

Sprawleigh: Generating Sustainable Solutions for Urbanization Impacts

A Case from Raleigh, North Carolina

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Summary

This case study focuses on the challenges of a university set in a rapidly increasing urban environment. Urbanization is related to a variety of environmental, societal, and economic impacts including ecosystem fragmentation, development of infrastructure, increased number of vehicles on roadways, increased impervious surface area in watersheds, and greater segregation of residential development according to income. Higher education institutions, especially those located in cities, have been identified as resources that can contribute to reaching sustainability goals (Molnar, et al., 2011). Many universities have created strategic sustainability plans to set goals for attaining sustainable campus solutions (White, 2014). North Carolina State University's Sustainability Strategic Plan "is a five-year roadmap that builds upon the university's strengths, momentum, and decades of sustainability progress" (NCSU, 2017). The university also offers a Sustainability Fund, honoring students, staff, and faculty members competitive grants for sustainability-related campus facilities improvements, educational programs, research, and student internships. A student-led board manages the Fund and chooses the award recipients. To encourage early student engagement in sustainable initiatives on campus, the Environmental First Year Program's final project requires small groups of students (4-5 per group) to generate feasible proposal ideas, draft a grant for submission, and pitch their ideas to their classmates. Students build upon the knowledge gained throughout the course including the concepts of sustainability, energy, urban watersheds, global environmental change, and environmental justice. Because of this, these topics are recommended being discussed prior to this case study. Each student group will find and analyze quantitative data to determine the metrics for assessment of their proposal, the budget of their plan, and cost savings to the university. Students will also gather qualitative data via interviewing an appropriate campus partner. Formative assessments occur as students draft sections of the grant. Summative assessments occur when students pitch their ideas to the class and submit the final version of their grant proposal.

This case should allow for group work and homework time outside of class. This case study will use two class periods (each total of 155 minutes). Class 1 of the case study will consist of discussing the overview and purpose of the case study and introducing the checkpoint assignments that will be completed as groups outside of class time (checkpoint assignments are discussed further in the activities section of these notes). Class 2, dedicated for this case study, will occur after students complete all three checkpoints, and will consist of student pitch presentations (also discussed further in the activities sections of these notes). The checkpoint assignments will require approximately 3-4 weeks of outside work.

What level is this case appropriate for?

- First Year Experience
- Lower Level Undergraduate
- Upper Level Undergraduate

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S-E Learning Goals

1. Co-develop research questions
 - a. Identify disciplines and approaches to the problem
Related activities: Through small group discussion, students will need to identify their area of focus (ex. Energy, transportation, food, etc.)
 - b. Communicate across discipline boundaries
Related activities: Student grant proposal pitches will require each group to communicate their ideas clearly to their peers as a general public audience.
 - c. Identify potential users of and applications for research findings
Related activities: Each student group must identify an appropriate campus partner. In addition, they will articulate how their project will benefit specific users, as well as the impacts to the broader vision.
2. Find, analyze, and synthesize existing data
 - a. Identify data sources, appropriate tools, evaluate the quality of data, and manage data
Related activities: Students will be required to find appropriate and adequate data to determine whether their ideas are feasible. In addition, they will need to outline a budget, as well as research the cost of specific materials and services.
 - b. Understand the different kinds of data and research methods used by relevant disciplines in the natural and social sciences
Related activities: Students will use quantitative data to estimate the budget and costs associated with their plan and qualitative data through interviews with a campus partner.
 - c. Integrate different types of data
Related activities: By combining the information learned from both qualitative and quantitative data, students will be able to determine the feasibility and anticipated outcomes of their projects.

Student Learning Objectives

1. Generate solutions that address a sustainability problem on campus.

2. Collaborate effectively with your team and campus partner(s).
3. Use critical and creative thinking skills to research and design the project to the Campus Sustainability Plan.
4. Create a team pitch to articulate your proposed plan.
5. Use feedback received from team pitch to revise the grant proposal.

Course Learning Objectives

1. Analyze environmental sciences majors, disciplines, and careers in relation to their interests,
2. Explore and articulate complex environmental challenges using systems-, critical- and creative-thinking,
3. Evaluate solutions to different environmental case studies using data interpretation, reporting, and quantitative reasoning.

Course Background, Prerequisites, and Time Allocation

This case has been designed to follow at the end of a first-year student course and can be adapted for other introductory environmental science, environmental studies, and/or sustainable conservation courses. The students in this particular course have already declared a environmentally-focused major such as environmental science, environmental technology, natural resources, forestry, or fisheries and wildlife. This case concludes the course and over the semester, students have learned about the following topics and concepts:

- Sustainability
 - The three pillars of sustainability (the three Ps): People, Planet, and Profit
 - How can someone achieve sustainability?
 - Why would someone want to achieve sustainability?
- Energy
 - Energy efficiency and use
 - Campus energy consumption
 - Costs and benefits of various energy sources
- Urbanization and urban streams
 - Water quality
 - Storm water runoff
 - Urban stream restoration
- Global environmental change
 - Sea-level rise
 - Coastal changes
- Environmental justice
 - Current and historic social, economic, and environmental conditions of traditionally marginalized neighborhoods and communities

This course meets once a week for 155 minutes for 16 weeks. This case should allow for group work and homework time outside of class. This case study will use two class periods (each total of 155 minutes). The first class is used to discuss the overview and purpose of the case study and the checkpoint assignments, especially introducing the first assignment, which will be due the following week. The second class dedicated for this case study will occur after the three checkpoints are due (discussed further in the activities section of these notes). Class number 2

will consist of student pitch presentations (also discussed in the activities sections of these notes). The checkpoint assignments (further discussed in the activities) will require approximately 3-4 weeks of outside work.

Introduction to case

Raleigh, the capital of North Carolina, is one of the fastest-growing cities in the nation with 143 square miles of land for an estimated population of 464,000 individuals (worldpopulationreview.com). When considering the greater Research Triangle, which consists of the Raleigh-Durham-Chapel Hill area, the population estimates to approximately 2,037,430 (worldpopulationreview.com). According to the U.S. Census, Raleigh is the second-fastest-growing major metro in the U.S., behind only Austin, Texas (Fine, 2017). In addition, Wake County gains a net average 40 individuals per day (Walston, 2017), giving the city its moniker of “**Sprawleigh**” by TIME Magazine (Goldberg, 2011).

The increase of urban sprawl and its environmental, social, and economic impacts have been highly studied by many researchers. Some of these impacts are listed in Table 1.

Table 1: Environmental, social, and economic impacts from urbanization		
Environmental	Social	Economic
<ul style="list-style-type: none"> ● Loss of land and forests, ● greater air pollution, ● higher energy consumption, ● decreased aesthetic appeal, ● reduced species diversity, ● increased storm water runoff, ● increased risk of flooding, ● and ecosystem fragmentation (Johnson, 2001) 	<ul style="list-style-type: none"> ● Degraded human health, including obesity, hypertension, respiratory problems (Ewing et al., 2003) ● High segregation between residential and commercial uses (Wheeler, 2006) ● Crowded schools ● Increased traffic congestion and traffic-related fatalities (Ewing et al., 2011) ● Greater segregation of residential development according to income (Wheeler, 2006) 	<ul style="list-style-type: none"> ● Increased development costs ● Inflated housing costs ● Increased commuting cost ● Increased public and private capital and operating costs (Burchell, 1997)

This emerging urban sprawl in the Raleigh metropolitan area calls upon local communities and institutions to seek innovative and sustainable solutions. Higher education institutions, especially those in urban areas, have been identified as entities that are particularly advantageous in addressing sustainability goals and initiatives (Molnar et al., 2011). One of

Raleigh's community leaders in sustainable efforts is North Carolina State University (NCSU). The University has developed a Sustainability Strategic Plan to engage its students, faculty, and staff to develop their own innovative solutions to campus sustainability problems and participate in conservation-minded practices. Through collaboration, education, and research, NCSU's campus seeks solutions that aid to a more sustainable future. The Sustainability Strategic Plan seeks to reduce greenhouse gases on campus by 25%, expand renewable energy efforts, reduce water consumption by 65%, and enhance storm water efforts to ensure water quality for the university. In addition, NCSU has committed that all new construction and major renovations over 20,000 square feet are at minimum LEED Silver Certified (NCSU Sustainability Strategic Plan, 2017). A Sustainability Fund was created in 2013 through a sustainability fee contributed by each student in both Fall and Spring semesters. The fee generates \$150,000 per year for the Sustainability Fund, which awards grants for campus sustainability projects that impact students. The fund is managed by a student-led board that reviews grant proposals and decides on grant award recipients.

The purpose of this case is to allow students to examine grand challenges they face in the environment and engage in campus sustainability. Through critical and creative thinking and teamwork, students will design a sustainable solution that is applicable on campus. The goal of the assignments are to encourage students to synthesize the knowledge they have gained through readings and class discussions and apply it by developing a sustainability grant proposal and pitch. The grant proposal structure and format have been established by the Office of Sustainability at NC State. After instructors have provided feedback and assessment of the grant proposals, students have the opportunity to submit (although are not required) their sustainability grant proposals to the Office of Sustainability for review.

Course materials

1. Teaching notes, including:
 - a. Instructions and guidelines for checkpoint assignments (total of 3)
 - b. Instructions and guidelines for the pitch presentation
 - c. Instructions and guidelines for the final grant proposal
 - d. Grading rubric for presentations (both for student-review and for instructors)
2. Students handout, including:
 - a. A list of readings and resources
 - b. Instructions and guidelines for checkpoint assignments (total of 3)
 - c. Instructions and guidelines for the pitch presentation
 - d. Instructions and guidelines for the final grant proposal

Activities

1. *Small group discussions*
 - a. Students submit broad interests in sustainability issues prior to class. Break students up into groups based on their shared interests. We have split students into 8 groups of 5 students.
 - i. Ask students to brainstorm ideas to make NC State a more sustainable campus and community. Have them discuss these topics and narrow them to the top three ideas related to the future of sustainability on NC

State's campus. They might already have a great idea that they need to research and/or they will discuss with their groups to finalize an idea.

Here are a few places that might help students ideas:

1. A topic covered in a past class during the semester
 2. The Sustainability Strategic Plan (your university may have a sustainability or stewardship plan similar to this)
 3. Past grant recipients– on the Sustainability Office website
 4. In students' communities – like EcoVillage, WISE, Environmental Education Club, Leopold Wildlife Club, or another student organization
- b. Reflection write-up after small group discussion. Explain each team member's interest in the three topics selected in part a) and how all team members came to a consensus on the final topic. Students should write about the other topics the team members also considered and why they chose the topic they did.

2. *Campus partner interview*

- a. Students are asked to find a representative or member on campus to discuss their proposed idea. Students should think of partners that may have an impact or influence on the specific sustainable piece they are interested in. For example, students may want to meet with individual(s) from the Clean Energy Technology Center, Grounds and Facilities, Transportation, or Dining Facilities. Students are asked to discuss with their campus partner to determine the following:
 - i. What can be done to make the project more feasible?
 - ii. What additional resources are needed to complete the project?
 - iii. Is the project appropriate for NC State's campus?
 - iv. Is the campus partner willing to submit a letter of support if the students wish to submit the grant to the Office of Sustainability?
- b. Students can also ask their campus partner for additional help to find resources for metrics for assessment, budget, and cost savings.
- c. After the interview, as a group, students will write-up a brief summary of their experience with the campus partner, addressing the above three points (items i-iii)

3. *Presentation/pitch*

- a. Students will pitch their sustainable solution ideas to their classmates. Students should be convincing when pitching their idea to their peers, as each student will vote on the best proposal.
- b. Students should use PowerPoint or another type of presentation template to pitch the idea during class time.
- c. Each team member should have a meaningful speaking role. Students should be thorough, enthusiastic, and convincing! Maximum 10 minutes. We recommend and encourage students to practice their pitch as a team *before* they arrive to class that day!

4. *Checkpoint assignments*

- a. Checkpoint assignments include all components of the final grant proposal, but break the various components into various stages. The checkpoints should encourage students to work on their sustainable solution and proposal throughout the case, and allow them to revise their proposals from instructor

feedback. Checkpoint assignment guidelines and questions to be assessed are discussed more in the “Assessment” section of this document.

- b. Team submits checkpoint assignments.
5. *Grant proposal*
- a. This is the student’s final output. Students will put together what they have discussed in small group work and what they have written in their checkpoint assignments.
 - b. Grant proposals should include a cover sheet and eight required sections (which students have already done via checkpoints!). Grant proposal sections *must* include:
 - A cover sheet
 - Project Description
 - Anticipated Outcomes and Impacts
 - Project Budget and Justification
 - Project Benchmarking and Innovation
 - Metrics for Assessment
 - Cost Savings
 - Broader Vision
 - Project Milestones

Assessment

1. Feedback on Checkpoint assignments
 - a. Students will only receive a completion grade. They will not be graded on the content. The content will be graded when students submit their final grant proposal. Students should have all required components in the checkpoints to receive the completion grade. If a section is missing in the checkpoint, the grade will result in a zero. The purpose of the assignment is for students to receive suggestions and feedback from the instructors that will aid them in finalizing their final grant proposal as well as for students to engage in self-reflection.
 - b. Students will address the following when completing checkpoint 1:
 - i. Brief summary of work completed and outline of next steps
 - ii. Notes on challenges faced
 - iii. Define overall scope of the project
 - iv. How did you choose which topic to pursue?
 - c. Students will address the following when completing checkpoint 2:
 - i. Brief summary of work completed and outline of next steps
 - ii. Notes on challenges faced
 - iii. What assumptions did you have going into the meeting with your campus partner?
 - iv. What did you learn from your campus partner?
 - v. How has your thinking changed (or been confirmed) based on your meeting with your campus partner?
 - vi. How did you prepare for your meeting?
 - vii. Is your project feasible? Is it appropriate for NC State’s campus? Please explain.
 - d. Students will address the following when completing checkpoint 3:
 - i. Brief summary of work completed and outline of next steps
 - ii. Notes on challenges faces

- iii. So far, was there a time when you realized you made incorrect or inappropriate assumptions? Describe your initial assumptions and how they have changed.
- iv. What were some of the most interesting discoveries you made while researching your project? What surprised you the most?
- v. How did you choose which sources were appropriate for the budget?

2. Peer-review and instructor feedback on Pitch presentations

- a. Students and instructors will use the rubric provided in Table 2 to review pitch presentations. Instructors will grade on specific presentation components.
- b. Students are also asked to write two to three strengths, weaknesses, and questions they still have about their classmates' proposals.
- c. All students should revise their final grant proposal after receiving feedback from peers and instructors.

Table 2: Grading rubric used for pitch presentations (adapted from North Carolina State University's Critical Thinking Standards)

Grading criteria	3 pts	2 pts	1 pts	0 pts
Relevance (How does the solution help us with the issue?)	Exceeds expectations. All or most relevant portions of the reflection are present, complete, and related to the scope of the question	Meets expectations. All or most relevant portions of the reflection are present, but not necessarily complete or related to the stated scope of the question	Below expectations. Many portions of the reflection are absent or not related to the stated scope	Not done or addressed
Clarity (Is the topic elaborated further? Could students illustrate what they mean?)	Exceeds expectations. All or most parts of the reflection are presented in a manner that is clear	Meets expectations. Some portions of the reflection are clear, but portions are unclear	Below expectations. Many portions of the reflection are presented in a manner that is unclear	Not done or addressed
Logic (Does all this make sense together? Does it follow from evidence?)	Exceeds expectations. The conclusions stated follow logically from the data	Meets expectations. The overall report makes sense, but there are a few logical inconsistencies	Below expectations. The reflection has a significant or multiple logical flaws	Not done or addressed
Depth (What are some of the complexities of the solution? What factors make this a difficult problem?)	Exceeds expectations. The reflection explores complexities with appropriate depth	Meets expectations. Some complexities are explored in the reflection, but it would benefit from deeper exploration	Below expectations. The reflection only scratches the surface	Not done or addressed

Breadth (Does the student look at this from another perspective?)	Exceeds expectations. The scope of the report is appropriately bold and contains the important elements.	Meets expectations. Some adjustment in narrowing or broadening the scope is needed	Below expectations. The scope is either much too narrow or too broad	Not done or addressed
Flexibility and Adaptability (Did students adjust thinking to changes in the situation or context?)	Exceeds expectations. The student is able to adapt to changes in context	Meets expectations. The student is able to adapt partially to changes in context and recognizes that a change in thinking strategy is called for	Below expectations. The student make a few adjustments in the face of change in context	Not done or addressed
FOR INSTRUCTOR USE ONLY: Organization and flow	Speakers present information in logical sequence in which the audience can follow. Students are well prepared for their speaking role and the presentation flows continuously	Speakers present information in logical sequence, but students are not prepared for their speaking role. Presentation flow is flows somewhat easily	Speakers present information somewhat in logical sequence, but transition between students is interrupted and disconnected	The presentation of information is very unorganized and inconsistent. It is difficult for the audience to follow the sequence. Speakers are not prepared for their speaking part
FOR INSTRUCTOR USE ONLY: Graphics and visual aids	Speaker's graphics, explain and reinforce screen text and presentation	Speaker's graphics relate to text and presentation	Speaker occasionally uses graphics that rarely support text and presentation	Speaker uses superfluous graphics or no graphics
FOR INSTRUCTOR USE ONLY: Speaking	All members of the team spoke during the presentation 3 pts		Not all members of the team had a speaking part 0 pts	
FOR INSTRUCTOR USE ONLY: Length	1 minute less or over the 10-minute mark	3 minutes less or over the 10-minute mark	5 minutes less or over the 10-minute mark	7 minutes less or over the 10-minute mark

3. Grade final grant proposals

- a. Grant proposals will be graded for writing, citations, completeness, and the following critical and creative standards: **Relevance, Clarity, Logic, Depth, Breadth, and Flexibility and Adaptation.**
- b. Each group will receive peer and instructor feedback from the presentation pitch, which they will use to revise their final grant proposals.

Table 3. Overall learning objectives, associated activities, and outcomes and assessments

Learning objectives	Activities	Outcomes and Assessments
1. Generate solutions that addresses a sustainability problem on campus.	<ul style="list-style-type: none"> ● SMALL GROUP DISCUSSION: Small group discussion on sustainable solution ideas for university campus 	<ul style="list-style-type: none"> ● Students will receive feedback on their ideas and how they relate their interests to the overall topic ● Students work as a team to narrow down to their final idea
2. Collaborate <i>effectively</i> with your team and campus partner(s).	<ul style="list-style-type: none"> ● INTERVIEW: students will interview a campus partner to understand sustainable needs on campus ● Small group discussions 	<ul style="list-style-type: none"> ● Students will receive feedback on their interview experience and how they can use the data they collected in their final grant proposal
3. Use critical and creative thinking skills to research and design the project to the Campus Sustainability Plan.	<ul style="list-style-type: none"> ● USING DATA: Students will use both qualitative and quantitative data from campus partner interview and research to design their sustainable solution on campus ● SMALL GROUP DISCUSSION: Create proposal budget and cost savings of their sustainable solutions 	<ul style="list-style-type: none"> ● Students will receive feedback on their proposed budget, cost savings, and broader vision of their sustainable solution
4. Create a team pitch to articulate your proposed plan.	<ul style="list-style-type: none"> ● PRESENTATIONS: As a team, students will “pitch” their campus solution to the class. ● PEER-REVIEW: Students will review their peers’ pitches and ideas. 	<ul style="list-style-type: none"> ● Students will use a peer-review rubric and list strengths, weaknesses, and questions they still have about each other’s solutions
5. Use feedback received from team pitch to revise the grant proposal.	<ul style="list-style-type: none"> ● GROUP GRANT PROPOSALS: students will put together what they 	<ul style="list-style-type: none"> ● Students will submit as a team their final grant proposals of their sustainable idea for campus ● Students will receive a grade based on

	<p>have written and discussed throughout the case study and checkpoint assignments</p>	<p>the instructor's rubric</p> <ul style="list-style-type: none"> • If students wish to submit their proposal to the campus' Office of Sustainability, instructors will give additional feedback and suggestions
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Suggested Modifications

This case study can be modified by adapting the criteria included in the grant to your own university's standards. If your university does not have a sustainability grant fund, you could use a template for a different type of grant funding (ex. [EPA](#)). For higher level undergraduate students, you could require students to work individually instead of in groups.

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