



Developing an Urban Heat Island Mitigation Policy

Examining the relationship between science and society in environmental policy development 

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Abstract 


The City of San Diego is currently developing an Urban Heat Island Mitigation Policy and Program, which is an important new type of environmental policy. The purpose of this study was to examine the interaction between science and government, between government and an outside entity, the role of public participation, and how knowledge is transferred and shared between these realms in regard to policy development. The purpose of looking at different actors was to see who influenced the policy and how action was coordinated. Data was gathered through interviews, participant observation, and primary documents. This study found that while the development of this environmental policy does incorporate some of the core beliefs of Sustainability Science, it does not fully utilize all of the principles. This study provides information about how theories of Sustainability Science are being utilized in a city context and allows other policymakers to begin to consider new and different ways to collaborate on environmental policy.


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Key words: environmental policy, urban heat island effect, collaboration, and public participation, Sustainability Science

Introduction


Currently the City of San Diego is developing an Urban Heat Island (UHI) Effect Mitigation policy and program. This policy is of particular interest because it is representative of new types of environmental policy that are increasingly becoming more common in regions around the country.  In the past most environmental action has come as a result of federally mandated regulations, which target point source emissions. The UHI policy differs from this past legislation because it is being initiated at the local city level and is a much broader policy that seeks to reduce greenhouse gas emissions by targeting non-point sources. It is important to understand how and why these new types of environmental policies are being developed and implemented because they represent a change from the past system and it can be argued that they are a potential beginning of a new path towards more sustainable practices. 


This study examines the development of the UHI policy by looking at the ways in which science and society collaborate and share knowledge as a way of creating sound action and policy. Specifically, key actors such as scientists, government policymakers, the public, and members of outside agencies will be examined in order to see who is exerting control over the process and for what reasons. Furthermore, this study uses these findings to understand the extent to which the development of this environmental policy follows the core values and principles of Sustainability Science. This study will provide a case study of how local government is able to develop a new type of environmental policy, and will provide an example for other policymakers who wish to take these actions further. 

Sustainability Science is an emerging interdisciplinary field that seeks to understand the interactions of global processes with the ecological and social characteristics of places and sectors. It seeks to integrate scientific knowledge with society, as a way of creating policy and action that will lead us to a more sustainable future. This study will examine the development of the UHI policy in regards to several of the key principles that are argued for in this field. The first idea that will be looked for in the development process is the knowledge-action collaborative and the co production of knowledge. The second is the degree to which the credibility, saliency, and legitimacy of the UHI issue are simultaneously promoted. Finally a look will be taken to the degree and nature of public participation in the development process. All three of these principles are key to Sustainability Science's efforts to build bridges between the often very separate realms of science and society. 

~~Current Literature:~~ Tracing the shift in environmental policy and the emergence and discourse of Sustainability Science


From the 1970's, when the first pieces of major federal environmental legislation were introduced, to today there has been a shift in terms of the types of environmental legislation, policy, and programs enacted, as well as a shift in the role that science has played in the development of this type of policy. The UHI policy is just one instance of a new approach to environmental policy. After World War II, with the Cold War in particular, science began to take on a new position in American society. Science was seen to be the provider of truth and reason, and above all something that had the ability to provide answers to our problems (Karl 2002). Scientists were given the task of defining

standards of performance, and more importantly the task of defining what was “unreasonable risk to human health (Houck 2003, 16)”. The federal government had complete faith that these individuals had the knowledge and ability to come up with definite answers to these questions. Scientists did come up with answers and created the system of command and control regulation in which the government commands the target levels for pollution reduction, which were determined by scientists, and controls the ways in which they must reach these targets (Pezzoli 2000). This so-called first generation of environmental policy was full of limitations, which in the end caused most of this type of legislation to be inadequate.  An important limitation was that the policies solely focused on point-source emissions, the emission of a pollutant from a single source such as a smokestack, and gave no attention to non-point source pollution (Pezzoli 2000). Another issue was that the decision making, research, and policy all dealt with environmental issues in a compartmentalized way, in which no look was given to how pollutants, regulations, or organizations interacted and or were connected to each other (Council 1999). As these types of regulations continued throughout the end of the twentieth century, it became evident that due the complex conditions that existed in society, there was no one absolute solution to environmental problems because most of these issues were the product of the interaction and combination of technological, governmental, scientific, and natural circumstances (Rosenbaum 2002).

Due to the realized limitations of the first generation environmental policy, there has been a shift in environmental regulation and management in the last decade. No longer is the federal government coming out with command and control type of regulations that creates mandates for the states and localities to follow.  Instead individual

agencies, and more often, local and regional governments are leading the way in developing innovative environmental policies and programs that seek to find more integrative ways to manage complex, non-point source, environmental issues as a way to create more sustainable communities (Rosenbaum 2002). This change is significant, because as localities are finding innovative ways to address environmental pollution and climate change, the role that science plays in policy development is also changing. The UHI policy fits in with this new type of environmental policy because it is coming out of the local level and it seeks a larger umbrella approach to managing the emission of green house gases. The field of Sustainability Science emphasizes the idea that scientific and technological knowledge is still a necessity in the development of policy, but now more attention needs to be given to the connection between nature and society, and to the ways in which scientific research can aid society in the move towards sustainable development.

Sustainability Science is a field that seeks to understand the interaction of global processes with the ecological and social characteristics of places and sectors. This new way of understanding and learning will permit different social actors to work together (Kates, Clark et al. 2001). In this study one of the key factors that will be used in the evaluation of the UHI policy is Sustainability Sciences emphasis of the desire to use co-produced knowledge and collaboration between society and science, not just as an academic exercise, but instead as a way of finding feasible and practical solutions that will eventually lead us down the path towards sustainability. One way that this issue has been addressed is by examining how knowledge is shared and transferred. One argument states "...efforts to mobilize science and technology for sustainability are more likely to be effective when they [institutions] are able to manage the boundaries between

knowledge and action in ways that simultaneously enhance the salience, credibility, and legitimacy of the information they produce (Cash, Clark et al. 2003, 8086).”  This excerpt highlights the importance of communication between different actors and the need to bridge gaps to facilitate mutual comprehension of the presented knowledge (Cash, Clark et al. 2003). The second part of Sustainability Science that will be used in this study is the idea of how and to what degree the credibility, saliency and legitimacy are being enhanced during the development process.

While the integration of science and policy making is an innovative approach to environmental policy making, it must be acknowledged that there are some inherent problems that come with this course of action. The first is that science has its own agenda and is an independent political actor with interests, strategies, motivations, and institutions all its own. This argument means that no scientific knowledge is going to be neutral, unbiased, or the absolute truth (Andresen, Skodvin et al. 2000). Due to this idea, all scientific research must be examined in relation to the rest of society. Another concern that has been raised is that of politics interfering with scientific research by introducing incentives to sway research results. Decision-makers must find a way to utilize the scientific knowledge and ask policy relevant questions about potential impacts, without demanding particular answers (Andresen, Skodvin et al. 2000). Finally there is the issue that by placing so much importance on integrating science and social policy making, that citizens, who have the most stake in the outcome of environmental programs, are completely left out.


Finally the last key principle that will be used in this study to judge the UHI policy is the role and nature of public participation. It has been argued that the science-

policy interface must be reframed in order to include citizens because these individuals hold knowledge about the local region and deserve to have an input about what is happening in their communities (Backstrand 2003; Kasemir 2003). Successful implementation is only possible when you have citizen consent, and policies will only obtain this consent if they mirror the values and visions of the community (Kasemir 2003). It has also been argued that it is important to look at whose knowledge is being presented when science and policy makers work exclusively with each other, and what knowledge is being represented as true and legitimate. With these viewpoints, it is argued that a more participatory account of scientific expertise, in which science is engaged in open communication with the public, is necessary (Backstrand 2003). Finally some research suggests that the role of science needs to change so that it provides a variety of assessments for different courses of actions, as a way of supporting an informed debate, instead of settling the debate by defining the correct course of action (Kasemir 2003). All of these arguments stress the need for citizen involvement because of the belief that it will lead to environmental policies that more accurately represent the needs of the community and region.


The research that examines the central issues of Sustainability Science offer many theories about why this field would be beneficial in moving society towards a more sustainable future, and some even offer types of organizations or management styles that could be used to achieve these goals. Several studies argue for the use of boundary type institutions (Andresen, Skodvin et al. 2000; Cash, Clark et al. 2003). These would be arenas that are organized as buffers in which scientific knowledge and the concerns of the policy makers can be brought together without disrupting the internal systems of either

realm. In this study, ICLEI (Local Governments for Sustainability) has been found to be just such a boundary organization. It is an outside entity that was able to bring science and government together in ways that either realm would not have been able to do if left on their own. Another study argues for the use of adaptive management systems in which policies are treated like experiments, where they are designed so that lessons can be learned from their implementation (Council 1999). What is missing from all of the current research are case studies that show how all of the different views and disciplines for which Sustainability Science calls for have been implemented in local regions. This study seeks to fill this gap left by the other literature that currently exists by examining how science and society interact within the City of San Diego.

Research Strategy **Gathering the data to get at the science/society connection**

This study employed qualitative research methods examine the connections between science and society in the development of the UHI policy. Participant observation, interviews, survey data, and primary documents were all used in order to answer the questions that have been set forth in this study. 

Setting and participation observation

This study was conducted as participant-observer within the City of San Diego Environmental Services Department from June 2004 to February 2005.  There was direct contact with the individuals involved with developing the policy on a daily basis. In addition much information was gathered from meetings and public forums that were attended. These events have been used to understand how the City is interacting not only with the public but also with individuals from other city governments and agencies. As a

participant-observer of the development process it was possible to experience first hand the amount of collaboration and outside input that was taking place everyday at the office. It was important to be involved at this level because it allowed for an understanding of how the goals that were espoused at the forums and the meetings were being addressed at the ground level everyday. The actions taken in all of these venues are critically examined in order to understand what information the City chooses to disseminate to these other actors, how they do it, and what ways, if any, they incorporate the ideas of others into their policy.

Interviews

To answer the questions about the development of an UHI policy and program, several different research methods have been used. The bulk of the data has come from extensive interviews. These interviews were done with individuals from different disciplines, who are all involved in some way with looking at the UHI issue. These experts were consulted in order to understand the different perspectives that are coming together to form this policy.

Information sought from interviews
Motivation for action
Strategy
Views of other disciplines

The first person I interviewed was Ryan Bell, the Project Coordinator from the International Council for Local Environmental Initiatives (ICLEI). This interview provided insight into the role of an intermediary and how they are able to coordinate and connect individuals from different regions and disciplines. The next individual that I interviewed was Hashem Akbari, a leading UHI scientific expert, because he is not only involved with UHI research but also interacts with policymakers. By speaking with a

scientist involved, it has provided for an understanding of how and why the scientific community has become involved in the development of innovative types of environmental policy. Finally, an interview was conducted with Linda Pratt, who works within the city government and is directly responsible for writing the policy and for bringing other actors into the development process. This interviews allowed for information to be gathered about how the City is approaching this issue, strategies they are using, and how collaboration fits into the development of policy making.

Survey



After the three forums that were held by the City in late September, surveys were distributed to those that attended. These surveys asked about their previous level of knowledge of the UHI issue, which speakers they responded to best, and their opinions about possible actions that should be taken. The surveys were compiled and the results were analyzed and used in this study. The purpose of these questions was to give information about how the participants took in the knowledge that was being shared with them and to provide insight into how receptive outside individuals would be to the implementation of UHI mitigation measures.

Documents

Finally the last research method that was used was the analysis of primary documents. Personal communications, information sheets distributed at forums, and transcripts from meetings and forums have all been utilized to understand how knowledge is being shared, and how this transfer of ideas impacts the development of the UHI policy. In addition websites from the various outside agencies and scientific groups

will be used to gather more information about the level of involvement and participation that these outside actors have in policy making in many different geographical settings.

Findings and Analysis: Critically examining the words, actions, and connections between three key actors

Policymakers working within the government, scientists, and the members of the community all played a role in the development of the Urban Heat Island Effect Mitigation policy. It is important to see how these different actors communicated, shared knowledge, and interacted in order to see to what extent there was collaboration and the co-production of knowledge. **This study answered examined**  these interactions by speaking to three key individuals who played important roles in the development of this policy. This analysis suggests that the role of an outside entity was able to connect science and society, facilitating the communication and collaboration process, because of the intellectual capital they possess. In addition it is argued that the development of this policy does fit in with some aspects of Sustainability Science, which is seen in the ability of the different disciplines to work together in ways that enhanced the credibility, saliency, and legitimacy of the issue. However, the development process fails to incorporate all of the principles of Sustainability Science because while there was collaboration between science and society, there was no evidence of the co-production of knowledge. Finally, while the UHI policy does not employ all of the precepts of Sustainability Science, it does represent the beginning of new paths that are being tested out at the local level. This study is significant because it allows one to see that changes are slowly being made and opens the door for further action to be taken in the future. 

ICLEI working to coordinate action

Local Governments for Sustainability (ICLEI) is an association of local governments that the City of San Diego joined in 1998. ICLEI was formed in 1990 with the mission to achieve improvements in global sustainability through local action (ICLEI Website). This association provides local governments with guidelines, models and technical assistance to help them develop climate change policies that they can then adapt for the specific needs of their city and region. ICLEI is an important actor to examine in this process because while they have guided the City of San Diego down a certain path, they have done so without explicitly telling the policymakers what to do. This is very different than older types of command and control legislation where the national government forced local municipalities and businesses to follow certain procedures, even if they did not make sense for a specific location. ICLEI has therefore become the driving force behind this new type of environmental policy. ICLEI is also an important player in this process because it acts as an intermediary between science and society. ICLEI helps to manage the boundaries between the two realms and makes communication and knowledge transfer between the two possible.

Within ICLEI, policymakers at the City of San Diego have had the most contact with the Program Officer, Ryan Bell. He has played a large part in helping the City to achieve certain goals and in connecting policymakers with individuals from different professional backgrounds. Through interviewing Ryan Bell, surveys, and participant

observation in the forums that were held, it can be argued that ICLEI works as an intermediary organization that helps to manage the boundaries between science and government in such a way that knowledge is transferred between the two in the hopes of leading to the creation of sound policy and of bringing credibility to this particular environmental issue. The City of San Diego could not have embarked on the development of an UHI policy without the help from Bell and ICLEI. He provides them with technical assistance in using software, helps with research, and assists in the writing of the Local Action Plan (Field note 1/10/05). In addition to these job duties, he has also helped the City to connect with scientists and the public in a number of significant ways.

In an interview, Bell outlined the reasons why ICLEI puts a great deal of effort into connecting the local governments that are part of the association with scientists who are actively involved with research and technological development. He argued that in a vacuum, neither science nor government has the ability to come up with sound environmental policies (Field note 1/10/05). He is suggesting that neither field would have the knowledge or expertise capable of understanding all the ecological, social, and economic dimensions of an issue and could never create a policy that had any chance of causing meaningful change. Due to this belief, ICLEI and Bell put a great deal of time and resources into connecting these two realms. There is also a secondary, but equally important reason that scientists are involved in the policymaking process. As discussed earlier, there is still a great deal of power and trust placed in science. Bell stated that when scientists are involved and are speaking to not only policymakers, but also with the public, then a greater degree of credibility is brought to the process. People within the government and the public almost always want quantifiable proof of levels, impacts, and

costs to the community and science is able to provide them with some of these answers (Field note 1/10/05). In this way, scientific knowledge is not only used to create a sound policy, but also as a political device. Scientific knowledge is allowing for the policy to gain support with the public and with policymakers.

The City of San Diego used the idea of employing experts as a device to gain credibility and support in a series of UHI forums that were held at the end of September. A series of three forums were held over a two-day period and each one targeted a different segment of the population. The first was a forum that was open to the public, which was then followed by one for policymakers from the different cities within the region, and finally the third was just for City employees. All three forums had experts from the local region and from outside of San Diego come and speak about the UHI effect and possible mitigation measures (Field note 9/30/04). In a survey that was given out after each of the forums, 77% of respondents stated that they felt that the presentations made by Bell and by Hashem Akbari, a scientist with the Lawrence Berkeley National Laboratory, were the most useful and the most effective in educating the participants (Survey 9/30/04). These two individuals both came from outside of San Diego to come and share their knowledge and experience with this issue. At the forums there were other individuals who gave presentations about UHI issues, but they did not have the prestige that Bell and Akbari did. In that context they seemed to have the most expertise on this issue, and this was something that those in attendance responded to positively. Bell and Akbari had been consulted previously for input and guidance on the policy, but at the forums they were solely there to inform individuals outside the development process. It can be argued that the City used these individuals not only to

educate and to share their knowledge about the UHI effect through presentation, but also a device to gain support for the issue.

ICLEI can be seen as a type of boundary organization that manages the borders between society and science. The utilization of this type of organization on the part of the City does fall into line with the core principles and arguments made within Sustainability Science. One study argues that "...efforts to mobilize science and technology for sustainability are more likely to be effective when they [institutions] are able to manage the boundaries between knowledge and action in ways that simultaneously enhance the salience, credibility, and legitimacy of the information they produce (Cash, Clark et al. 2003)." ICLEI is effectively an institution that is doing just that. The association is working to bring together science and government in ways where they can create feasible solutions together, without compromising their individual perspectives. In addition credibility, legitimacy, and saliency are all being promoted in the development of the UHI policy. Credibility is promoted through the use of scientific expertise, which also enhances the legitimacy and saliency of the issue. Scientific knowledge is made accessible to policymakers and the public in ways that convince them that this issue is one that does impact their lives. It can be seen that by utilizing a boundary organization, the City of San Diego is promoting some key values of Sustainability Science.

The Scientific Perspective

In order to understand how and why scientific knowledge is being shared with policymakers at this point in time, it was necessary to speak to a scientist who is on the frontlines of this movement. Hashem Akbari is the head of the Urban Heat Island Research group at the Lawrence Berkeley National Laboratory, and he came to forums

that were held by the City at the end of September to speak to policymakers, city employees, and the public about technical aspects of the UHI effect, the impacts, the costs and the possible mitigation measures that need to be taken in every city, no matter what level of UHI they are experiencing. At the forums he told the audience “Even if there is one building in the middle of the desert, it would benefit from Urban Heat Island mitigation measures (Field note 9/30/04).” was sharing his knowledge with the participants, but in a way was accessible to people without a scientific background. He connected the abstract concepts of the UHI effect with concrete examples of negative impacts that could result if left unattended and the potential benefits that could be experienced if this problem was mitigated. It was important that he connected the issue to the lives of those in the room because it allowed for there to be a degree of saliency brought to the discussion. Historically, people have only felt that environmental action is necessary once they have seen how it has or will impact their lives.

While it is important to see what type of scientific knowledge that he shared with those outside the scientific community it is also equally important to understand why he has become involved with educating others. In an interview, Akbari stated that he became involved with educating others about the UHI effect in 1989 because his research group came to realize that knowledge without utilization has no value (Field note 1/7/05). This thought is significant because it is a huge part of the principles of Sustainability Science and it is the reason that all of these people are getting involved at this time. Akbari further illustrated this point by giving the example of the fluorescent light technology that was first known about in 1920, but because there were no policies promoting its development, it was not explored or utilized until the 1950s (Field note 1/7/05). With this example, he

was illustrating that if scientists want progress to be made they have to educate and engage policymakers about their research so that it can be integrated into sound policy. It is also significant that he acknowledged in the interview that science alone cannot provide all of the knowledge necessary to create policy and that other fields must be considered (Field note 1/7/05). In addition he mentioned how border organizations like ICLEI have worked to facilitate the collaboration between these different spheres.

While he did mention the need for collaboration between science and policymakers in order to create sound environmental policy, it was also evident throughout the course of the interview that he felt it was still the job of science to develop appropriate technology to solve the problems that exist. He seemed to think that collaboration with policymakers was necessary more as a way of getting funding and support for new technologies, and not because the collaboration might lead to different types of co-produced knowledge. He spoke more of the need for collaboration between different branches of science, which is of course necessary and does fit in with Sustainability Science. Yet the idea that science is capable of providing ultimate truth and as having the capacity to determine the “correct” course of action does not quite fit into its goals. It has been argued that science does not have the authority to decide what is right, but instead should be there to provide people with information about what the effects could be of different courses of action. In that way, scientific knowledge would help people to make decisions about what would be best for a region, but would not act as the deciding authority on the matter. Perhaps if Akbari changed his perspective on this point, he could go beyond sharing his knowledge with policymakers, to actually working with them and with the public to find co-produced solutions.

Government working with science, the public, and ICLEI

Linda Pratt is the Sustainability Program Manager with the City of San Diego, and she has undertaken the task of writing the UHI Mitigation Policy. She has worked to bring together people from the community, such as policymakers, city employees, and the public in different types of forums about the UHI effect and global climate change, in order educate them about these issues and to get help in developing the UHI mitigation policy. She wanted to show everyone involved that “When you work with other organizations, and you are trying to move something forward, you never start from a place of zero knowledge (Pratt interview 1/19/05).” She is arguing here that when you are developing a policy like the UHI policy, you have to discover and acknowledge all the work that is already being done around the region as a way of building on actions already in place and as way of gaining political support. This effort was seen with work she did at the forums held for city and regional policymakers (Field note, September 30, 2004).

Pratt also saw the necessity of talking to scientists about the UHI effect and in bringing them into the discussion at the forums. She stressed the idea that as experts who have come up with clear concrete solutions to this issue, they were able to bring a lot of legitimacy and credibility to the whole event. The idea that people were to some extent convinced by the presentations made by experts can be seen with the surveys that were filled out after the forums were over. Only 10% of the respondents were not convinced that the mitigation measures discussed would work (Survey 9/30/04). With any environmental issues it is nearly impossible to convince 100% of people that something needs to or can be done. This point can be seen with the issue of global climate change. The causes and impacts of global climate change is the one issue where the biggest

consensus exists in the scientific community, and even though this has been expressed to the public, there are still many who do not believe the legitimacy of the scientific findings (Field note 11/16/04). So the fact that 90% of the people who responded felt that the mitigation measures would work is very impressive and suggests that experts at the forums adequately conveyed the importance of the problem and convinced most that mitigation measures do exist. It can be seen that by including these experts, the City was able to promote the legitimacy and credibility of the UHI issue.

It was only with the help of ICLEI, however, that the City was able to bring scientific experts to these forums. As Pratt stated, those in ICLEI are actively involved all around the country and it is their job to stay on top of the latest research that is happening around climate change issues. Due to this involvement they are constantly in contact with the scientists who are leading these studies. Pratt emphasized that on her own she does not possess the experience with scientists and she would have had no idea who to contact if it was not for Bell and ICLEI (Pratt Interview 1/19/05).

It is also important to look at the City's involvement with ICLEI on a more general level. As Pratt stated, the City joined the association in 1998 but it was not until she started working for the City in 2000 that they began to actively take part in their programs (Pratt Interview 1/19/05). It is significant that local governments, like the City of San Diego, are actively choosing to be a part of this association. While it is in their best interest to join, it is obviously something that no city is forced to do. San Diego has chosen to be a part of this association for themselves, which is extremely significant. They are choosing to be a part of a movement to create change and to move outside the normal system of doing things. Since they are initiating participation, it seems like there

might be more of a chance of people actually believing in the projects and putting significant forces behind them because there is no resentment over being forced into action.

The last relevant issue that Pratt discussed was the issue of public participation in the development of the UHI mitigation policy. She held the UHI forums and had another forum on the impacts of climate change on Southern California on November 16, 2004. Both of these forums invited members of the community to come on their own time and learn about these issues. The November 16 forum had many scientists from the around the country come and discuss the potential impacts of global climate change and how these experts have come to discover this information. One speaker was from the National Center for Atmospheric Research and she gave her presentation on communication strategies for discussing climate change issues with the public. This was very interesting because it was a scientist informing the public how experts can effectively communicate their knowledge with the public (Field note 11/16/04). This is significant because it allowed the public to see that no one was lying to them about these environmental problems and that they were just trying to find the best ways to communicate and share their knowledge. This perhaps allowed for an increase in trust on the behalf of the public. The whole purpose of the event was stated on the pamphlet that was handed out to the participants. It stated, "Our hope is that through an active exchange of ideas, we can all join together to ensure that San Diego remains a community worthy of our affection for generations to come (Pamphlet)." While the purported goal of this event was to engage in the exchange of ideas it was mostly designed, as was the UHI public forum, to educate the general populace and not to elicit feedback from them.

While efforts were made to include the community, it was done in order to gain a degree of support for the actions taken by the City, and not as a way of utilizing citizen knowledge to add to the policies.

In Sustainability Science it has been argued that while scientific findings are important, it must be combined with judgments that are drawn from other sources, such as common sense and the cultural traditions of local places (Kasemir 2003). This integration of knowledge is necessary because in order for there to be successful implementation of policy you must have citizen consent and to this is achieved by creating "...climate policies that are consistent with the visions, beliefs, and aspirations of the citizens...(Kasemir 2003, 6)." The question then becomes whether or not the City places the same importance on the values and viewpoints of the public. At this point in time it seems like Pratt wants to include the public in a fairly superficial sense. While it is important to educate the public about these issues, it is also important to integrate their local knowledge and beliefs in the policy if implementation is to be successful in the long run. At this point there has been no significant effort to make this happen. However, the policy is still in its very early stages of development and Pratt mentioned that she would have groups from the public look at the draft and comment on it (Pratt Interview 1/19/05). But once it again, it has been argued that asking for public participation after a policy is already complete takes away any power that the public might have been able to exert over the process (Backstrand 2003). In this way it can be seen that with the development of the UHI mitigation policy, efforts at public participation have only been made in a very traditionally limited way, and no new ways of engaging the community have been seriously considered.

While the City's efforts at developing the UHI mitigation policy does not fit in line with some of the arguments made in Sustainability Science, their other efforts at integrating knowledge and action do follow those principles to a certain extent. The acknowledged need to build upon the existing practices and knowledge present in the region is important because it demonstrates that this policy is looking not just at a single isolated issue, unaffected by other actors, but is instead consciously aware of all the other individuals and actions that are and will have an impact. In addition the fact that such great measures have been taken to specifically talk to scientific experts and learn from them shows that the core values of Sustainability Science are being embraced. Finally, while this effort is taking place at the city level, they are trying to engage individuals from other cities within the region, in order to encourage similar courses of action. There is the acknowledgement that no environmental policy will be effective just instituted in one city because the environment does not follow municipal boundaries. While not at the regional level yet, there is at least the recognition that action on a larger level is needed. The focus on the regional level is a large part of the theories that underlie Sustainability Science.

Finally it must be noted that the City of San Diego did not deliberately set out to align this policy with the field of Sustainability Science. There has been no acknowledged effort to promote the UHI policy as one that is part of this emerging interdisciplinary field. Instead the City is developing a policy in way that they feel best serves the community, and it just so happens that many of the methods fall in line with principles promoted by Sustainability Science. It seems that the whole policy is a genuine effort to help to create a more sustainable community and is not instead being created in

order to fit in with a trendy new development style or buzzword. It is still too early to tell whether or not this policy will be “effective” once it is implemented, but it seems that because of the effort to integrate science and society in meaningful ways, it has a chance of accomplishing its goals.

Conclusions

This study has examined the City of San Diego’s development of an Urban Heat Island Mitigation policy as a way of looking at how science and society are being integrated into new types of environmental policy. The UHI policy focuses on addressing global climate change in indirect ways and because it differs from first generation environmental legislation, it is important to understand how different actors are interacting and influencing the development process.

The first major finding of this study is that the City of San Diego was only able to develop the UHI policy because of the help of an outside entity, ICLEI. Linda Pratt stated that she would have had no way of connecting with the scientific community if it were not for Ryan Bell working at ICLEI. For an environmental policy it is necessary to have sound scientific research backing it, so without the input from science, this policy would never have been developed. ICLEI was able to put the City in contact with leading scientific experts and facilitate the transfer of knowledge between the two realms. This entity was able to play this role because of the large amount of intellectual capital that the City and scientists did not possess. As stated by Bell, those working within ICLEI constantly have to stay on top of the current research happening all over the world in order to carry out their various campaigns. These individuals already know those conducting scientific research and are therefore in the best position to connect them with

policymakers who are searching for reasons and ways to improve their communities.

Without the help of ICLEI, the City would not have been able to even begin to develop an environmental policy of this scale.

The second major finding of this study is that by incorporating scientific and other leading experts in the issue of UHI and global climate change, the City was able to simultaneously enhance the credibility, saliency, and legitimacy of the issue to others working within the City and the public, which is a goal that is argued for in Sustainability Science. All the experts that were interviewed, Bell, Akbari, and Pratt, emphasized the idea that it was necessary to have science and policymakers work together because of complex ecological and social systems that are in place. By acknowledging the need for shared knowledge they opened the doorway for action that would utilize scientific and other types of knowledge. At the same time the other reason all three of the experts touched upon for integrating scientific knowledge into policymaking was because it would increase the credibility of the policy. The fact is that most people still count on science to provide “truth” and to solve the problems that we have created. Without a scientific perspective, most people would place very little trust information that a policymaker was providing them. In addition to bringing credibility, the scientists involved with speaking to the public also brought a sense of saliency and legitimacy through their presentations. They connected the UHI issue with their lives and made it evident that there are clear concrete ways to mitigate the UHI issue. This was seen in the survey results from the UHI forums that were held in the fall. The results show that those who attended felt that the experts had clearly convinced most of them that there is a problem and mitigation measures are available. In Sustainability Science, it has been

argued that the simultaneous promotion of credibility, saliency, and legitimacy is essential in the creation of effective policy.

While the development of the UHI policy does employ some of the principles of Sustainability Science there are also a couple major instances where it did not fully follow all of the values. While there was an effort to get different disciplines together to share knowledge, there was no evidence found of any effort to move beyond surface level knowledge transfer to knowledge co-production. Akbari emphasized the need for science-to-science collaboration, but did not seem to see any need for input from outside the scientific community. He saw policy as a vehicle for utilizing scientific knowledge, but not as a means for advancing their research in any way. The development of this policy also failed to follow the principles of Sustainability Science because of the lack of meaningful public input and participation. Neither Bell nor Akbari seemed to think that there was much need to for public participation in the process and Pratt only seems to have superficially acknowledged the need to include the community's perspective. This is area that should have more importance placed on it because the policy will be hard to implement in a meaningful way if it does not reflect the needs and values of the community. In the end it will be interesting to see how well the City is able to implement necessary changes without the support of the public.

This study is significant because it provides a case study of the development of a new type of environmental policy at the city level that seeks to integrate different systems of knowledge and action in new and meaningful ways. It shows how the City was able to bring together individuals from different disciplines and different regions to create a policy that hopes to move the community towards a more sustainable future. The goal of

this study was to demonstrate how a local municipality was able to employ theories found within the academic world in a real world context. It has been shown that the City has taken the first steps in developing a policy that seeks new ways to address the environmental problems that surround us. This study can be used as an example of what one municipality has done to move outside the status quo and can allow other policymakers to see how they can take this type of action even further in their own setting. The UHI policy is just one instance of new directions that are being tested out at local and regional levels all around the country. Further study is needed to see how these initial efforts at integrating knowledge affected the final outcome of the policy and implementation efforts.

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