not* contributing directly to university-level teaching and learning, research and service, it will be danger of being marginalized and eventually lost. It is not enough for a university teaching and learning garden to be beautiful and decorative, or to produce organic food; it must also be doing the work that is at the heart of the university's mission.

The Cultivating Learning Network gardens have been research sites for over a dozen PhD and Masters theses (see, for example, Ostertag 2015; Adsit-Morris 2015; Urueta Ortiz 2016; Moore 2013), diverse faculty research projects resulting in peer-reviewed publications, international conference symposia, and scores of university classes and practica each year, across several faculties. As we move forward to establish an academic advisory panel, an integrative and interactive website and a more central presence in the UBC faculties that sustain us, we are aiming to make campus teaching and learning gardens an even more central part of our sustainable university focus. Long may our gardens flourish!

References

Adsit-Morris, C. (2015). The nomadic wanderings of a bag lady and her space chums: re-storying environmental education with feral figurations. Unpublished MA thesis, University of British Columbia. Retrievable from https://open.library.ubc.ca/cIRcle/collections/ubctheses/24/items/1.0166649.

Berhan, K. (2008). The garden, a master teacher. Retrievable at <http://www.lifelab.org/2009/03/master-teacher/>

Carpenter, N. & Rosenthal, W. (2011). *The essential urban farmer.* New York: Penguin.

Cutter-Mackenzie, A., Edwards, S., Moore, D., & Boyd, W. (2014). *Young children's play and environmental education in early childhood education*. New York: Springer.

De Zeeuw, H. & Drechsel, P. (Eds.) (2015). *Cities and agriculture: Developing resilient urban food systems.* New York: Routledge.

Fawcett, L. (2005). Bioregional teaching: How to climb, eat, fall, and learn from porcupines. In Muzzin, L. J. & Tripp, P. (Eds.), *Teaching as activism: Equity meets environmentalism*. Montreal: McGill-Queen's Press, pp. 269-280.

Gaylie, V. (2009). *The learning garden: Ecology, teaching, and transformation.* New York: Peter Lang.

Gaylie, V. (2011). *Roots and research in urban school gardens.* New York: Peter Lang.

Greenwood, D. (2013). A critical theory of place-conscious education. In Stevenson, R.B., Brody, M., Dillon, J. and Wals, A.E.J. (Eds.), *International handbook of research on environmental education*. New York: AERA/ Routledge, pp. 93-100.

Kahn, R. (2010). *Critical pedagogy, ecoliteracy, and planetary crisis: The ecopedagogy movement.* New York: Peter Lang.

Kallis, S. (2014). *Common threads: Weaving community through collaborative eco-art.* Gabriola Island, Canada: New Society.

Mayer-Smith, J., Peterat, L., & Bartosh, O. (2006). Growing together to understand sustainability: An intergenerational farming project. In W. Leal Filho (Ed.) *Innovation Education and Communication for Sustainable Development,* (pp 361-378), Frankfurt: Peter Lang.

Mayer-Smith, J., Peterat, L., Bartosh, O. (2009). Cultivating and reflecting on intergenerational environmental education on the farm. *Canadian Journal of Environmental Education*. 14, 107-121.

Moore, D. (2013). A discursive exploration of children's school garden experiences, perspectives, and developing ecological literacies. Unpublished Masters thesis, University of British Columbia. Retrievable at https://open.library.ubc.ca/cIRcle/collections/ubctheses/24/items/1.0058470.

Ostertag, J. K. (2015). School gardening, teaching, and a pedagogy of enclosures : threads of an arts-based métissage. Unpublished PhD dissertation, University of British Columbia. Retrievable from https://open.library.ubc.ca/cIRcle/collections/ubctheses/24/items/1.0166199.

Ostertag, J., Gerofsky, S. & Scott. S. (in press). Learning to teach environmental education by gardening the margins of the academy. In D. Karrow, M. DiGiuseppe, P. Elliot, Y. Gwekwerere, & H. Inwood (Eds.) *Canadian Perspectives on Initial Teacher Environmental Education Praxis*. Ontario, Canada: Canadian Association for Teacher Education (CATE).

Pleyers, G. & Touraine, A. (2011). *Alter-globalization: Becoming actors in a global age.* Cambridge, UK: Polity.

Scheub, U., Pieplow, H., Schmidt, H.-P., Draper, K., Flannery, T. (2016). *Terra preta: How the world's most fertile soil can help reverse climate change and reduce world hunger.* Vancouver, Canada: Greystone.

Toulmin, S. E., & Toulmin, S. (1992). *Cosmopolis: The hidden agenda of modernity*. Chicago: University of Chicago Press.

Urueta Ortiz, T. (2016). Exploring practice-linked identities construction in culturally diverse urban youth through and intergenerational garden-based learning project. Unpublished PhD dissertation, University of British Columbia. Retrievable at https://open.library.ubc.ca/cIRcle/collections/ubctheses/24/items/1.0226043.

Waters, A. (2008). *Edible schoolyard: A universal idea.* San Francisco: Chronicle Books.

Williams, D.R. & Brown, J. D. (2011). *Learning gardens and sustainability education: Bringing life to schools and schools to life.* New York: Routledge.

University Alliance for Sustainability
Freie Universität Berlin
Sustainability and
Energy Management Unit

Andreas Wanke, Head
andreas.wanke@fu-berlin.de
Katrin Risch, Program Manager
katrin.risch@fu-berlin.de

Schwendenerstraße 17
14197 Berlin, Germany
T + 49 (0) 30 838 510 44
www.fu-berlin.de/uas