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Enhancing Graduate Landscape Architecture Education Through Transdisciplinary Research Approaches: A Case Study at the University of Connecticut

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Enhancing Graduate Landscape Architecture Education Through Transdisciplinary Research Approaches: A Case Study at the University of Connecticut

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Masters of Science Thesis

Enhancing Graduate Landscape Architecture Education Through Transdisciplinary Research Approaches: A Case Study at the University of Connecticut

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INTRODUCTION
It is becoming increasingly important to create sustainable solutions for environmental problems. Many of the problems we face deal with the natural environment and human interface such as water scarcity, climate change and air pollution, energy, health, housing, land-use and quality of life (Lang et al., 2012; Lawrence & Després, 2004). The problems are complex and are difficult for any discipline to address these problems alone. Solutions to these problems require a cross-disciplinary approach that involves a diversity of actors such as scholars, political officials, and citizens.

Transdisciplinary (TD) research is a relatively new paradigm of research that attempts to solve “real” problems within communities. Transdisciplinary research has evolved as a response to complex problems that other forms of cross-disciplinary research (such as multidisciplinary and interdisciplinary) have not been able to address. It requires researchers to step back from their respective disciplinary boundaries and create knowledge that can be applied towards a solution.

This thesis advocates for the development of graduate Landscape Architecture education through the adoption of transdisciplinary research approaches. It provides a case study of transdisciplinary research that took place in the program of Landscape Architecture at the University of Connecticut. In addition, the thesis also provides a narrative discussion of the transdisciplinary experience from the perspective of the author, a graduate student studying Landscape Architecture at the University of Connecticut.

Landscape Architecture is a discipline well suited to make transdisciplinary contributions. According to Lawrence and Després (2004), “Architecture and planning seem to be fertile domains for transdisciplinary contributions because of their very nature as ‘multi-disciplinary’ involving both the natural resource sciences, and action-oriented practices aimed at
transforming the built environment” (p. 397). The academic training and practice of Landscape Architects makes the discipline capable of quickly adapting and adopting transdisciplinary approaches within natural resources professions. In addition, there has been a disconnection between what is taught in academia and what is practiced by professionals. There are many questions regarding the teaching methods and content of programs and how they prepare (or not) students for professional practice (Boyer & Mitgang, 2006). This is a major concern for the discipline that can be addressed by TD research and education.

The Landscape Architecture program at the University of Connecticut is situated in the Department of Plant Science and Landscape Architecture, within the College of Agriculture and Natural Resources. It is a four year program with a highly structured plan of study in comparison to some five year programs. The program consists of four full-time Landscape Architecture faculty, one adjunct professor and approximately sixty undergraduate students. The graduate program is still developing, but there are typically one to two Landscape Architecture graduate students at any given time.

The Community Research & Design Collaborative (CRDC) is “the umbrella organization for the outreach work of the Landscape Architecture faculty at the University of Connecticut” (CRDC, 2010). Their mission is to be a regional leader in sustainable planning and design. CRDC was founded in 2006 and has worked closely with multiple towns within Connecticut to improve their land-use management strategies. Landscape Architecture graduate students play an important role within CRDC. They work closely with faculty and members of the community on real projects which offer the opportunity to practice what they have learned as undergraduates. Klein (2004) states that “more programs are required that proactively foster cross-sectoral transdisciplinarity” (p. 522). In addition, Daniel Stokols (2011) stresses the
importance of “developing educational strategies for training the next generation of landscape researchers and professionals” (p. 3). Transdisciplinary education and centers such as the CRDC can prepare future professionals how to work with researchers from various disciplines, address the needs of the community and begin to reconnect the gap between Landscape Architecture education and professional practice.

The following chapters will discuss what transdisciplinary research is, some of the challenges associated with transdisciplinary research and why graduate Landscape Architecture programs should engage in transdisciplinary research. This will be followed by a case study of the Lebanon Pond, which illustrates a transdisciplinary collaboration that took place at the University of Connecticut. The case study will then be followed by discussion and reflection of the author’s experience.
TRANSDISCIPLINARY RESEARCH
Transdisciplinary research is a type of cross-disciplinary research that involves a diversity of actors and addresses complex, real problems. It can be viewed as an alternative method of research that can help to foster positive relationships between academic institutions and communities. According to Stokols (2011), because of their multidisciplinary nature, Landscape Architecture programs are capable of making valuable contributions to transdisciplinary research. This chapter will provide information on the following:

1. Cross-disciplinary Research Methods
2. Definition of Transdisciplinary (TD) Research
3. Challenges of TD Research
4. Landscape Architecture Education and TD Research
5. Common Ground Between the Scientific Method and the Design Method

1. Cross-Disciplinary Research Methods

It is very easy to confuse the words multidisciplinary and interdisciplinary. Add transdisciplinary to the mix and the confusion becomes even greater. According to Rosenfield (1992), multidisciplinary research involves researchers from different disciplines who contribute to a research problem solely from the perspective of their discipline. Someone then has to take the research findings and make use of it, such as in policy making. Rosenfield (1992) states that in comparison to multidisciplinary, researchers on interdisciplinary teams share more information and coordinate with more focus and frequency, but the participants address the common problem(s) from the perspective of their respective disciplines. It is these distinct perspectives of knowledge that prevent cross-disciplinary research from being effective at
tackling complex problems. Ramadier (2004) states that “regardless of the form it takes, interdisciplinarity, like multidisciplinarity avoids paradoxes and having to solve them. As a result…both approaches are fragmented.” (p. 433). In transdisciplinarity, disciplinary boundaries are removed and complexities are addressed.

According to Balsiger (2004), cross-disciplinary projects have not evolved from one another which would indicate that transdisciplinary is superior to interdisciplinary and multidisciplinary. The different approaches are valuable in their own right. Instead transdisciplinary research is a response to relevant problems with no easy solution and the process of attaining that solution requires the collaboration between researchers and affected stakeholders.

2. Definition of Transdisciplinary Research

Transdisciplinary research is a paradigm of research that is instigated by actual topics and aims to address highly complex issues concerning humans and the environment. “Of the various cross-disciplinary approaches, transdisciplinarity seems to have the most potential to respond to new demands and imperatives.” (Russel, Wickson & Carew, 2008, p. 461). The growing interest in TD research stems from the need for more sustainable development (Horlick-Jones & Sime, 2004) and the inability of a single discipline to respond to all of the social and environmental complexities that problems present. In the larger scope of things, the main intentions of TD research are to “achieve the highest level of intellectual integration across multiple fields” (Stokols, 2006, p. 67). In addition to intellectual integration, Lawrence and Després (2004) state that transdisciplinarity attempts to “understand the world and to bridge the gap between knowledge derived from research and the decision-making processes in society” (p. 399). The results of transdisciplinary research should provide solutions that can be applied within a social
and political context and that will bring about some degree of change (Wickson, Carew and Russel, 2006).

There is no consensus on the exact definition of TD research but there are common characteristics among the many descriptions of TD research. According to Wickson et al. (2006), one of the most common characteristics found in all definitions is the “explicit intent to solve problems that are complex, multidimensional, and involve an interface of human and natural systems” (p. 1048). Lawrence and Després (2004, p. 399) define TD through four general characteristics:

a. A high degree of complexity
b. Context specificity
c. Diversity of TD teams and consensus among actors
d. Action research oriented

Each of the four characteristics will be further discussed.

a. A high degree of complexity:

Transdisciplinary research addresses issues that develop in society and are brought into focus. The complexity takes shape when social, political and research interest’s conflict and when solutions cannot be obtained from the confinement of a single discipline. Complex projects typically “relate to the built or natural environment with regard to issues of sustainability” (Lawrence & Després, 2004, p. 397). According to Klein, “Environmental problems exemplify complexity. They comprise several sub-problems that fall into the domain of multiple disciplines and sectors” (Klein, 2004, p. 519). In addition, Wickson et al. (2006) states that
“problems are manifest in the real world, are complex, multi-dimensional and not confined by the boundaries of a single disciplinary framework” (p. 1048).

When addressing the problem, TD approaches should involve integration across natural and social sciences (Klein, 2004) because complex, sustainability problems typically arise at the intersection of natural and built environments. Too often, knowledge that is not based on “hard” scientific evidence is not integrated into the solution. The social sciences should be considered just as important as the natural sciences.

b. Context specificity:

TD research responds to complex, real problems. As such, each problem has its own set of unique challenges that must be overcome. The methods and conceptual frameworks used throughout the duration of TD research projects respond to the specific problem under investigation (Klein, 2008). For example, the site plan for an inner city park will most likely differ from a site plan for a park in a small rural town for a multitude of reasons including cultural factors, community objectives, available space and existing site conditions.

The ways in which TD teams respond to problems are not confined to any specific method of research. When projects adhere to “norms that govern basic research or academic science” (Gibbons et al., 1994, p. 4), conflict is likely to arise when aspects of a project such as public opinion or other qualitative factors cannot be incorporated. TD research provides the flexibility to appropriately respond to problems and allows for the consideration of both quantitative and qualitative factors.

c. Diversity of TD team and consensus among actors:
The collaboration of a diversity of stakeholders and researchers is seen as a vital component of transdisciplinary research. “Participatory procedures involving scientists, stakeholders, advocates, active citizens and users of knowledge are needed to transform knowledge claims into trustworthy, socially-robust, usable knowledge” (Kates and Clark, 2001, p. 3). Stakeholders can include anyone who can or will be affected by outcomes of the research project such as residents, business owners, employees and public officials. In reference to Klein, Lawrence and Després (2004) state that “transdisciplinary research includes the intentional involvement of stakeholders in the definition of problems and those criteria, objectives and resources used to analyze and resolve them” (p. 403). Lang et al. (2012) states that “complex sustainability problems require the constructive input from various communities of knowledge to ensure that the essential knowledge from all relevant disciplines and actor groups related to the problem is incorporated” (p. 26). The involvement of stakeholders is vital to TD collaborations and distinguishes TD research from other cross-disciplinary methods.

The diversity of stakeholders and researchers bring an even greater diversity of perspectives, values, attitudes and interests which will likely contradict during the collaboration. Addressing and resolving contradictions and disagreements is an important component of TD research. It is a way to build trust within the TD team. Building and sustaining trust is essential to the long term success of TD collaborations (Thering and Chanse, 2011). As opposed to ignoring disagreements or choosing which group “wins”, all involved in TD projects must be in agreement. Unresolved disagreements “foster interpersonal tensions, fragmentation of the team into subgroups with non-overlapping (and sometimes competing) agendas, and ultimately undermine the team’s ability to meet its collaborative research goals” (Stokols, 2006, p. 69).
Conflict resolution is challenging and also a time consuming aspect of TD research but it is a vital part of TD research and that promotes fairness within the TD team.

d. Action research oriented:

In her book “Action Research”, Eileen Ferrer describes action research as:

A reflective process that allows for inquiry and discussion as components of the ‘research’. Often, action research is a collaborative activity among colleagues searching for solutions to everyday, real problems….Rather than dealing with the theoretical, action research allows practitioners to address those concerns that are closest to them, ones over which they can exhibit some influence and make change (2000, p.1).

Moreover, Lawrence and Després (2004) state that TD research involves “making linkages not only across disciplinary boundaries but also between theoretical development and professional practice.” (p.399). In other words, TD research is relevant to real problems. The knowledge created and the work produced from TD collaborations are not intended to collect dust on a shelf but are meant to ensure changes that address the problem being investigated. In order to ensure changes, it is important to establish goals and expectations of team members at the beginning of the TD research project.

3. Challenges of Transdisciplinary Research

Transdisciplinary research entails collaboration between researchers and stakeholders with different values, attitudes and perspectives. The challenges of TD research increase as the scale and scope of the collaboration increases (Stokols, 2006). Two major challenges faced by
TD teams will be discussed: group dynamics and an incompatibility of TD research within traditional academic structures. The relationship of team members and required commitment is a major hurdle for TD research. Overcoming differences requires a high level of commitment that must be adopted by TD teams. Also, clear communication between disciplines and stakeholders can increase the likelihood of success for TD research projects. Furthermore, evaluating the quality of TD research projects is another point of concern within academia. The merit system within traditional academic structures may prevent some scholars from engaging in TD research.

There are many circumstances that can influence the effectiveness of TD collaborations (Hall et al., 2008; Fuqua, 2004). Commitment from all participants in TD research is necessary but also challenging. It entails a willingness to overcome disagreements and reach a consensus. This means that a TD research project may take several months or years to complete. The effort required to reach agreements can sometimes overwhelm TD participants and negatively impact the outcomes. Stokols (2006) discusses ‘collaborative readiness’ (p.69), where all participants are made aware that the project may take several months or years to complete and will require extra work compared to other types of research:

Research teams should be prepared in advance for the collaborative challenges they will face and must be willing to devote a substantial amount of time toward cultivating common ground at both intellectual and social levels by learning to accommodate each other’s different styles over the course of their projects. This type of preparedness can ensure consistent contributions from all involved in TD research. (p. 69)

Over time, a willing commitment combined with genuine respect, can help to maintain the dynamic of the TD team and motivate partners to follow through with each other
Carlson, Koepke and Hanson, 2011). Unresolved issues can eventually undermine the research project.

Jargon is the technical terminology of a special activity, profession or group (Merriam-Webster, 2013) and can hinder TD collaborations. Jargon can lead to misunderstanding(s) between researchers and stakeholders (community residents, business owners or politicians) because either party may not be familiar with specific disciplinary knowledge or there may be linguistic barriers. Ensuring that all information is understood by TD teams and that learning is going in both directions (researchers to community and vise-versa) is a significant component of TD research. According to Kessel and Rosenfield (2008), it is vital for team members to learn and be open to each other’s disciplinary languages. One method of addressing the issue of jargon is to employ a visual language that everyone can understand such as pictures and drawings.

The use of graphics to depict processes and potential solutions can be a very effective tool in ensuring that every group involved in TD research understands what is going on (Schroth, Hayek, Lange, Sheppard and Schmid, 2011; Pinson, 2004). Landscape Architecture students and practicing professionals rely heavily on the use of graphics and use them in almost every phase of projects. More specifically, they use a combination of photographs, plans, cross-sections, perspective drawings, and physical or 3D models to communicate information. Graphics serve as great tools for communicating the design process and discussing issues with other team members (Gazvoda, 2002). Through the use of graphics, the existing conditions, processes and potential of a site can be communicated easily and understood by all members of TD teams, including stakeholders.
Transdisciplinary research faces many barriers within academia because of what Fry (2001) refers to as the “sociology of academia” (p. 162). He states that disciplines are protective of their ways of working and many demonstrate little regard for other disciplines. This type of research culture can hinder TD collaborations. In addition, there is a divide between the natural sciences and the social sciences because of differences in quantitative and qualitative approaches to research (Fry, 2001). Furthermore, the scholastic requirements of disciplines vary greatly. The methodology and procedures used in a specific TD research project may differ from the methods and procedures utilized by disciplines involved in TD projects. The use of alternative methodologies can create barriers for those scholars trying to attain tenure or research merit points (Fry, 2001) in departments that have established, strictly adhered to methods of conducting research. This may prevent some academic departments from adopting TD research approaches.

Evaluating and assessing the quality of transdisciplinary research projects has also been a challenge. According to Wickson et al. (2006):

The evaluation of the quality of disciplinary research is traditionally performed by peer review. This relies on the existence of an established community of peers who judge research using quality criteria that are often implicit in disciplinary knowledge frameworks….The lack of an established peer community and the contextualized nature of TD research mean that a critically robust way to discuss and evaluate the quality of TD research is underdeveloped and insufficient.” (p. 1055).

The development of a robust means to evaluate TD research is no easy task but Daily and Ehlrich (1999) state that “reviewers should include well established disciplinary leaders” and that
“it takes time for a journal to gain an excellent reputation” (p. 279). With time, systematic ways to evaluate TD research projects will be developed.

4. Landscape Architecture Education and Transdisciplinary Research

There are disciplines well suited to deal with some of the issues commonly found in TD research projects. Lawrence and Després (2004) state that “architecture and planning seem to be fertile domains for transdisciplinary contributions because of their very nature as ‘multi-disciplinary’ involving both the natural resource sciences, and action-oriented practices aimed at transforming the built environment” (p. 397). The academic training and practice of Landscape Architects makes the discipline capable of quickly adapting to and adopting TD approaches within natural resources professions.

A typical undergraduate degree for Landscape Architecture takes about four to five years to complete. The first year includes fundamental classes required by the university. The years that follow are made up of a mix of courses, including natural resource courses. The design studio, found in virtually all Landscape Architecture programs, allows for a multitude of experiences not often found in the academic training of most disciplines. The many hours that students spend in the studio together creates an environment rich in peer review, discussion and knowledge sharing. According to Boyer and Mitgang (1996), “the study of architecture is among the most demanding and stressful on campus, but properly pursued it continues to offer unparalleled ways to combine creativity, practicality, and idealism” (p. 5). Landscape Architects are required to be familiar with a broad range of knowledge from the natural sciences and be able to fuse that knowledge with artistic creativity (Gazvoda, 2002). Gazvoda (2002) states that if “landscape architecture students are sufficiently exposed to the natural sciences, they become
capable of solving complex spatial problems” (p. 132). Within TD research projects, graduate students of Landscape Architecture have more opportunities to apply what they learned as undergraduates and gain more exposure to the natural sciences through collaboration with other disciplines.

The multidisciplinary nature of Landscape Architects allows them to be “brokers” on transdisciplinary teams. According to Gray (2008), “brokers” provide a link between groups or members that do not share common ground (p. 127). For example, Landscape Architects can provide a link between horticulturalists and town planners. The potential of Landscape Architects to link groups or domains of knowledge offers Landscape Architects the opportunity to play a leadership role within TD research.

The academic training of Landscape Architects differs greatly from a number of other disciplines, specifically within natural resource departments. One of the main differences is the approach to research; the scientific method is used in a majority of natural resource professions while Landscape Architects use the design method. The scientific method is mostly a quantitative approach whereas the design method used by Landscape Architects accounts for both quantitative and qualitative variables such as, attitudes, beliefs, and perceptions. The ability to incorporate immeasurable variables into research gives Landscape Architects unique opportunities to address complex human-environmental concerns. However, differences between research methods and approaches can also complicate group dynamics between researchers in TD teams.

5. Common Ground Between the Scientific Method and the Design Method
The press for sustainable design has placed increasing pressure on design-oriented professionals to act and decide on a systematic body of evidence (van Aken & Romme, 2009). Many design problems are not well defined (Archer, 1979) compared to scientific problems and as such, the research and design rigor of projects may go unnoticed or may be questioned by those disciplines that utilize the scientific method. It can be frustrating for those Landscape Architecture programs located within natural resource departments because the scientific method serves as the basis of how recognition and grants are awarded and is the method used by most researchers and professors (Fry, 2001). It also creates a lot of frustration for Landscape Architects who feel that design decisions are based on evidence (van Aken & Romme, 2012). For Landscape Architecture faculty and students working on TD teams, the differences between the scientific method and the design method can be a source of tension among researchers, specifically when most other researchers on the TD team utilize the scientific method. In order to prevent the differences of the scientific method and the design method from affecting collaboration within TD teams, similarities and difference must be recognized.

In the paper, “Design Method and Scientific Method”, Cross, Naughton and Walker (1981) state that there has been a desire to relate the design method to the scientific method even though the two activities are very dissimilar. They also state that the reason designers are eager to relate the two is because the “attraction lies not so much in the method of science, but in the values of science. These are the values of rationality, neutrality, and universalism (Cross et al., p. 195)”. These values guide scientific researchers to arrive at an objective truth. For Landscape Architects however, this is difficult to achieve because according to Archer (1979), designing relies heavily on modes of thought and ways of knowing that are incompletely defined and poorly understood because design is neither numerical nor literary. Landscape Architects use
graphical modes of thought that are neither verbal, numerical nor literary. However, in reference to Balchin, Cross et al. (1981) states that these “graphical modes of thought are consistently ignored or undervalued by those articulate theorists of cognitive processes who are so deeply immersed in the numerate-literate subculture of the scientific-academic world” (p. 199). These differences can negatively affect TD teams that include Landscape Architects and scientific researchers. The following is an overview of the different steps within the scientific and design methods and is intended to highlight similarities as well as acknowledge the differences.

The scientific method is a “body of techniques for investigating phenomena and acquiring new knowledge, as well as for correcting and integrating previous knowledge” (Bartneck, 2007, p. 1). The scientific method involves:

1. Observation
2. Literary Review
3. Hypothesis
4. Methods
5. Results

The steps in the design process used by Landscape Architects are as follows:

1. Project initiation
2. Case study review
3. Problem definition
4. Site inventory and analysis
5. Synthesis
6. Evaluation

The following describes the six components of the scientific method and the design process as they relate and differ from one another:

1. **Observation**: Scientists observe and define a question about something to be understood.

   **Project initiation**: A client (theoretical or actual) presents a problem or problems that need to be solved.
In his paper, Cross et al. (1981) quotes A.S Gregory; “Science is analytic; design is constructive” (p. 195). In other words, science attempts to understand something that already exists. Design attempts to improve upon what already exists. The first step highlights how both methods are initiated and highlights a fundamental difference between the two methods.

2. **Literary review:** Collection of data and information regarding the phenomenon to be understood.

   **Case study:** a “well-documented and systematic examination of the process, decision making, and outcomes of a project, which is undertaken for the purpose of informing future practice, policy, theory and education” (Francis, 2001, p. 16).

   Those using the scientific method investigate research that has previously been conducted on the topic to determine how to best approach the phenomenon under investigation (NASA, 2008). The case studies that Landscape Architects utilize are similar to the review of literature except that case studies tend to be more subjective. In either case, literary reviews and case studies provide a foundation from which to work.

3. **Hypothesis:** a tentative explanation that can be tested by further investigation.

   **Problem definition:** Definition of problem and project boundaries. Goals and outcomes are also established.

   A hypothesis and a problem definition both attempt to describe or state a problem whether it is theoretical or actual. However, based on the review of background information, a scientist has to make an educated guess about what will happen in the experiment. By contrast, the problem definition becomes a question of whether or not the goals can be achieved. For example, if a town establishes the goal of improving the water quality of a local pond, the question becomes; can the water quality be improved? Landscape Architects answer the question through design.
4. **Methods:** Involves the materials, tools and procedures used to prove or disprove the hypothesis. The researcher controls as many variables as possible.

**Site analysis and inventory:** Uses factual information (history, photographs, geographic location, existing vegetation and other artifacts) related to the site to find relationships and patterns that are used to respond to the problem and fulfill project goals.

Methods and site analysis and inventory are the specific process of how the research is approached. In either case, it relates directly to the problem being investigated. When carrying out an experiment, scientists try to control as many variables as possible. In the design process, Landscape Architects must account for and manage as many variables as possible. For example, a windy site can be uncomfortable for users. Wind cannot be controlled, but it can be managed by placing hedges, trees, or other elements in the appropriate place to reduce the effects of wind on the site.

5. **Results:** Objectively documents what occurred as it relates to the hypothesis and methodology.

**Synthesis:** Also known as the design of the site, synthesis directly responds to the problem definition. Designs communicate the solution to the problem(s) and how goals were met.

The results and synthesis are both direct responses to the hypothesis and problem definition. Results usually take the form of graphs, charts, and written documentation. Design alternatives typically take the form of illustrative plans, perspective drawings, section-elevations, charts, and written documentation.

The results of a scientific experiment are strictly objective. The final designs produced by Landscape Architects reflect artistic expressions and are not objective. However, the experienced designer is able to create an aesthetic space while also providing function for all the elements proposed within the design. When there is logical rationale as to why a design is
orchestrated the way it is, there is a premise for defensible design (van Aken and Romme, 2012) and an opportunity for Landscape Architects to fuse quantitative and qualitative elements.

6. **Conclusion:** Discusses whether or not the hypothesis was proved or disproved and the implications of the results. Conclusions also provide information on what was learned, and how the investigation can be improved in the future.

   **Evaluation:** Discusses whether or not the design solved the problem and met project goals. The evaluation of a design also provides insight into the weaknesses and strengths of a design and how it can be improved in the future.

Conclusions of an experiment and evaluation of final designs are similar in that they provide insight into what was learned and what improvements can be made in the future. The difference between the two methods is that in the scientific method, conclusions are typically written up soon after the results have been analyzed. Within the design method, projects may take much longer to evaluate because the project must be built in order to thoroughly evaluate the project. However, if the project is theoretical, it is typically evaluated by a design jury soon after the completion of the design.
In summary, transdisciplinary research differs from other cross-disciplinary research methods in that it thoroughly integrates researchers from various disciplines and involves a wide range of actors, including residents, business owners and public officials. The knowledge
derived from collaborations is intended to affect change within communities and is relevant to the complexities of real world problems. Moreover, transdisciplinary research can help to foster more positive relationships between academic institutions and communities. However, the process of integrating and coordinating TD teams is not easy. Those involved in TD research collaborations are met with issues concerning group dynamics and academic researchers have to overcome barriers within traditional academic structures.

The education and practice of Landscape Architecture constitutes a wide scope of knowledge and skills that enables Landscape Architects to link groups that do not share common ground. TD research approaches will help to develop and advance the education and discipline of Landscape Architecture.
A CASE STUDY OF THE LEBANON POND
Project Background

In April of 2011, Dr. Juliana Barrett, an ecologist and extension educator at the University of Connecticut contacted the Community Research & Design Collaborative (CRDC) at the University of Connecticut to discuss the possibility of working together to address a concern of a rural Connecticut community. CRDC is part of the Department of Plant Science and Landscape Architecture that specifically focuses on serving the citizens and towns of Connecticut with land-use issues.

Dr. Juliana Barrett was giving a workshop about riparian corridors in Lebanon, Connecticut, when members of the community expressed concern over a small local pond. Riparian corridors are the areas of vegetation along rivers, streams and lakes (Bentrup, 2008). They are of great ecological value because of their ability to keep the soil along the riverbanks stabilized. A healthy riparian corridor has also been proven to maintain and improve water quality. Other benefits include storage of flood waters, increased aesthetics, wildlife habitat for terrestrial animals, as well as maintaining habitat for aquatic animals (Agouridis, Wightman, Barton, Gumbert 2010; Norris, 1994). The pond residents were referring to had been in decline over the past several years and they wanted to know how it could be remediated.

Initially, Dr. Juliana Barrett wanted to develop a planting plan that would demonstrate how to rehabilitate riparian corridors in other towns within Connecticut. However, shortly after the project began, it became evident that a planting plan would not be sufficient for the Lebanon Pond site. Additional measures had to be taken to restore the health of the pond.

Initial observations of the pond were that water drains into the site from nearby wetlands via a culvert. The water from the wetland merges into the water from the pond and leaves the site via another culvert where it then merges into a much larger pond. Adjacent to the site is a Public
Works facility that stores large piles of salt and sand that are used to clean the roads during the winter months. During a rainfall, the water percolates through the sand and salt piles and makes its way to the pond, eroding the embankment and filling the pond with sediment that affects the water quality of the pond. The main focus of the project became improving the water quality of the pond and creating a prominent gateway into the center of Lebanon.

As the project evolved, additional professors from the University of Connecticut became involved to provide expertise. For example, Dr. John Clausen became involved to provide knowledge in hydrography and Dr. Michael Dietz is an expert on stormwater management. The team of professors raised questions in regards to the drainage of the site, the conductivity of the pond water, and the subsurface drainage. As a graduate student from the Department of Plant Science and Landscape Architecture, Julissa Mendez was responsible for collecting data to answer the questions being raised in addition to creating a design that would help to restore the health of the pond and meet the needs of the Lebanon community.

The following is a case study of the Lebanon Pond project. The details of the project and how it evolved are formatted in chronological order from project inception up until a final report (see appendix) was provided to the First Selectman. The information in this chapter has been adapted from a journal that was kept throughout the duration of the project. Discussion on how this case study relates to TD research will be provided in the next chapter.

**The Team**

University of Connecticut
Dr. Juliana Barrett- Ecologist and Assistant Extension Educator
Dr. Mark Brand- Professor of Horticulture
Dr. John Clausen- Professor of Forest Hydrology and Water Resources
Dr. Michael Dietz- Water Resources Extension Educator
Dr. Julia Kuzovkina- Professor of Horticulture
Dr. Juliana Barrett discussed a specific riparian corridor in Lebanon, Connecticut. Residents from the Town had expressed concern about a pond near the center of Town. It did not appear healthy due to algal blooms, large amounts of sand adjacent to the water, and limited vegetation. Dr. Juliana Barrett was interested in developing a planting plan that would improve the health of the riparian corridor. She wanted the plan to serve as example of how to plant riparian corridors in other towns in Connecticut.

**Outcomes:** The Community Research & Design Collaborative was interested in the project and agreed to help restore the riparian corridor. Julissa Mendez agreed to visit the site later in the week to observe and document existing site characteristics.

**Site Visit: April 19, 2011**
Purpose: Documented existing site characteristics
Attendees: Julissa Mendez
Location: Lebanon Pond site
The site is located at the intersection of Route 87 and Goshen Hill Road. The Town center is less than a mile away. About 200 feet from the site is a sign welcoming cars to the Town of Lebanon which made it easy to see why residents considered the site as a gateway into Town. Directly adjacent to the site is the Public Works facility that contains large sand/salt piles. Water enters the pond through a culvert and exits through another culvert, where it then enters a much larger pond across the street.

Figure 2. Aerial view of the Lebanon Pond site. The Public Works facility is adjacent to the site on the northwest side. The water entering the pond comes from wetlands south of the pond and enters via a culvert underground. The water leaves the pond site via another culvert and makes its way to a larger pond north of the site.

Figure 3. This photograph shows the view of the Lebanon Pond from Route 87
Outcomes: The poor condition of the pond was evident in the algal blooms of the pond, the strong presence of common reed (*Phragmites australis*), and the large amount of sand inside of the pond and directly adjacent to the pond. The source and extent of damage has yet to be determined.

Site Visit: **May 12, 2011**

Purpose: Examined existing site characteristic as a group  
Attendees: Dr. Juliana Barrett, Professor Peter Miniutti, Julissa Mendez  
Location: Lebanon Pond

Dr. Juliana Barrett identified a few of the plants within the site. The diversity of vegetation was limited; there were a few dead elms, poison ivy, and a strong presence of invasive common reed (*Phragmites australis*). The pond was also covered by little green specs that were identified by Dr. Juliana Barrett as duckweed. A large proportion of duckweed on the surface of the water indicates a stressed environment. Someone from the Department of Energy and Environmental Protection (DEEP) was scheduled to spray the common reed during the first week of July.
**Outcomes:** Dr. Juliana Barrett pinpointed the limited diversity of vegetation and the unwanted presence of common reed.

**Meeting:** June 2, 2011  
**Purpose:** Attained information and perceptions of the pond from local residents  
**Attendees:** Dennis, Mary, Dr. Juliana Barrett, Professor Peter Miniutti, Julissa Mendez  
**Location:** Lebanon Community Center

The residents of the Lebanon community said the pond was healthier. Residents also told stories of how they used to take their children to the pond to fish for gold fish, and on really hot days, swim. According to residents, the water was about 4-6 feet deep. At the time, the pond was no more than 2 feet deep. There was also a dry hydrant connected to the pond. A phone call to the fire department revealed that fire trucks pull up to dry hydrants and fill up their tanks with water from the pond to fight fires. The Lebanon fire department claims that they no longer use the dry hydrant at the Lebanon Pond site due to concerns over water quality.

**Outcomes:** Julissa Mendez was able to assess how residents felt about the pond. They recounted multiple positive memories that clearly expressed how important the pond was to them. However, residents felt that the pond had become an eyesore and since it was one of the first places people saw as they approached the center of Town, it gave an impression of poor maintenance and neglect by residents of Lebanon.

**Site Visit:** June 7, 2011  
**Purpose:** Gained insight into the source of pollution affecting the water quality of the pond  
**Attendees:** Dr. John Clausen, Dr. Michael Dietz, Dr. Juliana Barrett, Julissa Mendez  
**Location:** Lebanon Pond
Dr. John Clausen observed that runoff from the Public Works facility property was draining towards the pond and identified 4 “breakout” points along the fence that divided the pond site and the public works property. Breakout points are paths of least resistance where most of the water runoff enters the site. He stated that the Public Works facility needed to improve cleaning and containment practices to keep the sand and sediment within the Public Works property. Runoff that made its way onto the pond site needed to be intercepted and treated before it reached the water.

![Figure 5. Runoff from the Public Works facility. This photograph illustrates a breakout point along the fence that divides the pond site and the Public Works facility. The runoff that travels through the breakout point quickly makes its way to the pond.](image)

Dr. John Clausen also noticed the shallow depth of the pond. The runoff coming from the Public Works facility had deposited sand into the pond and had made it very shallow. He suggested dredging the pond as one of the first steps to revitalization. Once dredged, measures had to be taken to prevent more sediment from entering the pond site. Dr. John Clausen also wanted to
know the water shed of the site. Julissa Mendez expressed to him her limited understanding in this area and set up a meeting to go over how to map watersheds.

Dr. Juliana Barrett and Dr. Michael Dietz both made similar observations. Dr. Michael Dietz noted that water sheet-flows from Route 87 towards the pond. He suggested the use of sediment forebay systems. They serve to treat incoming water before it enters a larger body of water. They concentrate sediment in one spot for easier clean up and removal.

**Outcomes:** The professors agreed that runoff from the roads and the Public Works facility was affecting the water quality of the Lebanon Pond. Although runoff, erosion and sedimentation were clearly visible, the amount of salt entering the water was not. The amount of salt entering the pond from the Public Works facility needed to be measured. A conductivity meter is used to measure the salinity of the water. Dr. John Clausen offered to show Julissa Mendez how to use a conductivity meter so that she could take measurements at the Lebanon Pond.

Meeting: **June 14, 2011**  
Purpose: Discussed information collected on Lebanon Pond and received feedback  
Attendees: Joyce Okonuk, Philip Chester, Tom Conley, Dennis, Mary, Jeff, Dr. Juliana Barrett, Professor Peter Miniutti, Julissa Mendez  
Location: Lebanon Town Hall

The meeting at Lebanon Town hall included 3 Lebanon residents, the First Selectman, Joyce Okonuk, the Town Planner, Philip Chester, the Public Works Manager, Tom Conley, Dr. Juliana Barrett, Professor Peter Miniutti and Julissa Mendez. Julissa Mendez presented an overview of the project and discussed observations made by Dr. John Clausen, Dr. Michael Dietz and Dr. Juliana Barrett.

Towards the end of the meeting, Julissa Mendez asked the First Selectman if the Town possessed topographic information of the site. The topography maps Julissa Mendez was using
were older and did not accurately depict existing site conditions. Mr. Tom Conley, the Public Works Manager, offered to show Julissa Mendez how to record spot elevations of the site so that she could create an accurate topographic map.

**Outcomes:** During the meeting, Lebanon reiterated how they wanted the site to serve as a prominent gateway into Lebanon. They were also willing to use Public Works employees for construction of the project during the colder, less busy months. The First Selectman also stressed that due to a limited budget, any proposed design had to be low cost and low maintenance.

**Site Visit: ****June 23, 2011**
Purpose: Recorded spot elevations to create an accurate topographic map of the site
Attendees: Tom Conley, Julissa Mendez
Location: Lebanon Pond

Julissa Mendez met with Mr. Tom Conley from Public Works in Lebanon to take spot elevations around the pond site. Afterwards Mr. Tom Conley and Professor Peter Miniutti demonstrated how to interpolate the recordings to create a topographic map.
Figure 6. Existing topography of Lebanon Pond. This figure shows the existing topographic map developed with the help of Mr. Tom Conley of the Public Works Facility and Professor Peter Miniutti.

**Outcomes:** Julissa Mendez was able to create an accurate topographic map that she could design from.

**Meeting:** **June 28, 2011**  
**Purpose:** Created a watershed map of the site and learned to use the salt conductivity meter  
**Attendees:** Dr. John Clausen, Julissa Mendez  
**Location:** University of Connecticut

Dr. John Clausen showed Julissa Mendez how to compose a watershed map by hand and through a program online. He also demonstrated how to use a salt conductivity meter for measuring the amount of salt in the Lebanon Pond. He suggested key spots to take measurements such as before the water enters the pond and after it exits the pond.

Figure 7. The water shed of the Lebanon Pond. This figure shows that the watershed of the pond (red star) encompasses an area of approximately 300 acres. Most of that water enters the pond through a culvert.
Outcomes: Julissa learned how to create a watershed map and measure the salinity of water.

Plants sensitive to salt should not be exposed to conductivity higher than 700 microsiemens (Apps Laboratories, 2013). The conductivity of the water before it entered the pond was between 200 and 500 microsiemens. The water leaving the pond was approximately 1,500 microsiemens. This proved that the salt from the public works facility was affecting the water quality of the Lebanon Pond and explained the limited diversity of vegetation within the site.

Meeting: July 11, 2011
Purpose: Received feedback on project thus far
Attendees: Dr. Juliana Barrett, Professor Peter Miniutti, Julissa Mendez, Dennis, Inland Wetland Committee (5 members).
Location: Lebanon Town Hall

Julissa Mendez presented a five minute overview of the Lebanon Pond project to the Inland Wetland Committee. The Inland Wetland Committee supported the information that was collected about existing site characteristics and was interested in utilizing a sediment forebay to intercept sand before it entered the pond. One member of the committee suggested filling in the pond to prevent water from leaving the site and travelling downstream.
Outcomes: The Inland Wetland Committee was eager to see conceptual designs. It was very surprising to hear a member of the Inland Wetland Committee suggest filling in the pond. The possibility of filling in the pond offered the opportunity to be more flexible with design solutions.

Correspondence: July 12, 2012
Purpose: Concern of a Lebanon resident
Attendees: Dennis, Julissa Mendez

Julissa Mendez received an email from one of the Lebanon residents expressing their concern about filling in the pond. “…Is that what we want people to see as they enter our Town? How is this going to protect the habitat”? Julissa Mendez had not received emails from any of the other residents involved with the project regarding the suggestion to fill the pond.

Outcomes: The email from the concerned resident brought attention to the extent to which residents value the Lebanon Pond. Also, if the idea of filling in the Lebanon Pond was supported by other TD team members, it may have caused tension and mistrust within the TD team.

Meeting: September 30, 2011
Purpose: Discussed solutions for improving the Lebanon Pond
Attendees: Dr. Juliana Barrett, Dr. Michael Dietz, Dr. John Clausen, Professor Peter Miniutti, Julissa Mendez
Location: University of Connecticut

During the meeting there was a general consensus that a vegetated swale was necessary to capture runoff coming onto the site from the Public Works facility, Route 87, and Goshen Hill Road. The details of the vegetated swale had to be investigated during the design phase. During the meeting, Julissa Mendez brought up the idea from the Inland Wetland Committee meeting to stop the flow of water downstream by filling in the pond. Dr. John Clausen immediately
opposed the idea, stating that by law, a moving watercourse cannot be interrupted. The team also expressed interest regarding the ground water at the site and recommended that Julissa Mendez speak to Dr. Gary Robbins, a hydrogeologist at the University of Connecticut.

**Outcomes:** The Public Works facility needed to utilize best management practices for their sand and salt piles. Runoff coming from the Public Works facility and adjacent roads needed to be captured and treated before entering the Lebanon Pond. Filling the pond with soil was not likely and the groundwater conditions needed to be understood in order to determine whether or not capturing and treating runoff through vegetated swales was sufficient for improving the water quality of the Lebanon Pond.

**Meeting:** **October 10, 2011**  
**Purpose:** Evaluation of grading plan  
**Attendees:** Dr. John Clausen, Julissa Mendez  
**Location:** University of Connecticut

Julissa Mendez met with Dr. John Clausen in regards to a grading plan and sediment forebay that she was working on. He said the grading appeared to be correct but suggested she speak to Dr. Michael Dietz in regards to calculating the size of a sediment forebay for the site.

**Outcomes:** Julissa Mendez was on the right track in terms of properly grading the site and managing the storm water runoff that made its way onto the site. As an undergraduate student, she only took one semester of site engineering and did not feel confident in proposing grade changes. The potential construction of the design made it important to ensure the site was properly graded.

**Meeting:** **October 11, 2011**  
**Purpose:** Inquired how to determine the condition of ground water at the Lebanon Pond site  
**Attendees:** Dr. Gary Robbins, Julissa Mendez  
**Location:** University of Connecticut
Julissa Mendez spoke with Dr. Gary Robbins in regards to the groundwater at the site. He suggested installing wells at the site to monitor the salinity of the groundwater. He was willing to install the wells as long as CRDC provided the materials. The quote on the materials was approximately $500.

**Outcomes:** Dr. Gary Robbins offered to install about 4 wells throughout the site and teach Julissa how to monitor the ground water as long as CRDC provided the materials. At the time, CRDC did not have the $500 but Professor Peter Miniutti and Julissa Mendez applied for a small faculty grant to purchase the materials.

**Meeting:** October 26, 2011  
**Purpose:** Reviewed calculations and size of sediment forebay for the Lebanon Pond site  
**Attendees:** Dr. Michael Dietz, Julissa Mendez  
**Location:** University of Connecticut

Julissa Mendez met with Dr. Michael Dietz regarding the size of the sediment forebay. He recommended that she do the calculations a second time because some of the numbers seemed too high.

**Outcomes:** The size of the sediment forebay depended on how much water was coming onto the site. It was calculated through a formula that requires watershed information from the site. A misstep in the calculations can lead to a sediment forebay that is too large, or too small, which would not be able to properly treat storm water. Either situation would be a waste of financial resources.

**Meeting:** October 26, 2012  
**Purpose:** Received feedback for conceptual design
Attendees: Dr. Juliana Barrett, Dr. John Clausen, Dr. Michael Dietz, Dr. Mark Brand, Professor Peter Miniutti, Julissa Mendez
Location: University of Connecticut

There was a team meeting held to provide insight and feedback on a conceptual plan developed and presented by Julissa Mendez. She developed the design with the help and input from the academic researchers, public officials and residents from the Town of Lebanon. Julissa Mendez also used the information gathered from the site, such as topography and conductivity readings to develop the design of the pond site. Through the design, she addressed four problems of the Lebanon Pond site:

1. Runoff from the Public Works facility
2. Runoff from Route 87 and Goshen Hill Road
3. Bank erosion
4. Poor visual quality of the Lebanon Pond and immediate surroundings due to algal blooms, invasive plants, and a large amount of sand directly adjacent to the pond

The consequences of those problems were sedimentation of the pond, limited vegetative diversity and high conductivity of the pond water. The strategies used to address those problems were the utilization of a sediment forebay, dredging and reshaping the pond and the development of a planting plan. The professors explained which aspects of the design did not function and why. For example, the sediment forebay was 2 feet deep. Dr. Michael Dietz stated that 2 feet of standing water was a liability and would invite common reed (*Phragmites australis*). Also, the planting plan included non-native plants. Dr. Juliana Barrett stated that only plant species native to Connecticut should be used.
Figure 9. Conceptual site plan and cross-section drawings. This figure illustrates the first conceptual site plan presented to team members at the University of Connecticut.

**Outcomes:** The conceptual design presented to researchers needed to be improved. Specific information from the professors about the Lebanon Pond offered Julissa Mendez the opportunity to strengthen the design.
Meeting: **November 9, 2012**  
Purpose: Follow up to meeting on October 26  
Attendees: Dr. Juliana Barrett, Dr. John Clausen, Dr. Michael Dietz, Dr. Mark Brand, Professor Peter Miniutti, Julissa Mendez  
Location: University of Connecticut

There was a follow up meeting with the academic researchers on the TD team to evaluate the revised design based on the recommendations and feedback given during the previous meeting. The team stated that the second design was more developed than the first design and that it was ready to present to the Lebanon community. The following is a list of changes from the first design:

- The formal shape of the pond was made more natural to increase the edge length of the pond.
- The channel joining the two culverts where the ponds water enters and exits was made wider to help dilute the salinity of the Lebanon Pond
- Trees were planted up against the water’s edge to provide shade to regulate the temperature of the water
- The first bay of the sediment forebay was planted with perennial grasses that could be mown annually.
- Only plant species native to Connecticut were used
- The gabion walls would define and bring attention to the storm water management taking place within the site.
- The stone dust path could potentially connect with Lebanon’s historic Town green.
Figure 10. Final Conceptual Design. This figure illustrates the final site plan and cross-section presented to team members from the University of Connecticut. The design reflects suggested changes from the meeting on October 26, 2012.
Figure 11. Planting plan for the Lebanon Pond site. This figure illustrates the type and placement of plants proposed for the Lebanon Pond site. All the plants used are native to Connecticut. Plants were chosen based on their seasonal interest, availability and maintenance requirements. Their placement depended on their ability to tolerate wet or dry soils and the visual impact it would have on the site.

**Outcomes:** The professors approved of changes within the design such as the use of a perennial grass seed mix, a more natural pond shape, and the placement of trees closer to the water’s edge. Also there was a stronger rationale for the plants used and their placement within the site compared to the first conceptual design. All were in agreement that the design was ready to present to the Lebanon community.

Meeting: **November 29, 2012**
Purpose: Received feedback on design from Lebanon residents
Professor Peter Miniutti, Dr. Juliana Barrett and Julissa Mendez met with 3 residents from Lebanon, Connecticut. The residents were excited about the proposed shape of the pond, the use of plants native to Connecticut and a walking path that could potentially connect to the Lebanon Town green. In addition, the residents were also accepting of proposed changes to the Public Works facility. In order to improve management of their sand and salt piles, it was proposed that 3,500 square feet of the Public Works property be reallocated to the Lebanon Pond property. An analysis of the use and layout of the Public Works property revealed an inefficient use of space. Sand and salt piles appeared to be placed randomly throughout the site. Reorganizing the layout of the Public Works property offered space that would be more beneficial to the pond site.

Figure 12. Existing Public Works facility. This figure illustrates the existing conditions of the public works facility in relation to the pond site. The orange triangle indicates the property of the Public Works facility to be reallocated to the pond site (3,500 sq. ft.).
Outcomes: The Lebanon residents were impressed with the large amount of work that had been accomplished such as illustrative planting plans, cross-sections and hand-made models of proposed conditions. They strongly recommended the use of stone dust for the path and suggested that Julissa Mendez provide a project cost estimate. Surprisingly, there were no disagreements regarding the proposed design of the pond, even when changes to the Public Works facility were proposed. The residents suggested presenting the design project to the First Selectman and Town Planner.

Meeting: December 18, 2012
Purpose: Feedback from political officials of the Town of Lebanon
Attendees: Joyce Okonuk, Philip Chester, Dennis, Professor Peter Miniutti, Julissa Mendez
Location: Lebanon Town Hall

Julissa Mendez presented the proposed design at Lebanon Town Hall. The feedback from the First Selectman and Town Planner was similar to the feedback from the residents. In addition, the First Selectman revealed plans to move the Public Works facility in the future and
the potential to have a local nursery donate plants for the site when appropriate. The First
Selectman also disclosed land-use issues related to the Public Works facility. Due to sensitivity,
the details of the issues will not be discussed in this thesis.

**Outcomes:** The First Selectman and Town Planner were pleased that the cost estimate to
construct the project was attainable. The First Selectman is currently coordinating a committee
to find funding to for construction of the project. However, Town officials neglected to disclose
information regarding the Public Works facility that could have greatly affected the final design.
Town officials may have refrained from disclosing the information to avoid conflicts and legal
action. They are currently considering alternatives to solve the problem.
THESIS RESULTS AND REFLECTIONS
The proposed design of the Lebanon Pond site was well received by the community of Lebanon and by all of the professors involved in the project. The town was pleased to have a vision that would excite the community in order to raise funds and implement the design. They were also supportive that the cost for implementation was reasonable and attainable. The design of the pond was also low maintenance. The professors felt that the final design appropriately incorporated their contributions in an artistic way to create something both functional and aesthetic. All were glad with the way the graduate student, Julissa Mendez navigated the meetings in a manner that built consensus and fulfilled functional and programmatic goals.

Since the last meeting with the First Selectman and the Town Planner, a final report about the Lebanon Pond was compiled and given to the First Selectman. She is currently coordinating a committee to raise funds to begin construction and implementation of the design.

The question remains as to how the Lebanon Pond project measured up to the defining characteristics of transdisciplinary collaborations. In summary of Lawrence and Després (2004), the four common characteristics of TD research are:

1. Complexity
2. Context specificity
3. Collaboration among the TD team
4. Action research oriented

The following will discuss how the Lebanon Pond project did or did not comply with the four characteristics outlined by Lawrence and Després.

1. Complexity
Complex projects do not have to translate into large scale (100+ acres) projects that span several years. However, it is important that problems are real and actual and entail constraints that fall into the domain of other disciplines (Klein, 2004). The Lebanon Pond and its issues are real. They entail multiple problems and sub-problems that will be discussed. There were also various disciplines and domains of knowledge involved such as Horticulture, Ecology, Hydrology, Landscape Architecture, Politics and citizen opinions and perceptions. The mix of people and factors involved in the Lebanon Pond gave depth and complexity to a relatively small site (1 acres).

When Dr. Juliana Barrett contacted the CRDC regarding the concerns of the Lebanon community over the pond, there was no intention to establish a TD team. In contrast, the TD team grew out of a response to multiple problems that arose shortly after the project began. The problems were:

a. Ecological
b. Functional
c. Political
d. Aesthetic

a. Ecological

Ecologically, the goal was to improve the water quality and restore the health of the riparian buffer of the pond. The sediment and salt entering the pond via runoff from adjacent properties were the two main factors affecting the water quality. The sediment entering the pond had to be controlled. Dr. John Clausen and Dr. Michael Dietz both recommended the use of a vegetated swale to capture sediment coming from the roads and Public Works facility. After I presented them with the first conceptual design, it was determined that it was not necessary to capture the
runoff from Route 87 because a swale along Route 87 would create the ideal conditions for common reed (*Phragmites australis*), an invasive plant we were trying to remove. The sediment coming on to the site needed to be concentrated in one place for easy clean-up and removal before it made its way into the pond. A sediment forebay was used to treat runoff by allowing coarse particles in the water to settle at the bottom of a depression before continuing towards the pond.

b. Functional

Functionally, the TD team encountered land-use problems. Due to its use and the manner in which the Public Works site drains into the pond, it was determined that the site was not appropriate for a Public Works facility. Even though moving the Public Works Facility is the best ecological option, the process of doing so requires time, money and other resources that the Town of Lebanon cannot currently handle. It was agreed that the relocation of the Public Works facility would be more appropriate as a long-term goal. In order to address the issues with the Public Works facility, we looked into their salt and sand containment practices in comparison to the best management practices recommended by The Salt Institute (2006) and determined that the Public Works containment practices could be improved. We proposed a reconfiguration of the Public Works facility in addition to taking some of the Public Works property and reallocating it to the pond site in order to have more space and opportunity to improve the water quality of the Pond.
c. **Political**

Lebanon was dealing with a land-use issue related to the site, the details of which were not disclosed until the final meeting. If the entire TD team had known about the problem from the beginning, the proposed design may have been much different. The issue was politically sensitive and could have been costly for the Town of Lebanon, which is why the public officials refrained from sharing the information when the project began. The Town is currently trying to fix the problem.

When working in TD teams, it is important to disclose all information relative to the problem. The failure of the Town to disclose the information at the beginning of the project will delay the implementation and construction of the proposed design. It is important to be aware that towns will not always be willing to share or discuss certain information due to history, fear of liability or other concerns. Open communication from the very start of projects helps to ensure that TD teams understand all of the factors they are working with in order to appropriately address the problem.

d. **Aesthetic**

Another important goal of the project was to improve the visual quality of the site. The Lebanon community, including public officials stated multiple times that the Pond was much more attractive in the past. During the project, the Pond was very shallow and the surface of the water was covered by duckweed and algal blooms. Much of the topsoil adjacent to the Pond was sand from the Public Works facility and vegetation was limited to invasive common reed and poison ivy. Furthermore, the local farmer’s market takes place less than a mile from the site and has been gaining popularity over the last few summers. People come to Lebanon from all over
the state of Connecticut to shop for locally produced goods. The residents of Lebanon are very proud of their rural, farming heritage and in the condition that the Lebanon Pond was in, were concerned about leaving a negative impression on visitors. It was important not to underestimate the aesthetic quality of the site, especially since it was a priority for the community of Lebanon.

2. **Context specificity**

Transdisciplinary research addresses real problems. Since TD research responds to actual problems, Wickson states that “the methodologies employed in TD research need to respond to and reflect the problem and context under investigation” (Wickson et al., 2006, p. 1049). According to Gibbons, the knowledge and solutions that result from TD collaborations must include a broad range of considerations, is intended to be useful to someone in society and includes the interests of various actors (Gibbons et al., 1994, p. 4).

The methodologies utilized are much more flexible in TD research as compared to traditional scientific research that strictly “follows the codes of practice relevant to a particular discipline…the context is defined in relation to the norms that govern basic research or academic science” (Gibbons, et al., 1994, p.4). In TD research, each problem is different in terms of scope, scale, geographic location, funding, actors involved, etc. TD researchers are able to respond most appropriately to contextual factors without the pressures of conducting traditional science.

Fortunately, the design method is inherently context specific. Landscape Architecture students are taught early on to look beyond the boundaries of the immediate site and develop designs based on contextual factors related to the site. Also, the design method is inclusive of quantitative and qualitative methodologies. Landscape Architects and designers incorporate
social and cultural factors (qualitative) in addition to technical factors (quantitative) into designs. The Lebanon Pond project resulted in a final design and report that responded to contextual factors that were specific to the Lebanon Pond.

3. **Collaboration among TD team**

There was diversity among the actors on the TD team. There were 7 professors/researchers, 3 residents, 3 public officials, and a graduate student. As the project developed, the main focus for the researchers and the Lebanon community became to improve the water quality and the visual quality of the site and have it serve as an entryway into the center of town. It became the job of the graduate Landscape Architecture student to make sure the two goals were met. Fortunately, there were numerous aspects of the Lebanon Pond project that contributed to a smooth collaborative process. Some of those aspects include the relatively small scale of the project, the significant overlap between disciplines and the graduate student’s role as an administrative leader.

The relatively small scale and scope of the project was an advantage. The project took place in a community that was geographically close (20 minute drive) to the University of Connecticut. This made it easier to travel back and forth from the site to the University as necessary. The Town Hall and Lebanon Community Center, where most of the meetings took place was also less than a mile from the site. The professors involved were all from the University of Connecticut and more importantly, from the same college (College of Agriculture and Natural Resources). There was significant overlap between the disciplines which made it easy to communicate and overcome disciplinary language barriers.
The small number of community members involved made it easy to maintain consistent participation. Furthermore, the First selectman of Lebanon is highly favored within the community. She has served as First Selectman for over 20 years and is respected by residents. In addition, public officials and residents shared the same goal for the Lebanon Pond, which was to improve the visual quality and create a prominent gateway into the center of Town. A common goal between residents and public officials minimized disagreements within the Lebanon community.

A factor that is typically underrated by those who engage in TD research is the extra time commitment required. The extra time required comes from overcoming disagreements, coordinating meetings with the Town, traveling, and following up once the project is completed. As a graduate student working through the CRDC, Julissa Mendez’s schedule and curriculum was more flexible. She became in charge of the administrative tasks related to the Lebanon project and was responsible for coordinating meetings between professors and community members, a task that generally consumes a large amount of time. This made the TD experience more comfortable for the others involved but also proved a very valuable experience because up until that point, Julissa Mendez had little experience writing professional e-mails. Tasks such as coordinating meetings, writing and filing meeting minutes, reserving rooms and preparing for and leading meetings with researchers and community members offered valuable experiences for professional practice and addressed the added time constraints experienced by those involved in TD research.

Although the collaboration went well, the extent of collaboration throughout the project is questionable. For example, at no point during the project did everyone involved on the TD team meet. Instead, Julissa Mendez met with the professors, residents and public officials
separately. On a few occasions, she met with both residents and public officials such as the First Selectman and Town Planner. Dr. Juliana Barrett and Professor Peter Miniutti were present at most of the meetings and Julissa Mendez was at all of the meetings. Besides Dr. Juliana Barrett and Professor Peter Miniutti, none of the other professors met with residents or public officials from the Lebanon community. Much of this had to do with availability and scheduling conflicts but it required the graduate student to integrate all of the knowledge from the community and professors and put it in a format(s) that all could understand. If the graduate student had waited for the entire TD team to be available in order to hold meetings, the project might be considered more in tune with true transdisciplinarity but it would have extended the project time much longer than necessary for the small scope and scale of the Lebanon Pond project.

4. Action research oriented

According to Lawrence and Després (2004), “transdisciplinary contributions frequently deal with real-world topics and generate knowledge that not only address societal problems but also contribute to their solution” (p. 399). Furthermore, Ferrance (2000) describes action research as a collaborative activity. The Lebanon Pond project addressed problems that were real and actual and a collaborative approach was used to address the various constraints.

One of the concerns regarding action research within the Lebanon Pond project was due to the fact that the project did not begin as transdisciplinary but instead evolved into one. There were no goals established during the beginning that would ensure any changes towards a solution. This was an important step that was overlooked because the conceptual plans and the final report provided to the Town of Lebanon have the potential to be neglected and never utilized.
Fortunately, Lebanon officials and residents were very excited and have already taken the initiative to begin implementing certain aspects of the design. For example, after we discussed their containment practices within the Public Works facility, the Town has attempted to make improvements by creating a concrete crib and pad to store the pile of salt. The First Selectman has also pinpointed potential properties for the relocation of Public Works and is also speaking with the owners of a local wholesale nursery to donate most of the plants listed in the planting plan. Furthermore, a location for the storage of dredged materials has already been identified. For the Lebanon Pond project, we were able to avoid the fate of many final reports, but the process of establishing goals and ensuring changes that work towards solutions cannot be overlooked.

Additional Concerns about Lebanon Pond TD Collaboration

The Lebanon Pond project was more transdisciplinary for the graduate student researcher, than it was for any other of the TD team members, including the other professors, residents and policy makers. Although there was collaboration among the TD team, the information conveyed was directed to the graduate student, Julissa Mendez. She became responsible for the information from the professors, Lebanon officials, and residents and had to incorporate it into the design of the site. Since one of the main defining characteristics of TD research places emphasis on collaboration, is it possible for one researcher to carry out a TD project? According to Wickson et al. (2006):

“If however, we see the distinguishing feature of transdisciplinarity as not simply collaboration between researchers from different disciplines, but as collaboration with the community, then this allows the possibility for lone researchers to adopt
TD approaches. What becomes important then is the ability of the individual to fuse knowledge from a number of different disciplines and engage with stakeholders in the process of generating knowledge” (p. 1052).

Julissa Mendez combined information and knowledge from policy makers, residents, and the other professors to create a final conceptual design for the Lebanon community. Wilson (1996) argues that solo TD scholars encounter higher levels of information overload. This was not the case for the Lebanon project. Julissa Mendez collaborated with other professors and did not have to thoroughly research all subjects related to the Lebanon Pond project. Instead, the different professors imparted expertise that specifically related to the site. The salt conductivity readings that were taken at the pond provide a great example of her interaction with the other professors. Since she collaborated with other researchers but was responsible for the knowledge exchanged, the graduate student can be considered more as a transdisciplinary leader than a lone TD researcher. Although she designed the site, it was the knowledge and feedback from the TD team that made the final conceptual design strong, rational and well received. Without the TD team, it would have been more difficult to achieve the goals of the Lebanon Pond.

There are some variables that may have kept the project from being fully transdisciplinary. For example, the Lebanon Pond project began in April of 2011. By the time the final report was given to the Town, over a year and a half had passed by. As a graduate student involved in the project through the Community Research & Design Collaborative (CRDC) at the University of Connecticut, Julissa Mendez was able to commit the four semesters that it lasted. However, a project of such a relatively small scale should not have lasted as long as it did. When the team of professors had gotten together on October 26, 2011, they were interested in the condition of the ground water at the pond site. They recommended she speak to
Dr. Gary Robbins, a professor at the University of Connecticut and expert in hydrogeography. Dr. Gary Robbins offered to install wells in order to examine the ground water. However, CRDC needed to purchase the materials, which cost $500. The CRDC did not have $500 to cover the well materials so Professor Peter Miniutti and the graduate student applied for a small faculty grant from the University of Connecticut.

Applying for funding proved to be a challenge. They did not receive the $500 for the well materials. The process of trying to secure funding, delayed the project about 8 months. It was not until the CRDC was contacted by one of the residents that the Lebanon Pond project resumed. The project had to continue without a full understanding of the groundwater conditions. In this particular case, financial constraints delayed the project many months. The TD team lacked understanding of the groundwater conditions and the question remains as to how this could have affected the final design. Also, the Town of Lebanon was notified that CRDC was trying to secure funding and understand subsurface conditions but were not informed that the wells were not installed. Since a year had already passed and the Lebanon community seemed eager for conceptual designs, the project continued without a full understanding of subsurface conditions. The issue was disregarded and is not in line with TD research.

Future TD Collaborations

Certain characteristics and processes of the Lebanon Pond project were in line with Lawrence and Després’s (2004) four defining characteristic of TD research although not every aspect of the project was truly TD. Some factors that made the project successful in terms of TD research were the short geographic distances between the site and University of Connecticut as well as consistent commitment from the Lebanon community and professors. In addition, the
disciplines involved on the TD team shared a lot of common ground. The Lebanon residents and public officials also shared similar goals for the Lebanon Pond. Furthermore, the graduate student’s role as administrative leader assisted with time-constraint issues typically encountered in TD collaborations. Factors that kept the Lebanon Pond project from being truly transdisciplinary include Julissa Mendez’s role as a lone TD researcher, meetings that isolated professors and the community, the failure of the Town to disclose important information at the beginning of the project and a lack of understanding of ground water conditions.

Graduate Landscape Architecture programs seeking to adopt TD research approaches will experience their own set of achievements and challenges that may or may not be similar to those encountered in the Lebanon Pond project. However, the following guidelines can help to ensure that project goals are met and that positive relationships are developed within the TD team:

- Establish goals and expectations at the beginning of the project
- Establish the importance of communication and full disclosure of relevant information
- Secure funding as soon as possible
- Research site should be within reasonable proximity (less than 1 ½ hours’ drive) from research institution.
- Establish a location where a majority of the meetings will be held (preferably in the host community for consistent stakeholder participation)
- Graduate students should play a lead role in administrative tasks relating to TD research projects and should prepare, manage and lead discussions and meeting amongst researchers and communities.
• Acknowledge and understand the similarities and differences between the different disciplines, town officials and citizens

• Address and resolve all issues and conflicts. Unresolved issues may create tension and mistrust within the TD team.
CONCLUSION
The term sustainability is a hot topic and will remain so for the foreseeable future. In order to better address the challenges of sustainable development and practices, graduate programs of Landscape Architecture must make a shift in how they relate to the community, how they relate to other academic disciplines, and how they prepare students for professional practice. Transdisciplinary research entails a holistic approach to sustainability and provides an alternative path to effectively address the challenges of sustainability.

As a Landscape Architecture graduate student, I have had multiple experiences that have prepared me for future TD research projects and professional practice. Before the Lebanon Pond project began, I was involved in a project that worked with the community and public officials but involved limited collaboration with other disciplines. The Lebanon Pond project offered the opportunity to work with other disciplines within the College of Agriculture and Natural Resources, whom I had seen on a daily basis, but had limited understanding of what they did.

Furthermore, the project exposed me to the administrative aspect of design projects, which are very time consuming but an important aspect of professional practice that is not typically experienced by undergraduates. The Lebanon Pond project experience has prepared me to work with other disciplines and collaborate in a manner that fosters healthy relationships within a college and with communities to overcome some of the challenges associated with TD research. The wide range of responsibilities within the TD research project has taught me how to coordinate and facilitate projects that address real needs. The experience as a whole has helped me to grow both as a scholar and future professional.

Training and educating Landscape researchers and professionals about TD research is essential if it is to be practiced. Programs such as the Community Research & Design
Collaborative (CRDC) at the University of Connecticut are in a good position to adopt or continue using TD approaches because they are inherently cross-disciplinary and are created for building positive relationships with communities. TD approaches can better prepare graduate students for professional practice and help to develop the discipline of Landscape Architecture.
References


THE LEBANON POND
A FEASIBILITY STUDY OF THE POND AT THE INTERSECTION OF ROUTE 87 AND GOSHEN HILL ROAD

NOTICE

This is a feasibility study for the Lebanon pond located at the intersection of Route 87 and Goshen Hill Road. It is intended to depict the opportunities for this site.

*All of the following documents are not engineered plans and are not for construction purposes
OUTSTANDING ISSUES

1. There is much uncertainty concerning the pipe that drains into the pond. The source and materials of what drains through the pipe is also unknown in addition to the condition of the pipe itself.

2. There is potential for the relocation of the public works facility. Although we support relocating the facility, these documents are for existing conditions.

OVERVIEW

PROBLEMS
1. Runoff from public works Facility
2. Runoff from Route 87 and Goshen Hill Road
3. Bank Erosion
4. Poor Visual Quality

CONSEQUENCES
• Sedimentation of the pond
• Limited flora/fauna diversity
• Higher conductivity of pond water

SOLUTIONS
2. Intercept + Treat the Water That Comes Onto the Site
3. Bank Stabilization
4. Improve Visual Quality

TECHNIQUES
• Sediment Forebay
• Reshaping of the Pond
• Planting Plan
• Framing Views
SITE AERIAL

THE SITE
THE SITE: RUNOFF

ADJACENT PUBLIC WORKS
Water enters the site through a culvert under Goshen Hill road. The water exits the pond through a culvert under route 87 and makes its way to a larger pond located downstream.

This graphic depicts where the water that enters the pond is coming from. It enters the pond after it makes its way through wetlands. It is important that the polluted condition of the pond does not undo the purification work of the wetlands and does not pollute downstream from the pond.
PROBLEMS

1. Runoff from public works,
2. Runoff from Route 87 and Goshen Hill Road
3. Bank Erosion
4. Poor Visual Quality

CONSEQUENCES
• Sedimentation of the pond
• Limited flora/fauna diversity
• Higher conductivity of pond water

1. RUNOFF PUBLIC WORKS
2. RUNOFF FROM ROADS

3. BANK EROSION
SEDIMENTATION

Sedimentation:
The action or process of depositing sediment

Due to the runoff from the public works facility and adjacent roads, the amount of sand in the pond has greatly increased.

SEDIMENTATION

Existing

2 ft

Before

6-8 ft

According to residents and public officials, the pond had a depth of about 6-8'. Currently, the pond is about 2' deep.
CONDUCTIVITY OF POND WATER

A conductivity meter measures the amount of electrical current or conductance in a solution. Conductivity is useful in determining the overall health of a natural water body...in natural water bodies, the ions that contribute to high conductivity result from dissolved minerals and salts.

http://www.yahow.com/about_5134892 conducitity-meter.html

<table>
<thead>
<tr>
<th>Condition</th>
<th>Conductivity (μS/cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking water</td>
<td>100</td>
</tr>
<tr>
<td>Desirable limit to people</td>
<td>830</td>
</tr>
<tr>
<td>Brackish water</td>
<td>27000</td>
</tr>
<tr>
<td>Seawater</td>
<td>34000</td>
</tr>
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</table>

If growing salt sensitive plants, conductivity should be less than 700 μS/cm.


As the amount of salt increases, the conductivity readings also increase. There are different units used to measure the conductivity of the water. For the Lebanon Pond, the unit of micro-siemens per centimeter (μS/cm) is used.

CONDUCTIVITY OF POND WATER

The graphic depicts points within the pond where the conductivity was measured and the corresponding readings in micro-siemens (μS/cm). The red line in the graph represents 750 μS/cm. For a healthy growing environment, the conductivity of the water should be less than 750 μS/cm. Most of the readings were well above the 750 μS/cm mark.
SOLUTIONS

2. Intercepting + Treating the Water That Comes Onto the Site
3. Bank Stabilization
4. Improve Visual Quality

TECHNIQUES
• Sediment Forebay
• Reshaping of the Pond
• Planting Plan
• Framing Views

1. BMP OF PUBLIC WORKS

• Salt should be stored under a roof, or if in the open, properly covered.

• All salt, inside or outside, should be stored on an impermeable pad.

• Runoff should be properly controlled

• The pad site(s) should be located away from water sources and situated so that if any drainage leaves the storage area it will not affect the water.

WWW.SALTINSTITUTE.ORG

Proper sand/salt storage facility
EXISTING PUBLIC WORKS

The public works facility has potential to better utilize their existing space and to use best management practices for storing their sand and salt piles.

PROPOSED PUBLIC WORKS

Shifting the entrance closer to the pond would allow for placing all of the sand/salt piles to one side of the facility. The space that is freed up can be allocated to the pond site for more rehabilitation opportunities.
To keep the sand and salt from leaving the site, we suggest a trench-like structure that captures the sand and salt as they leave the piles. Once the trench is filled, the sand and salt in the trench can be removed and placed back into the pile.

2. INTERCEPT + TREAT

The runoff that enters the pond site from public works and part of Goshen Hill road will be directed to a sediment forebay before entering the pond.
The runoff that enters the pond site from public works enters a shallow swale and is directed to a sediment forebay. Part of the runoff from Goshen Hill Road is also captured and redirected to the sediment forebay.
EXISTING / PROPOSED CONDITIONS

EXISTING

PROPOSED

Sediment forebay area
Pond, 6-8'

SEDIMENT FOREBAY

Provides pretreatment by settling out coarse sediment particles, which will enhance treatment performance.

-ConnDot Drainage Manual

The sediment forebay consists of a shallow depression covered by lawn. It is recommended that the forebay be cleaned bi-annually or when necessary. If any water were to spill over, it would be captured by swale before making its way into the pond.
SEDIMENT FOREBAY CALCULATIONS

A sediment forebay should be sized to contain at least 10% of the Water Quality Volume (WQV)

\[ \text{WQV} = \frac{(I^*) (R) (A)}{12} \]

\[ R = 0.05 + 0.009 (I) \]

- \( I \): percent of impervious cover
- \( A \): Site area (acres)

GABION WALLS

1. Reinforcement
2. Flexible
3. Economic
4. Permeable
5. Lifespan of 40-60 years

Gabion walls would be used to bring attention to the water treatment occurring at the site.
3+4. BANK STABALIZATION + VISUAL QUALITY

Reshaping the pond

<table>
<thead>
<tr>
<th></th>
<th>Existing pond area</th>
<th>Proposed pond area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3,200 sq ft</td>
<td>3,800 sq ft</td>
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</table>

The proposed shape of the pond creates more edge. This is more beneficial for the overall health of the pond.
3+4. BANK STABALIZATION + VISUAL QUALITY

Proposed planting plan

A. Acer rubrum
   Red Maple

B. Aesculus rubra
   Red Oak

C. Aronia melanocarpa
   Black Chokeberry

D. Betula papyrifera
   Paper Birch

E. Cornus florida
   Flowering Dogwood

F. Juglans nigra
   Eastern Redbud

G. Myrica gale
   Black Gum

H. Rhododendron succulentum
   Swamp Azalea

I. Viburnum dentatum
   Arrowwood Viburnum

J. Perennial Seed Mix

CUT + FILL DIAGRAM
## TOTAL CONSTRUCTION COSTS: $20,654.18

*Based on "Site Work and Landscape Cost Data 2011", By RS Means
*These figures are general estimates and may not reflect actual costs

### Site Size Information
- Total area: 20,000 sf / 0.45 Acre
- Pond Area: 4,400 sf
- Land Area: 15,600 sf / 0.35 Acre

### Cost Estimates

#### Clearing + Grubbing

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<th>Unit</th>
<th>Material</th>
<th>Labor</th>
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<td></td>
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#### Enthusiastic and Stockpiling

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#### Site Earthwork

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### Cost Estimates

#### Gabion Wall

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#### Fencing Removal + Rsct

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<td>5' Benches</td>
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#### Plants

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<th>Size</th>
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86