Towards Evidence-Based Sustainable Communities

Report on Survey of Urban Sustainability Centers in U.S. Universities

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WHATWORKS COLLABORATIVE

Building Knowledge & Sharing Solutions for Housing & Urban Policy

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Executive Summary

This report summarizes the results of an inventory and survey of urban sustainability centers in universities in the United States. It represents the first phase of a larger research project, "Towards Evidence-Based Sustainable Communities," which will build on these results to provide a research review of major research issues in urban sustainability, and subsequently to develop research objectives and common performance metrics in the various dimensions of sustainability to support the federal initiatives on sustainable communities. The report provides the results of the inventory and survey of university centers conducted by the Center for Sustainable Cities at the University of Southern California during the fall of 2010 and spring of 2011. The research for this first phase of the study was funded by a grant from the What Works Collaborative at the Urban Institute. The What Works Collaborative is a "foundation-supported partnership that conducts timely research and analysis to help inform the implementation of an evidence-based housing and urban policy agenda."[1] The inventory identified research centers and their basic characteristics, and was followed by a survey to obtain a profile of the centers; their capacity in terms of personnel and financing; current center objectives; and recent research. We have provided links to the research centers that responded to the survey on the web site of the Center for Sustainable Cities, http://sustainablecities.usc.edu/resources/.

The project had two aims, to provide information on basic characteristics of the urban sustainability research centers and to identify their current research projects and topics. The report is thus organized into two parts, the first part focusing on the characteristics of the research centers, and the second part on the research topics of the responding centers. Characteristics of the centers, such as major research focus or size of budget, can be useful indicators of the institutional capacity for conducting research on certain topics, as well as the likelihood that research on a topic will continue over time. The second part of the report identifies current major research themes, subthemes, and cross-cutting issues of urban sustainability research centers in U.S. universities. The major aim of this second part of the study was to identify topics for several major research reviews or syntheses in urban sustainability, thus leading to the second phase of the larger, "Towards Evidence-based Sustainable Communities" project. The second phase of this larger project calls for the development of research reviews on relevant policy issues in urban sustainability. A research synthesis is a systematic review of the evidence on a policy issue, for example, how to reduce vehicle miles traveled, or what strategies are effective in reducing water use in residential buildings. The objective of the reviews would be to characterize major research on a topic, to identify the findings of the research, and to assess the evidence and methods used in the research. The conclusion of such research reviews would be to identify evidence-based policies and action strategies in the topic areas, in effect, to identify what works and what doesn't work in a policy area.

[1] See the What Works Collaborative web page for further information: http://www.urban.org/what-works-collaborative.cfm.

Part I. Characteristics of Centers

Centers surveyed are clustered in certain areas of the country—the Pacific coastal states, the Northeast, and the Midwest. Research is the primary focus of most responding centers, education the second focus, and public outreach the third. The majority of respondents identified their centers as having an interdisciplinary focus. Of the centers with a more focused approach, half identified their focus as transportation, and the others varied, from biodiversity/ecology, green jobs, green buildings, and new technologies for energy efficiency to climate change. The great majority of responding centers have budgets below $1 million, with a diversity of funding but with most relying on government and university funding. With respect to the ease or difficulty of funding research topics related to sustainability, a majority of centers perceive that transportation and energy projects are easiest to find funding for, and that interdisciplinary projects are the hardest to fund. Respondents to the survey also indicated their staff and faculty affiliations, but without in-depth studies of their organizational structures, the results are too varied to conclude anything but great variation.

Major Findings of Center Characteristics from Survey Results

- University centers that conduct research on urban sustainability are not evenly distributed in the U.S., with greater concentrations along the Pacific coastal states, the Northeast and the Midwest, and fewer centers in the Southeast and Southwest.
- Most university centers have budgets below $1M relying on a diversity of funding sources.
- Most centers obtain funding from federal and state agencies.
- The perception of centers is that interdisciplinary research topics are the hardest to fund.

Potential Policy Implications for Federal Policy

- Uneven geographic distribution of centers. Urban sustainability topics have a local/regional dimension. Filling gaps in regional research on urban sustainability may contribute to better policy outcomes in areas that lack research centers, since regional research may result in better understanding of regional contexts and receive greater regional attention and support.
- Obtaining support for interdisciplinary research in urban sustainability. The difficulty of obtaining support for interdisciplinary research is reflected in the relatively low budget size of most centers, under $1M, and the perceived difficulty of research centers to obtain funding support for interdisciplinary research. The Sustainable Communities Partnership is an early and noteworthy effort to address this problem. Such a partnership could be broadened and deepened among federal agencies, in particular, by including National Science Foundation.
- Dedicated, longer-term funding of urban sustainability research centers at universities. Urban sustainability challenges call for expanded university research capacity. Just as

university transportation research centers and research in transportation have benefitted from dedicated, longer-term federal transportation funding, in the future, federal funding could be dedicated to the support of regional urban sustainability research centers.

Part II. Research Themes of Centers

In order to conduct a first scan of the research conducted by urban sustainability research centers, we analyzed the responses of the centers, and conducted further web research on center projects and publications. We identified 195 research projects, assigned keywords, and grouped the projects into major themes, subthemes and cross-cutting topics. The major topics based on number of projects are transportation (72 projects), built environment and sustainability (including affordable housing) (53 projects), climate change (26 projects), urban issues (19 projects), electric power (15 projects), and water (14 projects).

Based on these results, and our knowledge of the fields, we identified several topics for research reviews. We also identified several topics in areas where the empirical research is scarce as potential subjects for framing papers. The objectives of framing papers are to describe the existing literature on the topic, to identify policy issues, and to develop a research agenda that will provide evidence for policy and action strategies.

We recommend *research syntheses* on the following topics:

- Building sustainability—focusing on the effectiveness and cost-effectiveness of sustainable measures on new construction
- Building sustainability—focusing on the effectiveness and cost-effectiveness of sustainability measures for the existing housing stock, or retrofitting the existing housing stock
- Climate change—focusing on the effectiveness of urban growth management strategies to reduce conversion of rural land for urban uses
- Water supply—focusing on the effectiveness of policies and strategies to conserve water and improve water quality and supply issues
- Urban ecology—focusing on what the results of empirical research on urban ecosystem services imply for urban and neighborhood development

We recommend *framing papers* on the following topics:

- Green jobs—focused on developing a research agenda on measures to create green jobs
- Environmental justice—focused on strategies to reduce environmental inequities
- Inclusive/diverse housing and neighborhoods—focused on developing a research agenda on measures to improve diversity or inclusiveness
- Urban heat island effect—focused on a research agenda on the effectiveness of measures to reduce the effect

Introduction

This report summarizes the results of an inventory and survey of urban sustainability centers in universities in the United States. It represents the first phase of a larger research project that will build on these results to provide research reviews of major research issues in urban sustainability (Phase II), and subsequently will seek to develop research objectives and common performance metrics in the various dimensions of sustainability to support the federal initiatives on sustainable communities (Phase III). This report provides the results of the inventory and survey of university centers conducted by the Center for Sustainable Cities at the University of Southern California during the fall of 2010 and spring of 2011. The research for this first phase of the study was funded by a grant from the What Works Collaborative at the Urban Institute. The What Works Collaborative is a "foundation-supported partnership that conducts timely research and analysis to help inform the implementation of an evidence-based housing and urban policy agenda."[2] The inventory that we conducted identified research centers and their basic characteristics, and was followed by a survey to obtain a profile of the centers; their capacity in terms of personnel and financing; current center objectives; and current and past research.

The survey had two aims: to provide information on basic characteristics of the urban sustainability research centers—this is covered in the first part of the report; and, to identify their current research projects and topics, which is covered in the second part of the report. Characteristics of the centers, such as major research focus or size of budget, can be useful indicators of the institutional capacity for conducting research on certain topics, as well as the likelihood that research on a topic will continue over time. The second part of the report identifies current major research themes, subthemes and cross-cutting issues of urban sustainability research centers in US universities. A major objective of this part of survey was to identify topics for several major research reviews or syntheses in urban sustainability, thus leading to the second phase of the larger, "Towards Evidence-based Sustainable Communities" project. The second phase of this larger project calls for the development of research reviews on relevant policy issues in urban sustainability. A research synthesis is a systematic review of the evidence on a policy issue, for example, how to reduce vehicle miles traveled, or what strategies are effective in reducing water use in residential buildings. The objective of the reviews would be to characterize major research on a topic, to identify the findings of the research and to assess the evidence and methods used in the research. The conclusion of such research reviews would be to identify evidence-based policies and action strategies in the topic areas, in effect, to identify what works and what doesn't work in a policy area. In addition to identifying topics for research reviews, we also identify significant topics as potential subjects for framing papers in areas where the empirical research is scarce. The objectives of such framing papers would be to describe the existing literature on the topic, to identify policy

[2] See the What Works Collaborative web site for further information: http://www.urban.org/what-works-collaborative.cfm.

issues, and to develop a research agenda that will provide evidence for policy and action strategies.

Part I. Center Characteristics

Chapter 1: Scope of Inquiry: Urban Sustainability Research Centers

The purpose of this research was to scan the current state of urban sustainability research at universities in the United States. The project had two aims, to provide information on basic characteristics of the urban sustainability research centers and to identify their current research projects and topics. Characteristics of the centers, such as major research focus or size of budget, can be useful indicators of the institutional capacity for conducting research on certain topics, as well as the likelihood that research on a topic will continue over time. To accomplish these aims, we sought to identify university research centers where urban sustainability research is being conducted, the researchers involved, the resources available for such research, and basic information about the research itself.

In this chapter, after a review of definitions of sustainability, we describe the selection of centers, how the survey was conducted, and survey respondents. The chapter then goes on to describe the main objectives and research focuses of the centers responding to the survey.

1.1 Defining Sustainability

Sustainability is an elusive concept with a variety of definitions and applicable in a variety of fields. “Sustainable” and “sustainability” are currently popular buzzwords in many fields; centers using these terms can often call attention to themselves even if the concept of sustainability is only tangential to their research. Two major definitions of sustainability are important to understand, the Brundtland Commission’s and balancing the three E’s definitions (Environment, Equity, and Economy). The prime definition of sustainable development is that of the United Nations World Commission on Environment and Development Report published in 1987, commonly known as the Brundtland Commission Report’s (after its chairman, Harlen Brundtland):

> Sustainable development is development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.[3]

This definition builds on the ordinary or dictionary meaning of the term, the ability to maintain an activity “at a certain rate or level,” and emphasizes retaining opportunities of development for present generations, especially the poor, and for future generations. The Brundtland definition also refers to the more recent ecological meaning of sustainability, the

[3] United Nations. 1987. Report of the World Commission on Environment and Development: Our Common Future. United Nations, 2 September 2010, http://www.un-documents.net/wc.

natural environment's ability to meet human needs and functions. This idea implies that earth systems have a carrying capacity, a finite ability to sustain or carry life, and that at this point human activity is unsustainable.

Development that balances the 3E's, Environment, Equity and the Economy, is the most popular definition of sustainability (Campbell 1996; Godschalk 2004)[4]. This balancing of the three spheres concept has been further popularized for the business sector through the concept of the triple bottom line (TBL) or the three pillars: People, Planet, and Profit (People standing for the social, planet for the environmental, and profit for the economic aspects of sustainability.) [5]

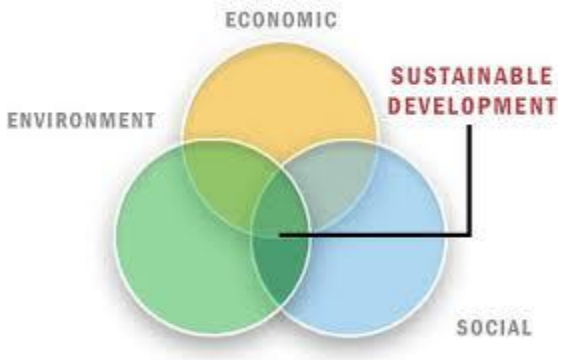


Figure 1. Sustainable development as a balance or interface among three spheres

An aspect of sustainability that is central to the concept, but not as widely noted is the interdisciplinary, systems-oriented or integrative aspects of the concept. The interdisciplinarity or better the intent to integrate various dimensions in a situation is the hallmark of a sustainability approach, which is implicit in the definition of sustainability as balancing the three E's. Thus, when applied to urban issues or urban sustainability, a sustainable approach requires *substantive interdisciplinarity*, beyond issues of environmental conservation, social justice or economic efficiency. That is, since urban issues are interdisciplinary issues, where issues of housing, land use, transportation, etc. are fundamentally interconnected, whether development can be sustained over time requires knowing and taking into account the fundamental connections, for example, that housing has to transportation or public health or other systems on which it is dependent or interdependent. Figuring out how to make urban settlements more sustainable requires knowledge of how a local economy works, of how transportation systems are connected to land use and urban density, to economic activities, to housing supply, to other public infrastructure and services, etc. The way urban systems work or

[4] Campbell, S. 1996. "Green Cities, Growing Cities, Just Cities? Urban Planning and the Contradictions of Sustainable Development," *Journal of the American Planning Association* 62:296–312; Godschalk, D.R. 2004. "Land Use Planning Challenges," *Journal of the American Planning Association* 70 (1): 5–13.

[5] TBL has developed accounting systems that expand the traditional financial performance measures to incorporate social and environmental dimensions. See Elkington, J. 1998. *Cannibals with Forks: The Triple-Bottom Line of 21st Century Business*. Gabriola Island, BC, Canada: New Society Publishers.

fail to work together is a large aspect of the sustainability of an urban settlement. Thus, a sustainable approach fundamentally relies on interdisciplinary knowledge.[6] The Sustainable Community Partnership established by U.S. HUD, EPA and DOT recognizes the essential interdisciplinary nature of sustainable development. [7]

Thus, we expect that urban sustainability centers engage in interdisciplinary research that addresses several aspects of urban areas, such as land use, transportation, built environment issues, housing supply and conditions, water supply and quality, energy and power, other infrastructures, air quality, public and neighborhood services, climate change, urban design, urban ecology, among others. Following the definition of sustainable development as balancing environment, equity and economy, we also expect that these topics are addressed from environmental, as well as economic, and social dimensions.

1.2 Selection of the Centers: Methods, Criteria, Hurdles

To ensure a comprehensive list of universities with centers conducting urban sustainability research and to prevent an inadvertent bias for centers already known by our researchers, we obtained data in a number of ways to compile a draft list of centers to administer our survey. We started with a list of the universities belonging to the American Association of Universities, an association of 63 leading research universities in the United States and Canada.[8] We searched the websites of each of the universities on this list for evidence of an on-campus research center related to urban sustainability using key words such as "sustainability", "urban" and "green". More centers were found through a list of university centers focused on sustainability obtained from contacts at HUD, from the personal knowledge of our researchers, and from the knowledge of known researchers in urban sustainability. We accessed the websites of each of these suggested centers to ensure that the ones ultimately contacted focused primarily on sustainable cities research rather than campus sustainability, advocacy or another objective. Finally, we created a survey question soliciting suggestions from our respondents of other research centers, which resulted in a couple of centers being added to our outreach list.

After compiling the draft outreach list, we conducted further research into the objectives of each of the centers on the list. Many of the centers on the list that seemed, at first

[6] The 3Es could be conceived as meta-criteria, which rely on an integrative, systems-oriented, interdisciplinary knowledge base. That is, they are larger questions that can be posed of existing or proposed systems or projects, once a rich understanding of a situation has been established: how can changes in such a situation conserve ecological systems, how can changes make systems be more efficient , how can they improve social equity. In such a way, urban sustainability research could be conceived as essentially interdisciplinary research, with an overlay of environmental, social, and economic criteria.

[7] In June 2009, HUD, DOT, and EPA joined together in the Partnership for Sustainable Communities "to help communities nationwide improve access to affordable housing, increase transportation options, and lower transportation costs while protecting the environment." See the Partnership for Sustainable Communities web site, http://www.sustainablecommunities.gov/aboutUs.html.

[8] See the web site of the Association for a list of participating universities: http://www.aau.edu/.

glance, to conduct research related to urban sustainability actually did not conduct such research. For instance, this list included general transportation or urban studies centers that might have had one or two active sustainability projects, but no clear dedication to sustainability research. To cull out these centers, we reviewed the websites of all the centers on this list in greater depth, examining the research topics listed online, the centers' stated missions, and any other material that might shed light on the true focus of each center. This screening resulted in a final contact list of 49 centers (see Appendix 1).

Prior to distributing the survey, we contacted the desired centers with an introductory email explaining the purpose of the research and asking for their cooperation in completing the survey (Appendix 2). In the following week, we sent the centers an email with a PDF copy of and the link to the internet survey attached and a request that they complete the survey (Appendix 3 and 4). Many of the centers responded after this initial distribution of the survey. In the weeks and months following initial distribution, we followed up with the research centers that had not responded with a series of emails and telephone calls. We administered the survey during the fall of 2010 and winter of 2011.

A total of 35 research centers responded in some way to the survey. From those responses we determined that seven of the responding centers performed research that was not relevant to urban sustainability in any significant way or else had a main purpose that was not research-oriented, so we eliminated these responses from our analysis. Three of the responding centers only completed the first couple of survey questions on the center's name and the responder's name and did not provide much additional data. A total of 25 relevant research centers provided substantive responses to the survey, although, most of these left one or more survey questions blank (Appendix 5). The data from the survey responses along with the data we were able to obtain from the websites of relevant centers was combined to canvass the state of urban sustainability research in the United States in this report. These 25 relevant centers with significant responses will be referred to in this report as the Urban Sustainability Research Centers, or USRCs.

Geographic Distribution of the Centers

Figure 2 shows the grouping of the various states into five regions: Northeast, Southeast, Southwest, West, and Midwest and indicates the distribution of the 35 centers that responded to the survey.[9]

[9] There are 33 dots on the map instead of 35. This is due to the fact that the dot notation used in the map is not able to identify multiple centers in the same location. There were two responding centers in New York City, one at Columbia University and one at the City University of New York, and two at Georgia Tech.

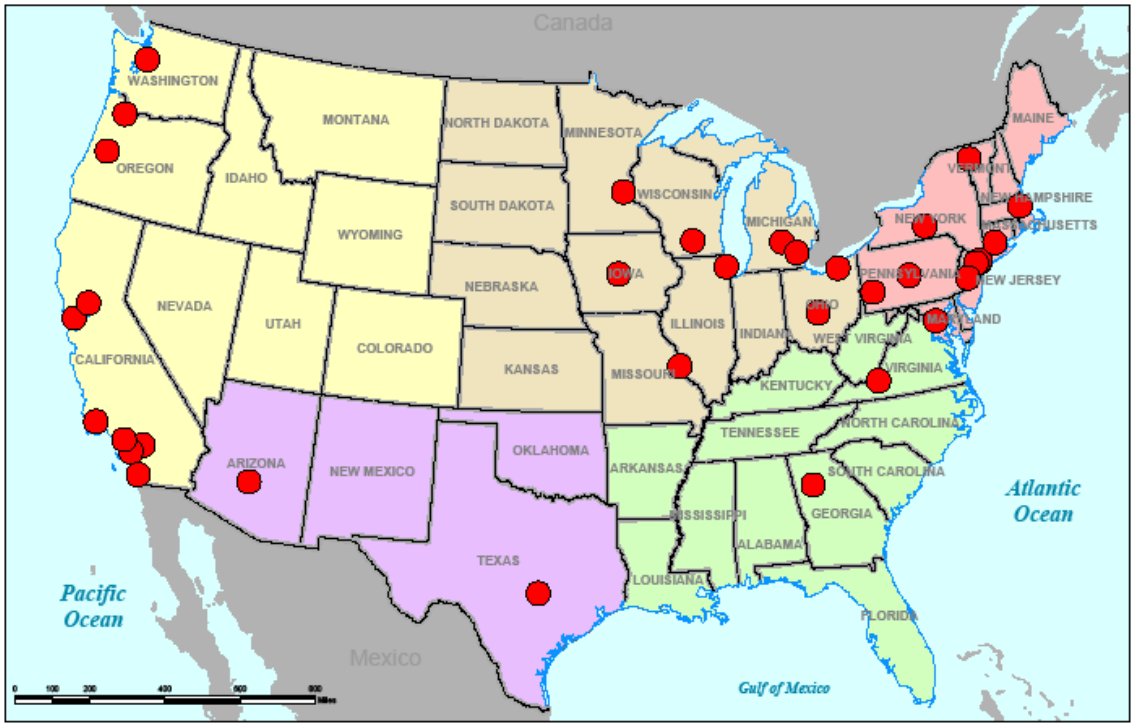


Figure 2
Geographic Distribution of Centers Surveyed

Legend
State Boundaries
Northeast
Southeast
Midwest
Southwest
West
Research Centers

Table 1 describes the regional geographic distributions of the 25 research centers that responded substantively to the survey. As demonstrated by this table, and the map, the regions with the lowest percentages of USRCs are the Southeast and Southwest. The other three regions (Northeast, West and Midwest) have higher numbers of research centers focused on sustainability research, as well as higher percentages of centers responding to the survey. We have provided links to the research centers that responded to our survey on the webpage of the Center for Sustainable Cities at USC: http://sustainablecities.usc.edu/resources/

Table 1. Research centers contacted and responding urban sustainability research centers with a relevant mission ("USRCs")

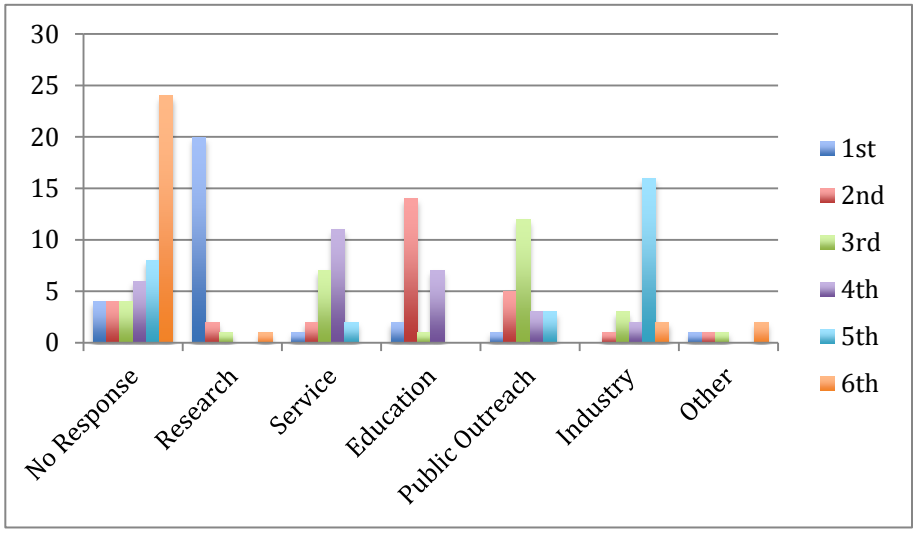
	Centers Contacted		Urban Sustainability Research Centers	
	Number	% of total	Number	% of total
Northeast	15	30.6%	6	24%
Southeast	3	6.1%	2	8%
Southwest	2	4.1%	1	4%
West	17	34.7%	8	32%
Midwest	12	24.4%	8	32%
Total	49		25	

The low number of research centers in the Southeast and Southwest cannot be interpreted as indicating that no significant research is being conducted in these regions. For instance, at the Georgia Institute of Technology in the Southeast region there are two research centers focused on issues central to urban sustainability. Similarly, the southwest region is home to the Arizona State University's Global Sustainability Institute, one of the most highly regarded research institutes in the country focusing on interdisciplinary sustainability. This global institute is home to several smaller research centers with a variety of focuses, but the responses from the Institute were incomplete.

1.3Main Objectives and Research Focuses of the Centers

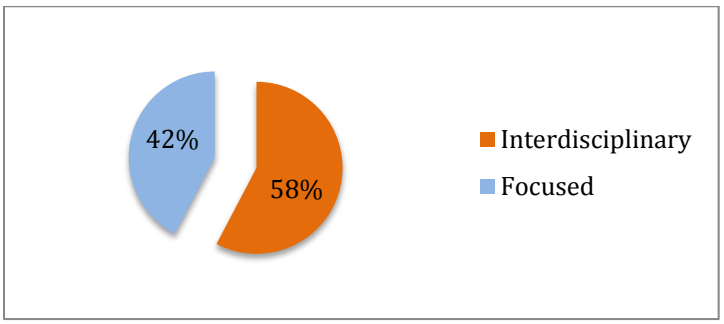
To distinguish between centers focused on research and those focused on other objectives such as community service or advancing the sustainability programs of the host university we created a survey question for our respondents to identify the main missions of their centers. This question revealed that, as expected, some of the centers contacted focus on objectives other than research, and that even among those than focus primarily on research, there are a variety of secondary focuses. Figure 3 shows the responses given to "Question 4: Research Focus", which asked respondents to rank the current objectives of the centers in order of importance to the responding center. (See Appendix 4 for the full questionnaire). The most common first objective for responding centers was clearly research, with 20 centers listing it as their primary objective. There was greater variation in secondary objectives. The most common second objective was education, the most common third objective was public outreach (followed by service), the most common fourth objective was service (followed by education) and the most common fifth objective was industry. The majority of respondents did not provide a sixth objective.

Figure 3. Center objectives in order of importance



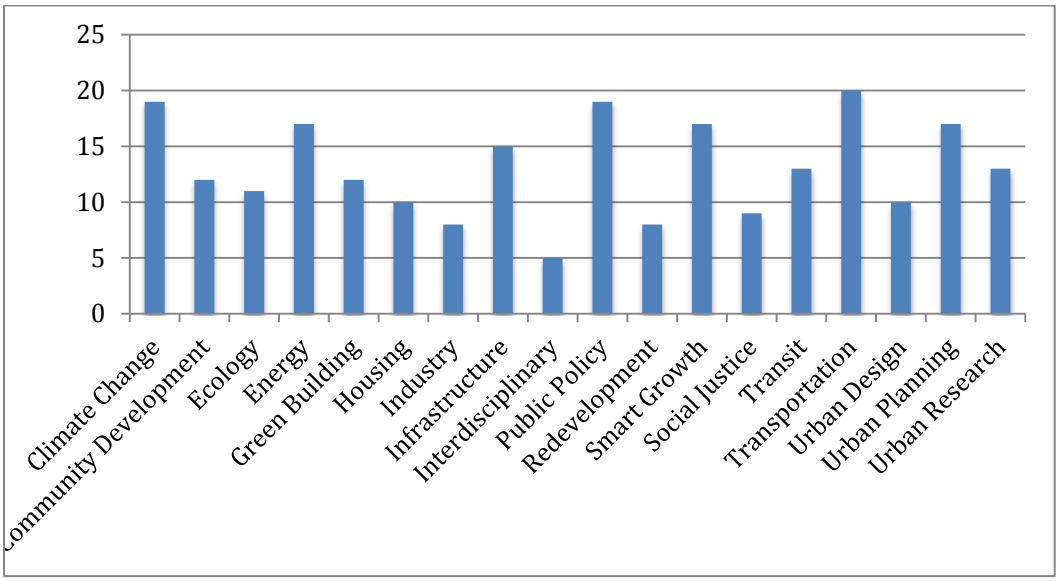
The research centers we located have varying core research areas: some focus on sustainability in an interdisciplinary sense, others focus on a specific segment of sustainability. Centers with a specific focus, were asked to specify their focus. A majority (15) of responding centers listed Interdisciplinary Sustainability as the core of their research (Figure 4).

Figure 4. Focus of responding centers: interdisciplinary vs. focused



Of the centers that listed a focus as their core research, the descriptions of the focus were as follows: biodiversity/ecology, green jobs, green building, new technologies for energy efficiency, energy, climate change adaptation/mitigation, transportation (two centers), interdisciplinary or multidisciplinary transportation (two centers), and land use and transportation. Thus, transportation is the most common theme and energy is the second most common theme for USRCs with a focus other than interdisciplinary sustainability (figure 5).

Figure 5. Number of USRCs researching each of the listed topics



We also requested the respondents to indicate which topics are researched at their centers from a list of topics. As demonstrated in Figure 5, transportation was the most commonly researched topic, with 20 of the USRCs indicating transportation research was conducted at their facilities. Public policy and climate change were tied as the second most popular topics of research with 19 centers performing research on each of these topics. Tied for third place were energy, smart growth and urban planning, with research being conducted on each of these at 17 different USRCs.

Respondents were also provided the opportunity to describe research conducted at their centers "other" than the types listed in the question. The responses to this were:

- Air quality, water, public health, agriculture
- Tourism and leisure travel, eco-labeling, modeling, tailpipe emissions
- Water
- Ecological foot print of cities
- Sustainability indicators, metrics and frameworks
- Traffic models, traffic simulation, air quality and emissions, environmental justice
- Air quality
- Economic development
- Workforce development – labor market research

Part II of this report provides a more in-depth discussion of research topics.

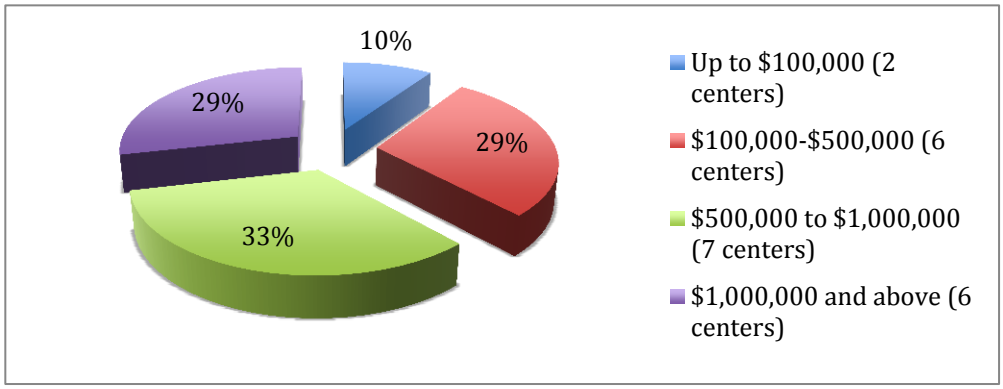
Chapter 2: Organizational Structure and Finances

This chapter discusses annual budget size and sources for the responding centers. It also discusses the perception of the ease or difficulty of obtaining funding for research for different research topics. It also presents basic information on the staff of the responding centers.

2.1 Financial Dimension of Research Centers

Twenty-one USRCs responded to the survey question inquiring into the size of their budgets. Thirteen centers reported annual budgets above $500,000. The majority report budgets between $500,000 and $1,000,000. A significant group of centers have budgets over $1,000,000, while a small minority has budgets of $100,000 or less (figure 6).

Figure 6. Budget size



Twenty USRCs responded to the survey question inquiring into the percentages of funds received from various types of funders. The responses to this question highlight the role of the universities in supporting the centers. 16 out of 20 centers indicated that they were funded by their universities.. Most centers also reported that they receive government funds (Table 2).

Table 2. Sources of funds for USCRs' budgets

	University	Government	Private Sector	Non-Profit	Other
Centers receiving this type of funds	16	15	12	8	1
Centers not receiving this type of funds	4	5	8	12	19

The proportion of funds from the various funding sources varies widely among the USRCs, but on average, the highest proportion of funds for funding a USRC comes from government sources (figure 7). Government funding comes from Federal, State, County, Local and other sources. Federal and state were the most frequent government funders, funding 21

and 22 centers, respectively. Local governments provided funding for ten centers while county governments provided funding for four centers and other types of governments provided funding to three centers (figure 8).

Figure 7. Average percentages of funding sources

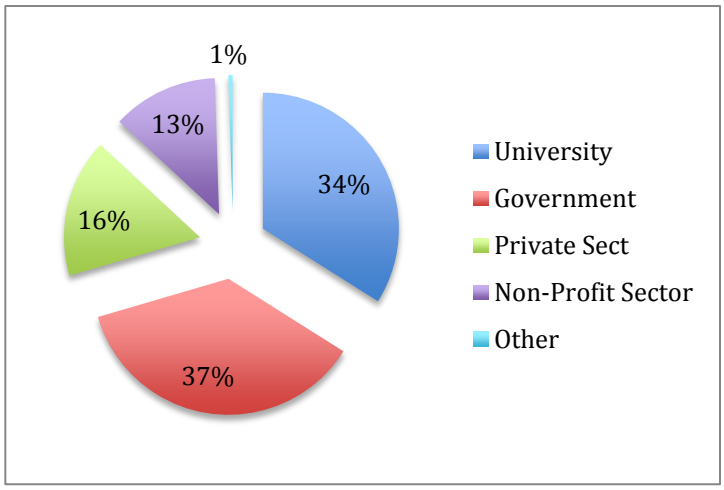


Figure 8. Sources of government funding

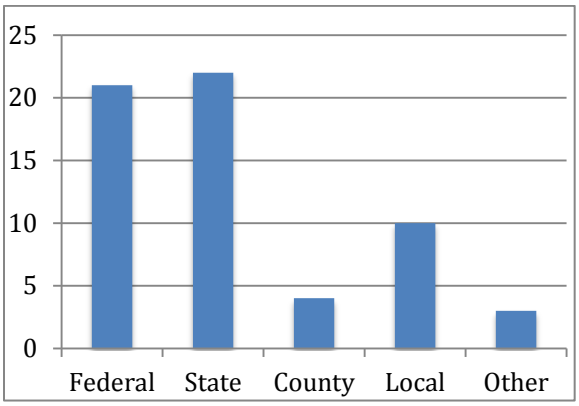
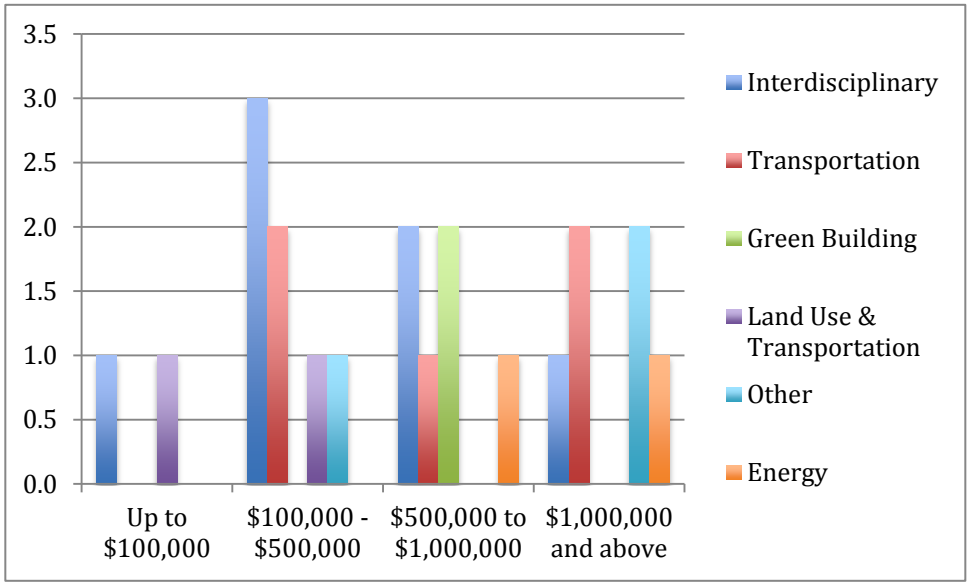


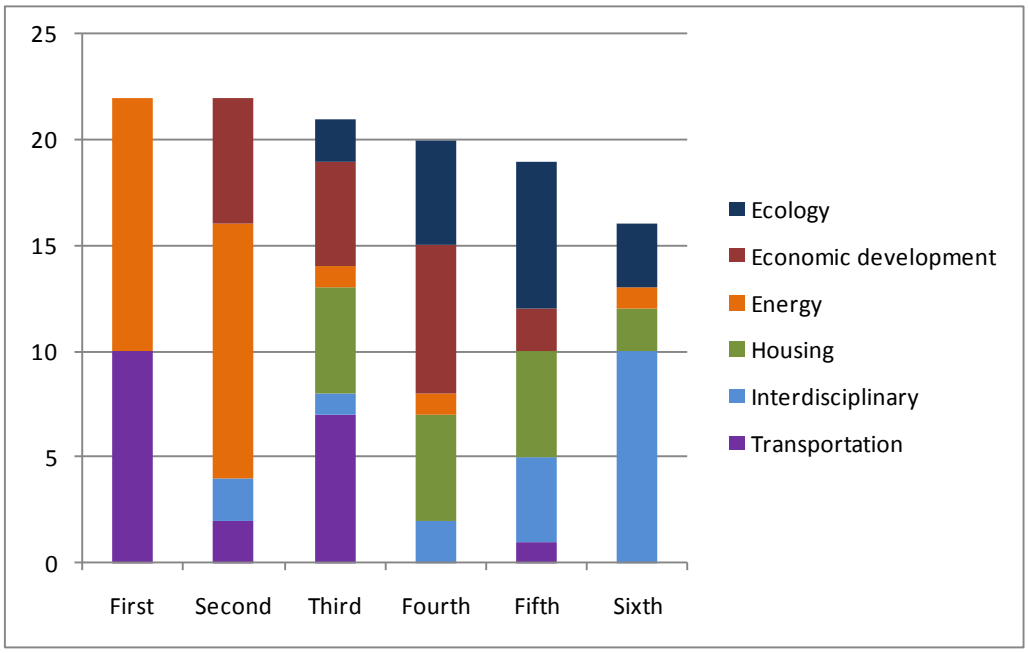
Figure 9 shows the number of centers at the various funding ranges organized by topic, as determined by their expressed main purpose or a main purpose evident from their name (for instance, if a center's name included the word "transportation", its main purpose was assumed to be transportation). The category "other" includes centers focused on climate change adaptation, and mitigation, green jobs, and planning and governance, the latter two of which had budgets at the highest level of funding.

Figure 9. Levels of funding by USRCs' area of focus



Survey respondents were also asked to rank (from 1-6, with 1 representing the greatest ease of funding, and six the most difficult) the ease of obtaining research funding for the following topics: integrated sustainability, transportation, housing, energy, economic development, and ecology. Figure 10 shows that survey respondents perceived that the easiest types of research for which to obtain funding are energy and transportation research. On the other hand, the type of research that survey respondents view as most difficult to obtain is integrated sustainable cities research.

Figure 10. Ease of obtaining funding for different types of research based on opinion of respondents



We expected that due to the current poor state of the economy, centers would report that their annual budgets are below average. But only two centers reported low levels of funding.

2.2 Characteristics of the Researchers

The USRCs varied greatly in the number and types of faculty, researchers and other individuals they employ or are affiliated with. Appendix 6, "Reported Center Personnel" displays the data compiled through survey responses and from data obtained from the centers' websites.

About 249 faculty members are reportedly working in the centers and more than 800 are somehow affiliated. In the average, each center has about 8 faculty members, but in reality, the centers are very different. Some do not have permanent faculty members and rely only on affiliated faculty; others have more than 50 faculty members that actively participate in the center's activity. A limited number also hire non faculty researchers.

Most centers employ dedicated staff for administrative duties. In the average, there are 8 administrative employees per center, but the individual organizational structures are very different. The smallest units have zero non faculty personnel, some are embedded in bigger research units and rely on the administrative resources of the larger centers and some have up to 54 non faculty members. Some of the employees also perform research duties.

Given the great variety of research staffing and faculty involvement, it is difficult to draw conclusions from the survey results without in-depth case studies to establish typologies of research centers.

Chapter 3: Conclusions on Center Characteristics

The first chapter of the report began with a discussion of the concept of sustainability as it applies to the urban context. After describing the survey and its administration, Chapters 1 and 2 focused on the geographical distribution of the centers responding to the survey, the research focus of the centers, as well as fiscal and administrative characteristics of the centers.

Major Findings from Survey Results

- University centers that conduct research on urban sustainability are not evenly distributed in the U.S., with greater concentrations along the Pacific coastal states, the North East and the Midwest, and fewer centers in the South East and South West.
- Most university centers have budgets below $1M relying on a diversity of funding sources.
- Most centers obtain funding from federal and state agencies.
- The perception of centers is that interdisciplinary research topics are the most difficult to fund.

Potential Policy Implications for Federal Policy

- Uneven geographic distribution of centers. Urban sustainability topics have a local/regional dimension. Filling gaps in regional research on urban sustainability may contribute to better policy outcomes in areas that lack research centers, since regional research may result in better understanding of regional contexts and receive greater regional attention and support.
- Obtaining support for interdisciplinary research in urban sustainability. The difficulty of obtaining support for interdisciplinary research is reflected in the relatively low budget size of most centers, under $1M, and the perceived difficulty of research centers to obtain funding support for interdisciplinary research. The Sustainable Communities Partnership is an early and noteworthy effort to address this problem. Such a partnership could be broadened and deepened among federal agencies, in particular, by including NSF.
- Dedicated, longer-term funding of urban sustainability research centers at universities. Urban sustainability challenges call for expanded university research capacity. Just as university transportation research centers and research in transportation have benefitted from dedicated, longer-term federal transportation funding, in the future, federal funding could be dedicated to the support of regional urban sustainability research centers.

Part II. Research Themes

Chapter 4: Main Research Themes

In this chapter, we first explain how we processed the survey results on the research projects that research centers identified. We then identify and discuss major themes, subthemes, and cross-cutting themes, with accompanying tables and graphics. Based on these results, we recommend topics for systematic research reviews focused on providing evidence for policy. We also identify topics for framing papers, that is, topics where there is insufficient empirical research that could benefit from papers that describe the existing literature, frame the policy issues and identify a research agenda.

In order to understand the current empirical research of the sustainability centers of the survey respondents, we requested a list of their most recent research projects and a brief summary of their content. Based on this information and on additional research on the centers' websites, the research team attributed keywords to each project (from a minimum of 1 to a maximum of 8 keywords for each project), for a total of 332 different keywords. We then standardized the keywords and compiled a database that includes 195 research projects from the 21 research centers that responded to this survey question.

In order to analyze the content of this rich dataset, we summarized the keywords and identified subgroups of research projects according to their dominant theme.

From this analysis the research efforts of the USRCs can be grouped into 7 main themes (Figure 11):

- Transportation (72 projects) 34.8% of the total number;
- Built environment and sustainability (53 projects), 25.6%;
- GHG emissions, climate change mitigation and climate change adaptation (26 projects) 12.6%.
- Urban issues (19 projects) 9.2%;
- Electric power (15 projects) 7.2%;
- Water (14 projects) 6.8%;
- Miscellaneous (8 projects) 3.9%.

4.1 Subthemes in Transportation

In order to better understand the focus of transportation research of the centers, we further divided the projects into subgroups. The resulting subthemes are diverse and range from modeling the relationship between land use and transportation to developing acceleration cycles for roundabouts and other traffic control tools. According to the secondary research

theme, we divided them in subgroups (table 3). In this heterogeneous subgrouping, land use and transportation and criteria pollutant emissions are the dominant sub themes.

Figure 11 - Sustainability research main research themes

Source: CSC – USC

Transportation
Built environment and sustainability
climate change mitigation or adaptation
Urban Issues
Electricity
Water
Other

Table 3. Research projects on transportation: subgroups

Subgroup	Number	Percent
Criteria pollution emissions reduction	10	13.9
Land Use - Transportation	9	12.5
Public Transit	8	11.1
GHG emissions and mitigation	7	9.7
Transportation behaviors	7	9.7
Transportation infrastructures	7	9.7
Personal transportation	7	9.7
Non Motorized Transportation	6	8.3
Materials for transportation infrastructure	5	6.9
Technology	3	4.2
Electricity and the electric car	3	4.2
Total	72	100.0

Source: CSC – USC research

4.2 Overlapping subthemes in Transportation

Many research projects have overlapping subthemes. The largest combination of topics are criteria pollutant emissions and air quality (6 projects) and land use/transportation and GHG emissions (5 projects, among which two focus on the implementation of SB 375[10]), followed by materials and infrastructures (4 projects, including the analysis of road pavements in bad weather) and health consequences of personal transportation.

Very few projects analyze the relationship between transportation and other main research themes, however, the projects that do address other research themes address very relevant issues, such as the relationship between the use of electric cars and electricity supply or the modeling of storm-water capture in suburban roads.

In this category, only 6 projects (8%) approach the issue specifically from the urban perspective, and three of the six analyze the relationship of urban form/land use to transportation and air quality.

4.3 Subgroups in the Built Environment Theme

The research projects about the **built environment and sustainability** were also divided into subgroups (Table 4).

Table 4. Research projects on the built environment and sustainability: subgroups

Subgroup	Number	Percent

[10] SB 375 requires metropolitan planning organizations to adopt a sustainable communities strategy as part of their regional transportation designed to achieve specific goals for the reduction of greenhouse gas emissions from automobiles and light trucks in a region. See http://www.arb.ca.gov/cc/sb375/sb375.htm.

Green buildings	16	30.2
Affordable housing	10	18.9
Technologies for green buildings	6	11.3
Building materials	6	11.3
Planning	5	9.4
Buildings energy efficiency	5	9.4
Urban sustainability	4	7.5
Water	1	1.9
Total	53	100.0

Source: CSC – USC research

The largest subgrouping of research projects in the Built Environment Theme is composed of projects that address the issues related to environmentally sustainable or green buildings and are mostly aimed at assessing cost and cost effectiveness of green building practices. Numerous other projects address specifically the use of information technology (IT) in new construction (6) and energy efficiency in buildings (7). A small group (5) also focuses on materials to reduce energy consumption in buildings.

Research projects that analyze affordable housing issues represent a large subgroup (10). They mainly focus on social justice and on tools and issues that link affordable housing to sustainability practices. Most of the projects in this group combine affordable housing retrofit, energy efficiency and health issues related to buildings. Infill housing and the relationship between affordable housing and sustainable infrastructures are also subjects of research.

Only four projects mention sustainability as their main theme, and they mainly concentrate on the definition of sustainability indicators.

4.4 Greenhouse Gas Emissions and Climate Change Theme

The third largest group of projects is focused on **GHG emissions and their mitigation and on climate change adaptation**. Half of these projects study GHG emissions (emissions from agriculture and emissions at the urban scale are the subtopics), while 10 projects examine the consequences of climate change and possible adaptation strategies.[11] Climate change adaptation strategies are strategies aimed at adapting communities or urban systems to the unavoidable impacts of climate change, such as strategies to respond to sea level rise, more intense flooding, or heat waves. Research on adaptation is mainly concerned with the urban dimension and with governance issues. Two projects focus on the economic impact of climate change, while others focus on stakeholder involvement to determine the impacts and assess the risk. Two of the latter projects use scenario techniques to predict how climate change will impact local areas and to arrive at agreement on adaptation strategies.

Research on climate change mitigation and on GHG emissions is focused on two important areas. One is the life-cycle and footprint analysis, which was initially concerned with

individual products' supply chain and has expanded to more complex phenomena such as the city, while the third is the analysis of the interaction between urban environment and ecosystems, which takes a systematic approach and takes into account the complexity of the reciprocal relationships between human and natural phenomena.

4.5 Urban Research Projects

A significant group of projects (19) has **urban perspectives** as the leading theme and makes an effort of integrating environmental, social and spatial aspects of sustainability. It is not a very coherent group, but the most numerous subgroups include research on urban ecology (5) and research on the relationship between urban environment and social phenomena (3). This group also includes research on urban form, urban history, urban redevelopment and urban growth. In this cluster a few projects have a design component and a small set makes intense use of remote sensing techniques to assess the extent of urban areas and to develop methods to screen different urban density patterns. To this category belongs the only project that focuses on *brownfields* redevelopment and addresses the health assessment of the redevelopment of an industrial area.

4.6 Production and Distribution of Electricity

The projects that have the **production and distribution of electricity** as the main theme are mostly concerned with renewable energy. More than half of them have renewable energy technologies as the main focus, such as solar tiles, the potential for aeroelastic wind farms, solar driven hydrogen fuel cells, and others. Only one project focuses on how to reduce GHG emissions through distributed generation.

Two projects under this theme have links with other main themes and are focused on the relationship between Plug-in Hybrids and energy production, which links to the transportation theme.

4.7 Water Research Projects

The group of projects under the **water** theme are mostly concerned with water supply (7 projects), and less focused on water quality (3). Water supply, in fact, is a relevant issue of climate change adaptation, one of the drivers of many centers' interest in this theme.

4.8 The "Other" Themes Category

The grouping under "**other projects**" includes a heterogeneous group of projects such as research on the life cycle assessment of agricultural products, on green jobs and on initiatives to educate the general public on climate change issues.

4.9 Cross-cutting Issues

We identified several cross-cutting themes that could be helpful in further understanding the research projects surveyed: technology and materials; urban issues; equity, health and justice; and climate change mitigation and adaptation. These cross-cutting themes were identified through further analysis of the project descriptors.

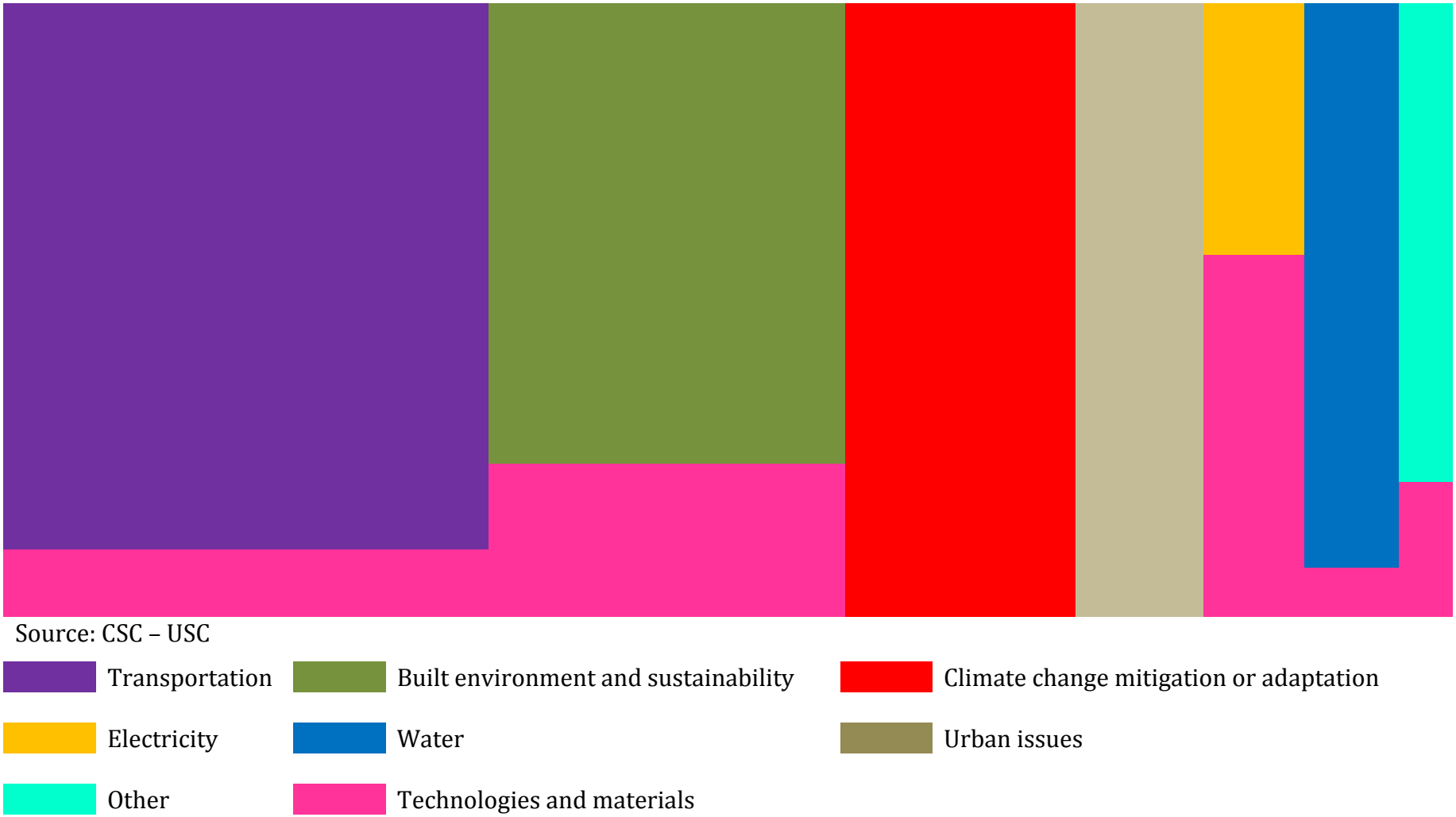
Technology and materials is an important cross-cutting theme that connects research projects in transportation, buildings and sustainability, electricity, water and other minor topics. About 17% of the research projects undertaken by USRCs are focused on innovation of processes and products. Projects focused on technology and materials were grouped primarily under the Electricity and under the Buildings themes (Figure 12). A large group of these projects were focused on improving renewable energy technologies, both solar and wind, while a small group focused on the nexus between renewable energy, electric cars and electric grid issues. Another group of projects analyzed the use of new materials and new technologies to improve energy efficiency in buildings.

Urban issues are also a relevant cross-cutting theme. About 14% of the projects that did not have urban sustainability as a primary theme approached the research from an urban perspective. Projects that deal with climate change and with water, in particular, analyzed the main issue as an urban problem (Fig. 13). The research on climate change mitigation with an urban dimension included projects with different focuses, e.g., projects on urban ecology, on ecological footprints, as well as on collaborative policy design. Research projects on climate change adaptation with an urban focus, on the other hand, were clustered in three groups. One group focused on measuring social and economic impacts of climate change, another focused on collaborative governance and stakeholder participation in policy design, and the third analyzed the relationship between water conservation and urban development.

We have clustered several social aspects of urban sustainability, *equity, health and environmental justice* as a cross-cutting theme. This cross-cutting theme was a consistent thread found in research projects classified under every theme (Fig. 14). Excluding projects that address affordable housing, about 11% of the research conducted in the centers surveyed was focused on issues related to equity and health impacts. Freight emissions and environmental justice, the health impact of energy efficiency measures, the equity of energy efficiency and renewable energy projects, and the connection between social and environmental characteristics of distressed neighborhoods were topics identified under this cross-cutting topic.

Different aspects of *climate change* were secondary themes in a small proportion of the projects. About 8% of the research that did not have climate change as the main topic included mitigation or adaptation as one of the aspects they considered (Fig. 15). Among the projects dealing with climate change as a secondary theme, a cluster of projects focused on the nexus between land use / transportation / GHG emissions.

Figure 12 -Sustainability research: research on technology and materials across main research themes



Source: CSC – USC

Figure 13 - Sustainability research: research on urban issues across main research themes

Source: CSC – USC

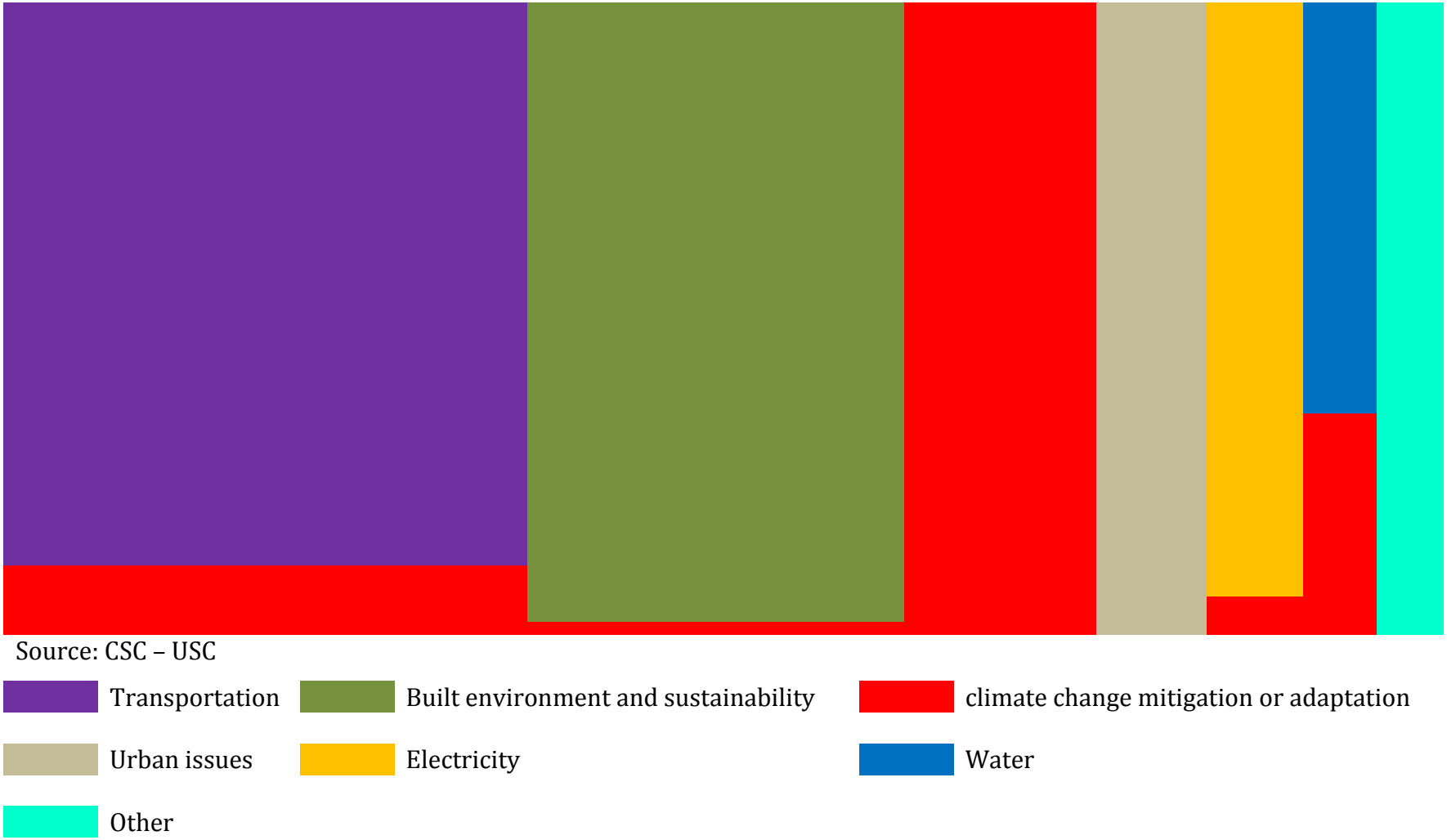
Transportation
Built environment and sustainability
Climate change mitigation or adaptation
Urban issues
Electricity
Water
Other

Figure 14 - Sustainability research: research on equity, health and justice across main research themes

Source: CSC – USC

Transportation
Built environment and sustainability
Climate change mitigation or adaptation
Electricity
Water
Urban issues
Other
Equity, health and environmental justice

Figure 15 - Sustainability research: research on climate change across main research themes



Source: CSC – USC

4.10 Topic Recommendations for Research Reviews

In this chapter, we have identified current major research themes, subthemes and cross-cutting issues of USRCs in US universities. The major aim of this part of the study is to identify topics for several major research reviews or syntheses in urban sustainability. A research synthesis is a systematic review of the evidence on a policy issue, for example, how to reduce vehicle miles traveled, or what strategies are effective in reducing water use in residential buildings.[12] The objective of the reviews would be to characterize major research on a topic, to identify the findings of the research and to assess the evidence and methods used in the research. The conclusion of such research reviews would be to identify evidence-based policies and action strategies in the topic areas, in effect, to identify what works and what doesn't work in a policy area.

Our recommendations are based on two major criteria. The first criterion is the frequency that a theme or subtheme was identified in the survey results. This is a rough indicator of the maturity of research in an area and the potential for synthesizing the research and assessing the evidence available for policy. For example, based solely on this criterion and our survey results, the topic of transportation would be the most ripe for research reviews. The second criterion is whether research syntheses have been conducted recently on the topic.

Transportation. On the basis of the first criterion, the transportation topic, especially the cluster of sub-themes on land-use transportation, emissions reduction, public transit, transportation behavior, non-motorized transportation, would be the first choice for a major research synthesis. But, in this case, a recent National Research Council Report (2009), as well as two recent meta-analyses (Ewing and Cervero 2010; Graham-Rowe et al (2011) [13] have examined the relationship between driving and the built environment, and the evidence for the relationship. As a result of these recent research reviews, taking into account the second criterion, we are inclined *not* to recommend a new research synthesis on this topic.

Built environment and sustainability. The built environment and sustainability was the second major research theme identified by our survey, and the evidence on this topic is not widely known. We would recommend two comissioned papers synthesizing the research on building sustainability, one focused on new housing construction, and another on retrofitting of the existing housing stock. Retrofitting the existing building stock presents different policy

[12] Often the terms research synthesis and meta-analysis are used interchangeably. But meta-analysis is now commonly understood as a type of research synthesis that uses statistical methods to combine results from different studies focusing on the same topic.

[13] U.S. National Research Council. 2009. *Driving and the Built Environment: The Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions*, Special Report 298, Committee for the Study on the Relationships among Development Patterns, Vehicle Miles Traveled, and Energy Consumption. Washington, DC: National Research Council; Ewing, R. and Cervero, R., 2010. "Travel and the Built Environment," *Journal of the American Planning Association* 76(3); Graham-Rowe, E., Skippon, S., Gardner, B. and Abraham, C., 2011. Can we reduce car use and, if so, how? A review of available evidence, *Transportation Research Part A: Policy and Practice.*

issues than new construction, in terms of cost-effectiveness, practical feasibility, different decision-makers, etc., that merits a separate synthesis.

Climate change. Based on our criterion, we should recommend another paper synthesizing the research on climate change mitigation and adaptation, since these topics place third in our survey. But from the standpoint of urban sustainability, two of the most important topics in climate change mitigation are urban form issues, which are covered by the travel and built environment literature discussed above, and the green buildings literature, for which we have already recommended a research review. However, there is one topic very important to climate change mitigation that is not directly addressed by the recent syntheses of the travel and built environment research, that is, the effectiveness of urban growth management strategies to reduce the conversion of land for urban purposes. Urban expansion reduces vegetation, which acts as carbon sinks. Land conversion is a major contributor to climate change. Over the past decade, empirical research has been published on this topic, which could be the basis for a research synthesis. The remaining climate change subtopic is urban adaptation to climate change. Here, we are undecided, since the research on this topic is just emerging, and it may be better to commission a research review in a few years.

Energy and electricity. The fourth ranking topic is production and distribution of electricity research, with a strong focus on renewable energy. This topic may be a good subject for a research synthesis, but further analysis of the existing literature may be necessary to assess whether the research identified is primarily focused on engineering aspects and whether such research has an urban orientation.

Water. The fifth ranking topic is water, supply and quality. This, we believe could be a good topic for a research synthesis, such a synthesis could focus on the effectiveness of local policies to address supply and quality issues, including evidence for sustainable strategies to deal with storm water runoff, flooding, best management practices to conserve energy, and the water-energy nexus[14] among others.

Urban ecology. The relationship between the urban and the natural environment, including urban open space, biodiversity, and ecosystem services, was not widely reported in the survey results. Some research centers surveyed for this study are making an effort to ground urban policies in the natural sciences, but the field is broad and the complexity is high. A summary of research on urban ecology that lays out the scientific foundation for urban policies aimed at sustainability could be very useful.

4.11 Topic Recommendations for Framing Papers

As we analyzed the topics of research projects conducted by the surveyed centers, several topics emerged, such as green jobs, where not much research was reported, but which are

[14] The water-energy nexus refers to the energy requirements for water supply and treatment, as well as the water requirements to produce energy. The energy requirements for water supply are of particular concern in the arid West.

important to the development of sustainable communities. As a result of discussions with the Urban Institute and HUD officials, we have also identified topics that could benefit from framing papers—that is, papers that discuss and categorize the existing literature on the topic, identify policy issues and develop a research agenda for future work to establish evidence for policy and action strategies.

Green jobs. The topic of green jobs, or, in general, of sustainable economic development did not emerge as a major topic or subtopic. Although there is a growing literature on the economic development prospects that the renewable and clean energy industries could open up for communities, there is a lack of empirical research in the area to warrant a research review. However, this topic area would benefit from a framing paper to identify areas for empirical research.

Environmental justice. Issues of environmental justice emerged as a cross-cutting issue. There is much empirical work establishing environmental injustices based on race[15], but there is not much empirical work on the effectiveness of strategies to reduce environmental inequities. This could be a good topic for a framing paper.

Inclusive or diverse housing/neighborhoods. Issues of social inclusiveness or diversity in the context of housing emerged as a cross-cutting issue. Here again there is much empirical work that establishes the segregation of housing, and some work that analyzes certain policies to reduce segregation, but a framing paper that assesses the literature as a whole and sets out a policy and research agenda on measures to increase diversity or inclusiveness in housing and neighborhoods could be useful.[16]

Urban Heat Island Effect. Research on the urban heat island effect has been conducted for the last three decades, and with a warming climate, this effect will be magnified in cities. The urban heat island effect has been established empirically, and many cities are using diverse strategies to reduce the effect. But there is a lack of empirical research on the effectiveness of these strategies to reduce the effect. A framing paper that describes the existing literature and identifies the research needed to provide evidence for the effectiveness and cost effectiveness of policies would be very useful.

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[15] Ringquist, EJ. 2005. "Assessing Evidence of Environmental Inequities: A Meta-Analysis ," *Journal of Policy Analysis and Management* 24(2): 223–47.

[16] A good effort towards this end is Emily Talen's and Cliff Ellis's "Compact and Diverse: The Future of American Urbanism," in H. Blanco and M. Alberti (Eds.), 2009. "Hot, Congested, Crowded and Diverse: Emerging Research Agendas in Planning," *Progress in Planning* 71(3): 153–205.

Chapter 5. Conclusions on Research Themes

In order to conduct a first scan of the research conducted by urban sustainability research centers, we analyzed the responses of the centers, and conducted further web research on center projects and publications. We identified 195 research projects, assigned keywords, and grouped the projects into major themes, subthemes and cross-cutting topics. The major topics based on number of projects, in order of number of projects: transportation (72 projects); built environment and sustainability (including affordable housing) (53 projects); climate change (26 projects); urban issues (19 projects); electric power (15 projects); water (14 projects).

Based on these results, and our knowledge of the fields, we identified several topics for research reviews. We also identified several topics in areas where the empirical research is scarce as good topics for framing papers. Framing papers are aimed at describing the existing literature on the topic and developing a research agenda that will provide evidence for policy and action strategies.

We recommend *research syntheses* on the following topics:

- Building sustainability—focusing on the effectiveness and cost effectiveness of sustainable measures on new construction
- Building sustainability—focusing on the effectiveness and cost-effectiveness of sustainability measures for the existing housing stock, or retrofitting the existing housing stock
- Climate change—focusing on the effectiveness of urban growth management strategies to reduce conversion of rural land for urban uses
- Water Supply—focusing on the effectiveness of policies and strategies to conserve water, improve water quality and supply issues.
- Urban Ecology—focusing on what the results of empirical research on urban ecosystem services imply for urban and neighborhood development

We recommend *framing papers* on the following topics:

- Green jobs—focused on developing a research agenda on measures to create green jobs
- Environmental justice—focused on strategies to reduce environmental inequities
- Inclusive/diverse housing and neighborhoods—focused on developing a research agenda on measures to improve diversity or inclusiveness.
- Urban heat island effect—focused on a research agenda on the effectiveness of measures to reduce the effect

Appendix 1
Research Centers Contacted

Center Name	University name	State	Region	Did Center Respond?	Is Center's Mission or Research Relevant?	Was Response Substantive and Ccomplete?
Remaking Cities Institute	Carnegie Mellon University	Pennsylvania	Northeast	No	N/A	N/A
Center on Urban Poverty and Social Change	Case Western Reserve University	Ohio	Midwest	No	N/A	N/A
Earth Institute	Columbia University	New York	Northeast	No	N/A	N/A
P-REX	Massachusetts Institute of Technology	Massachusetts	Northeast	No	N/A	N/A
Land Policy Research Program	Michigan State University	Michigan	Midwest	No	N/A	N/A
Center for Sustainability at Penn State	Pennsylvania State University	Pennsylvania	Northeast	No	N/A	N/A
Center for Sustainable Processes and Practices (CSP2)	Portland State University	Oregon	Pacific	No	N/A	N/A
Center for Urban Restoration Ecology	Rutgers, The State University of New Jersey	New Jersey	Northeast	No	N/A	N/A
Berkeley Institute of the Environment	University of California, Berkeley	California	Pacific	No	N/A	N/A
Scripps Institution of Oceanography: California Applications Program and California Climate Change Center	University of California, San Diego	California	Pacific	No	N/A	N/A
Sustainability Solutions Institute	University of California, San Diego	California	Pacific	No	N/A	N/A
Ocean and Coastal Policy Center	University of California, Santa Barbara	California	Pacific	No	N/A	N/A
National Center for Smart Growth Research and Education	University of Maryland, College Park	Maryland	Northeast	No	N/A	N/A
Hixon Center for Urban Ecology	Yale University	Connecticut	Northeast	No	N/A	N/A

Center Name	University name	State	Region	Did Center Respond?	Is Center's Mission or Research Relevant?	Was Response Substantive and Ccomplete?
Center for Urban Research	City University of New York	New York	Northeast	Yes	No	N/A
Center for Resilience	The Ohio State University	Ohio	Midwest	Yes	No	N/A
Center for Future Urban Transport	University of California, Berkeley	California	Pacific	Yes	No	N/A
Center for Energy Efficient Design (subcenter of IEE)	University of California, Santa Barbara	California	Pacific	Yes	No	N/A
The Institute for Energy Efficiency (IEE)	University of California, Santa Barbara	California	Pacific	Yes	No	N/A
Tyson Research Center	Washington University in St. Louis	Missouri	Midwest	Yes	No	N/A
Center for Urban Forest Research	University of California, Davis	California	Pacific	Yes	No	N/A
Global Institute of Sustainability–Sustainable Cities Network	Arizona State University	Arizona	Southwest	Yes	Yes	No
The Center for Sustainable Urban Development	Columbia University	New York	Northeast	Yes	Yes	No
Center for Quality Growth and Regional Development	Georgia Institute of Technology	Georgia	Southeast	Yes	Yes	No
The Institute for Sustainable Cities	City University of New York	New York	Northeast	Yes	Yes	Yes
Center for a Sustainable Future	Cornell University	New York	Northeast	Yes	Yes	Yes
Brook Byers Institute for Sustainable Systems	Georgia Institute of Technology	Georgia	Southeast	Yes	Yes	Yes
Center for Transportation Research and Education: Sustainable Transportation Systems Program	Iowa State University	Iowa	Midwest	Yes	Yes	Yes
Northwestern Institute for Sustainable Practices	Northwestern University	Illinois	Midwest	Yes	Yes	Yes
Rutgers Center for Green Building	Rutgers, The State University of New Jersey	New Jersey	Northeast	Yes	Yes	Yes

Center Name	University name	State	Region	Did Center Respond?	Is Center's Mission or Research Relevant?	Was Response Substantive and Ccomplete?
Institute for Sustainability, Planning and Governance	The College of New Jersey	New Jersey	Northeast	Yes	Yes	Yes
Institute for Energy and the Environment	The Ohio State University	Ohio	Midwest	Yes	Yes	Yes
Center for Sustainable Development	The University of Texas at Austin	Texas	Southwest	Yes	Yes	Yes
Center for a Sustainable California	University of California, Berkeley	California	Pacific	Yes	Yes	Yes
Sustainable Transportation Center of the Institute for Transportation Studies	University of California, Davis	California	Pacific	Yes	Yes	Yes
Institute of Transportation Studies	University of California, Irvine	California	Pacific	Yes	Yes	Yes
Blakely Center for Sustainable Suburban Development	University of California, Riverside	California	Pacific	Yes	Yes	Yes
Center for Sustainable Systems	University of Michigan	Michigan	Midwest	Yes	Yes	Yes
Metropolitan Design Center	University of Minnesota	Minnesota	Midwest	Yes	Yes	Yes
Center for Sustainable Building Research	University of Minnesota, Twin Cities	Minnesota	Midwest	Yes	Yes	Yes
Sustainable Cities Initiative	University of Oregon	Oregon	Pacific	Yes	Yes	Yes
Mascaro Center for Sustainable Innovation	University of Pittsburgh	Pennsylvania	Northeast	Yes	Yes	Yes
Center for Sustainable Cities	University of Southern California	California	Pacific	Yes	Yes	Yes
Transportation Research Center	University of Vermont	Vermont	Northeast	Yes	Yes	Yes
Northwest Center for Livable Communities	University of Washington	Washington	Pacific	Yes	Yes	Yes
Urban Ecology Research Laboratory	University of Washington	Washington	Pacific	Yes	Yes	Yes
Center for Sustainability and the Global Environment	University of Wisconsin–Madison	Wisconsin	Midwest	Yes	Yes	Yes

Center Name	University name	State	Region	Did Center Respond?	Is Center's Mission or Research Relevant?	Was Response Substantive and Ccomplete?
Metropolitan Institute	Virginia Tech	Virginia	Southeast	Yes	Yes	Yes
Initiative for Sustainability and Energy at Northwestern	Northwestern University	Illinois	Midwest	Yes	Yes	Yes

Appendix 2

Template of Initial Outreach E-Mail to Research Centers

Greetings.

This summer, in connection with a grant from the Urban Institute to identify research conducted on sustainable cities in university centers, the Center for Sustainable Cities at the University of Southern California is compiling a comprehensive list of centers specializing in such research located at universities in the United States and Canada. You are receiving this email because we have identified the [name of research center] as one such facility and we are hoping you will assist us by responding to a web survey about your center's work.

We define sustainability broadly to include environmental, economic and social aspects. In addition, we have identified several subcategories of sustainability—Ecology, Energy, Public Policy, Smart Growth/Planning, and Interdisciplinary Sustainability—which help us further understand the scope of research currently being conducted in this field.

Within the next week, you will be receiving a surveymonkey.com survey soliciting information about your research center, along with an example completed by the Center for Sustainable Cities. There will be approximately 20 questions seeking information about your facility's personnel, resources, research, history and goals. Please respond as fully as you are able and if you have any questions, do not hesitate to contact my research assistant, Michelle Buchmeier at mbuchmei@usc.edu or (760) 809-8157.

Yours truly,

p.p. Michelle Buchmeier

on behalf of Hilda Blanco

Interim Director, Center for Sustainable Cities

Appendix 3

Template of E-Mail to Research Centers Containing Link to Survey

Greetings [Researcher's name],

Approximately one week ago you received an email from me soliciting your assistance in a Center for Sustainable Cities research project compiling a comprehensive list of university research centers specializing in sustainable cities research. Here is the link to the survey collecting the information for our project:

http://www.surveymonkey.com/s/ZF96MFC

The person who responds to the survey should have adequate knowledge of your center to respond to questions regarding its personnel, resources, research, recent history and goals. If they have any questions or need assistance, they should not hesitate to contact my research assistant, Michelle Buchmeier, at mbuchmei@usc.edu or (760) 809-8157.

Thank you kindly for your assistance.

Yours truly,

p.p. Michelle Buchmeier

on behalf of Hilda Blanco

Interim Director, Center for Sustainable Cities

****

[PREVIOUS EMAIL]

Greetings,

This summer, in connection with a grant from the Urban Institute to identify research conducted on sustainable cities in university centers, the Center for Sustainable Cities at the University of Southern California is compiling a comprehensive list of centers specializing in such research located at universities in the United States and Canada. You are receiving this email because we have identified your center as one such facility and we are hoping you will assist us by responding to a web survey about your center's work.

We define sustainability broadly to include environmental, economic and social aspects. In addition, we have identified several subcategories of sustainability—Ecology, Energy, Public Policy, Smart Growth/Planning, and Interdisciplinary Sustainability—which help us further understand the scope of research currently being conducted in this field.

Within the next week, you will be receiving a surveymonkey.com survey soliciting information about your research center, along with an example completed by the Center for Sustainable Cities. There will be approximately 20 questions seeking information about your facility's personnel, resources, research, history and goals. Please respond as fully as you are able and if you have any questions, do not hesitate to contact my research assistant, Michelle Buchmeier at mbuchmei@usc.edu or (760) 809-8157.

Yours truly,

p.p. Michelle Buchmeier

on behalf of Hilda Blanco

Interim Director, Center for Sustainable Cities

Appendix 4

Sustainability Centers Survey

Sustainability Centers

1. Introduction

We are seeking information about research centers affiliated with universities that focus on sustainability. For the sake of simplicity, we use the term "center" throughout this survey, which we loosely define as an organized group of researchers based under a single entity with shared funding, administration and communication but which need not have its own offices or laboratory.

For the purposes of our research, we define "sustainability" broadly to include environmental, social, and economic aspects of sustainability.

2. General questions

1. What is the name of the sustainability research center for which you are responding to this survey?
2. What is the name of the center's host university?
3. What is the name of the individual completing this questionnaire?
4. Please provide a telephone number and e-mail address so that we may contact you if we have questions regarding your responses to this survey.

3. Personnel

1. Please list the names of the researchers based in your research center and working on sustainability-related projects and, for each, (a) their affiliations with the host university, (b) whether they are tenured, tenure track or non-tenure track, and (c) full-time or part-time.
2. How many nonfaculty staff members does your research center employ?
3. Please indicate which of the following functions the non-faculty staff members perform at your research center (select all that apply):
    a. Research
    b. Clerical Work
    c. Accounting
    d. Human Resources
    e. Field Work
    f. Scheduling
    g. Editing
    h. Statistical Analysis
    i. Grant Writing

4. Research Focus

1. We would like to know about the current objectives of your center. Please rank (1–6) the following objectives in order of importance for your center:

	1 (most important)	2	3	4	5	6 (Least important)
Research						
Service						
Education						
Public Outreach						
Industry						
Other						

If you selected "Other", please specify

2. The research centers we located have varying core research areas: some focus on sustainability in an interdisciplinary sense, others focus on a specific segment of sustainability such as energy, transportation, or green building. Which best characterizes your research center's core research area?
    a. Focus on interdisciplinary sustainability
    b. Focus on a specific segment of sustainability
    If your research is focused on a specific segment of sustainability, please specify what that segment is:

3. Sustainability research often crosses disciplines. Besides your center's primary focus area, on what areas do the researchers in your center work?

a. Climate change
b. Community development
c. Ecology
d. Energy
e. Green building
f. Housing
g. Industry
h. Infrastructure
i. Interdisciplinary
j. Public policy
k. Redevelopment
l. Smart growth
m. Social justice
n. Transit
o. Transportation
p. Urban design
q. Urban planning
r. Urban research
s. Other (please specify)

4. Please list and provide a brief description of projects pertaining to sustainability currently being pursued by researchers in your center. (Feel free to cut and paste this information from an existing source.)
5. Please list and provide a brief description of projects at your center pertaining to sustainability that were completed over the last 36 months. (Feel free to cut and paste this document from an existing source.)

6. In the field of sustainability, researchers from various institutions and/or sectors often collaborate with each other. Please check off all the types of organizations with which your center's researchers regularly collaborate:
    a. Community organizations
    b. Local government
    c. Other universities
    d. Private sector
    e. State government
    f. Student groups
    g. Our center does not regularly collaborate with other organizations.
    h. Other (please specify)

5. Resources

1. Does your research center have a dedicated physical facility?
    a. Yes
    b. No
2. Please indicate the approximate percentage of your center's funding that comes from the following sources. Enter the number as a decimal, with no non-numerical characters (i.e. enter ten percent as .10):
    a. University
    b. Government
    c. Private sector
    d. Non-profit
    e. Other
3. Which types of government entities provide your center with funding? (Mark all that apply.)
    a. Federal
    b. State
    c. County
    d. Local
    e. Other
    f. N/A
4. Is an annual report or progress report for your center publicly available?
    a. Yes
    b. No
    If "yes", how may we obtain a copy of the latest such report?
5. Which range applies to the size of your center's budget for the last full fiscal year?
    a. Up to $100,000
    b. $100,000 to $500,000
    c. $500,000 to $1,000,000
    d. $1,000,000 and above
6. Was the last full fiscal year's budget high, normal or low in comparison to your center's average yearly budget?
    a. high

b. normal
c. low

7. We understand that certain research topics may have easier access to funding. In your opinion, what is the relative ease of obtaining funding for the following areas of sustainability research. Please provide a ranking from 1-6, with 1 being the least difficulty in obtaining research and 6 being the most difficulty in obtaining research.

	1 (most important)	2	3	4	5	6 (Least important)
Ecology						
Economic development						
Energy						
Housing						
Integrated sustainable cities						
Research						
Transportation						

6. Other researchers

1. As we plan to compile a comprehensive list of sustainability researchers, we'd appreciate it if you would list the names of sustainability-focused researchers with whom you are familiar so we may ensure our information is as complete as possible.

Appendix 5

University Sustainability Research Centers Included in Survey Results

1. Blakely Center for Sustainable Suburban Development, University of California, Riverside
2. Brook Byers Institute for Sustainable Systems, Georgia Institute of Technology
3. Center for a Sustainable California, University of California, Berkeley
4. Center for a Sustainable Future, Cornell University
5. Center for Sustainability and the Global Environment, University of Wisconsin–Madison
6. Center for Sustainable Building Research, University of Minnesota, Twin Cities
7. Center for Sustainable Cities, University of Southern California
8. Center for Sustainable Development, The University of Texas at Austin
9. Center for Sustainable Systems, University of Michigan
10. Center for Transportation Research and Education: Sustainable Transportation Systems Program, Iowa State University
11. Initiative for Sustainability and Energy at Northwestern, Northwestern University
12. Institute for Energy and the Environment, The Ohio State University
13. Institute for Sustainability, Planning and Governance, The College of New Jersey
14. Institute of Transportation Studies, University of California, Irvine (with affiliated centers at the Berkeley, Davis and Los Angeles campuses of the University of California)
15. Mascaro Center for Sustainable Innovation, University of Pittsburgh
16. Metropolitan Design Center, University of Minnesota
17. Metropolitan Institute, Virginia Tech
18. Northwest Center for Livable Communities, University of Washington
19. Northwestern Institute for Sustainable Practices, Northwestern University
20. Rutgers Center for Green Building, Rutgers, the State University of New Jersey
21. Sustainable Cities Initiative, University of Oregon
22. Sustainable Transportation Center of the Institute for Transportation Studies, University of California, Davis
23. The Institute for Sustainable Cities, City University of New York
24. Transportation Research Center, University of Vermont
25. Urban Ecology Research Laboratory, University of Washington

Appendix 6

Reported Center Personnel

* Data were obtained from centers' web sites because they were not provided, or were incomplete, in the survey response.

Center name	Host university	No. tenured or tenure-track faculty	No. full-time faculty, untenured or unspecified	No. full-time nonfaculty researchers	No. part-time researchers	Affiliated faculty or researchers	Emeritus faculty	Staff	Does staff conduct research?
*Global Institute of Sustainability	Arizona State University		86					54	No data
CUNY Institute for Sustainable Cities	City University of New York	3						12	Yes
Center for Urban Research	City University of New York Graduate Center			1	2			10	Yes
*Center for Sustainable Urban Development	Columbia University		1	2		4		6	Yes
Center for a Sustainable Future	Cornell University					Approx. 230		2	No
*Center for Quality Growth and Regional Development	Georgia Institute of Technology		5	7		2		2	No
Brook Byers Institute for Sustainable Systems	Georgia Institute of Technology (Georgia Tech)		3			30		5	No data
Sustainable Transportation Systems Program	Iowa State University		2	2				Works under the Institute for Transportation, which employs	Yes

Center name	Host university	No. tenured or tenure-track faculty	No. full-time faculty, untenured or unspecified	No. full-time nonfaculty researchers	No. part-time researchers	Affiliated faculty or researchers	Emeritus faculty	Staff	Does staff conduct research?
								approx. 50 staff	
Initiative for Sustainability and Energy	Northwestern University	2						4	No
*Northwestern Institute of Sustainable Practices	Northwestern University					31			No
*Rutgers Center for Green Building	Rutgers University		7	6				Approx. 6	Yes
Institute for Sustainability Planning and Governance	The College of New Jersey							8	Yes
Institute for Energy and the Environment	The Ohio State University	0				300		3	Yes
*Sustainable Transportation Center	University of California, Davis		1	2		56		2	No data
Center for a Sustainable California	University of California, Berkeley	1	1		2			3	Yes
Institute of Transportation Studies	University of California, Irvine	13	3	9	1		1	4	Yes
Center for Sustainable Suburban Development	University of California, Riverside	4						2.45 FTE	No
Center for Sustainable Systems	University of Michigan	4 tenured full time, 1 tenured part time	2		3			27	Yes
Center for Sustainable Building Research	University of Minnesota		10					15	Yes
Metropolitan Design Center	University of Minnesota	1		3				6	Yes
Sustainable	University of		23		4			4	Yes

Center name	Host university	No. tenured or tenure-track faculty	No. full-time faculty, untenured or unspecified	No. full-time nonfaculty researchers	No. part-time researchers	Affiliated faculty or researchers	Emeritus faculty	Staff	Does staff conduct research?
Cities Initiative	Oregon								
Mascaro Center for Sustainable Innovation	University of Pittsburgh		26					2	No
Center for Sustainable Cities	University of Southern California	1	6					1 (.50 FTE)	Yes
*Center for Sustainable Development	University of Texas at Austin		24	1				6	Yes
Transportation Research Center	University of Vermont			4		35		11	Yes
*Northwest Center for Livable Communities	University of Washington–Seattle					approx. 130		0	No data
Urban Ecology Research Laboratory	University of Washington–Seattle	1		1				1	Yes
SAGE (Nelson Institute Center for Sustainability and the Global Environment)	University of Wisconsin–Madison	6	1		1			6	Yes
*Tyson Research Center	Washington University in Saint Louis		16	7				6	Yes