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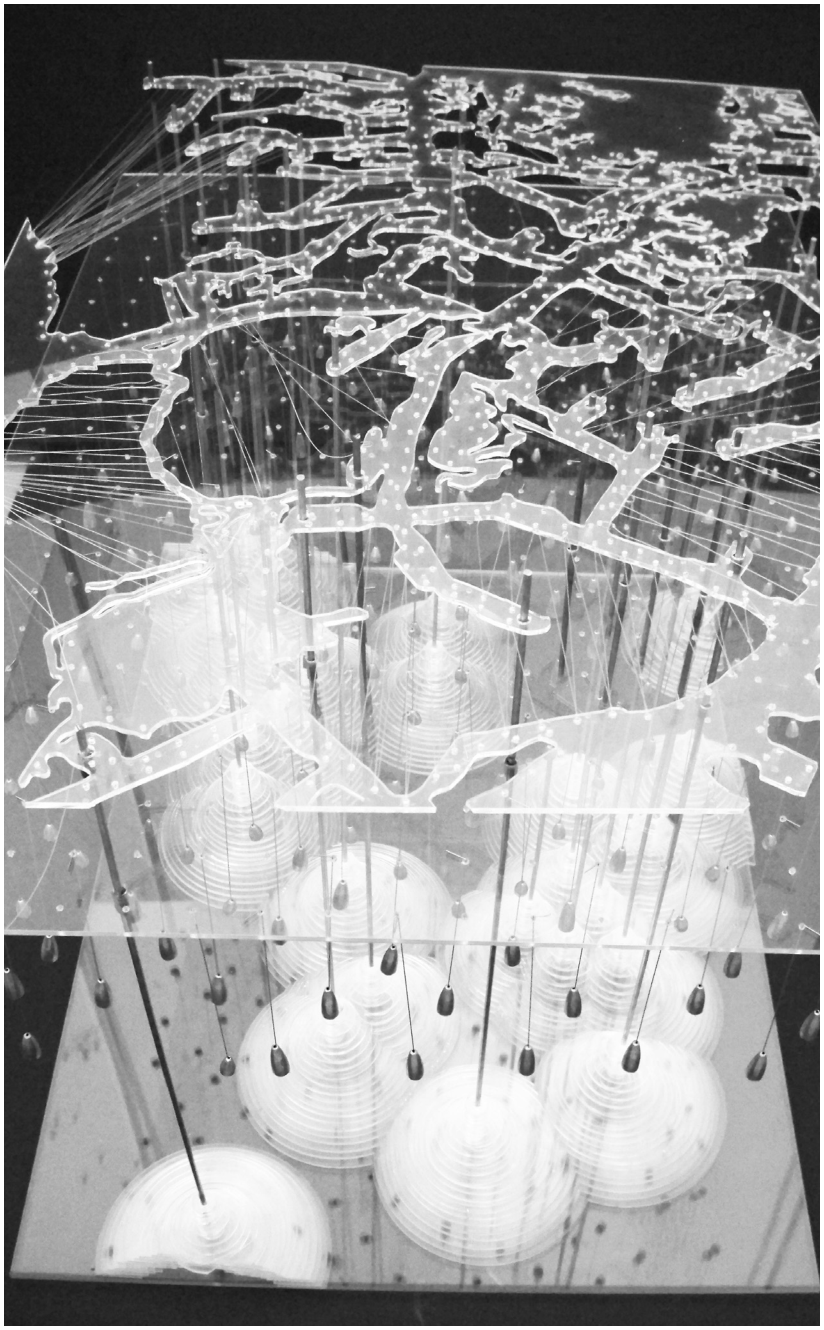


Overview of analog model of oil and gas strata, Andrea Galinski

Pedagogy

In an attempt to understand the complex relationships occurring within ecological systems, methods of representation must explore modes that focus on illustration, simulation and dynamic modeling. Illustrating Ecologies, an advanced research seminar at the Louisiana State University Robert Reich School of Landscape Architecture, explores animating and modeling ephemeral ecological systems through analog and digital models. Students are asked to research ecological processes, infrastructure and/or biotic systems through processes that are deconstructed through modeling and animation. Students learn techniques necessary to model ephemeral processes such as decomposition, deposition, growth and hydrology utilizing particle systems and other techniques that are, at times, simulations and at other times illustrations. Digital and analog representations were combined with field observations of ecological processes, as well as recording methods such as video, photography, sensing and sketching, in order to fully understand the complex processes that were illustrated.

The research was conducted in groups where each focused on a representation methodology and ecological system definition. Within the course of the seminar, students became experts on specific software and representation techniques, as well as their chosen ecological system. The two concurrent research streams would focus the group's research on the ecological science and the representation techniques. The information was documented throughout the semester at lab.visual-logic.com to serve as a resource for the seminar and for outside collaborators.

Through this process, research groups were asked to clearly define the scope of an ecological system. This required the creation of a comprehensive body of research that included both scientific and anecdotal evidence to be used to describe an ecological system model. This research required the development of observation methods that were used to document dynamic, ephemeral processes for the purpose of developing representations of ecosystem complexity. The observations and research were tied directly to the concurrent research into software, techniques and methodologies for illustration and simulation.

Ecological System Research

The groups defined an area of research and scope through the specification of an ecological system. For the purpose of the seminar, ecological system was defined as a naturally occurring and/or constructed or reconstructed system that could be biotic and/or abiotic. Typically, ecology refers to the relationship of organisms to one another, or in terms of human ecology, the relationship of human beings to the environment. The students were asked to define an ecological system and to create a body of research to support the representation of the components of the ecology. The ecological system research was comprehensive, concentrating on the overall system/framework, relationships of elements (flora, fauna, etc), relationship to larger systems, temporal change, ephemeral qualities, perceived experience and physical relationships.

Software/Tool Review

The tools necessary to create compelling digital representations are complex and not specifically tailored to the design professions. Each research group focused on a specific digital tool in order to research and review the tool's ability to create ecological illustrations. The review contained an overview, specific application and examples. A wide variety of software and systems were explored, including:

- Particle Flow: 3ds max
- Reactor: 3ds max
- Polygon and Nurbs Modeling
- Vue xStream
- Autodesk Civil 3d
- Fluid Dynamics: Maya
- Adobe After Effects
- 3d Printing/Laser Cut
- Globlal Illumination Systems
  Mental Ray, Vray

Technique Documentation

It was necessary to understand and share techniques developed to represent the researched ecologies. Each group documented two techniques that they developed for the representation of a specific ecological system or feature. The techniques were original and/or derived from other work or tutorials. The documentation showed the representation process step-by-step and explained not only how it was done but why the technique was appropriate. The documentation contained images and/or screenshots, as well as source files, to allow others to work their way through the process.

Exhibition

The culmination of the semester was an exhibition representing the researched ecological system as a framework, process and experience. Each group determined, based on their research, the appropriate methods to represent each of these modes. This was accomplished through prototype models, animations and/or illustrations. Each group's exhibition was assembled to express the following three terms to frame the ecological system creating three modes of inquiry.

Framework : a basic structure underlying a system or concept

Process: a series of actions or steps taken in order to achieve a particular end, or a natural or involuntary series of changes, or a systematic series of mechanized or chemical operations that are performed in order to produce or manufacture something

Experience: (noun) practical contact with, and observation of, facts, or events, or an event or occurrence that leaves an impression on someone. (verb) encounter, or undergo, or feel

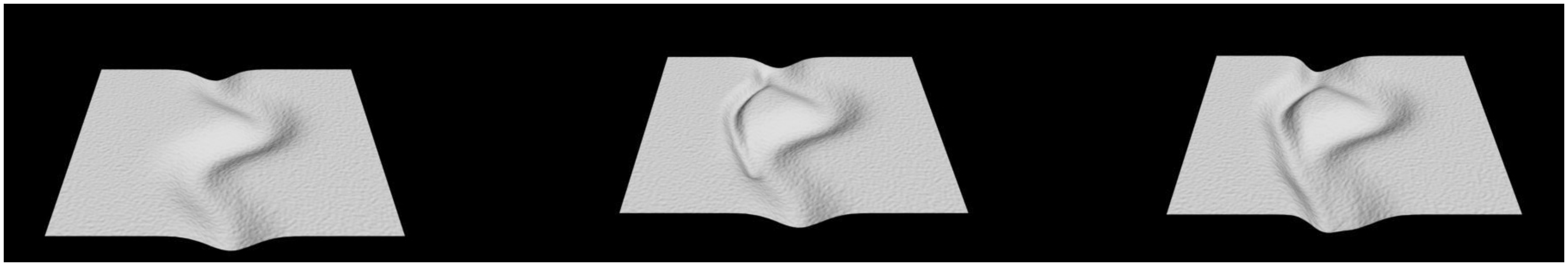
Each group was responsible for designing and creating a stand-alone exhibit that worked with each of the other research groups in the class as a single exhibition. The following four projects represent the range of work completed in the course, including digital illustrations, digital simulations, analog simulations, and physical models.

Stream Bed Modeling Fluctuating Infrastructure

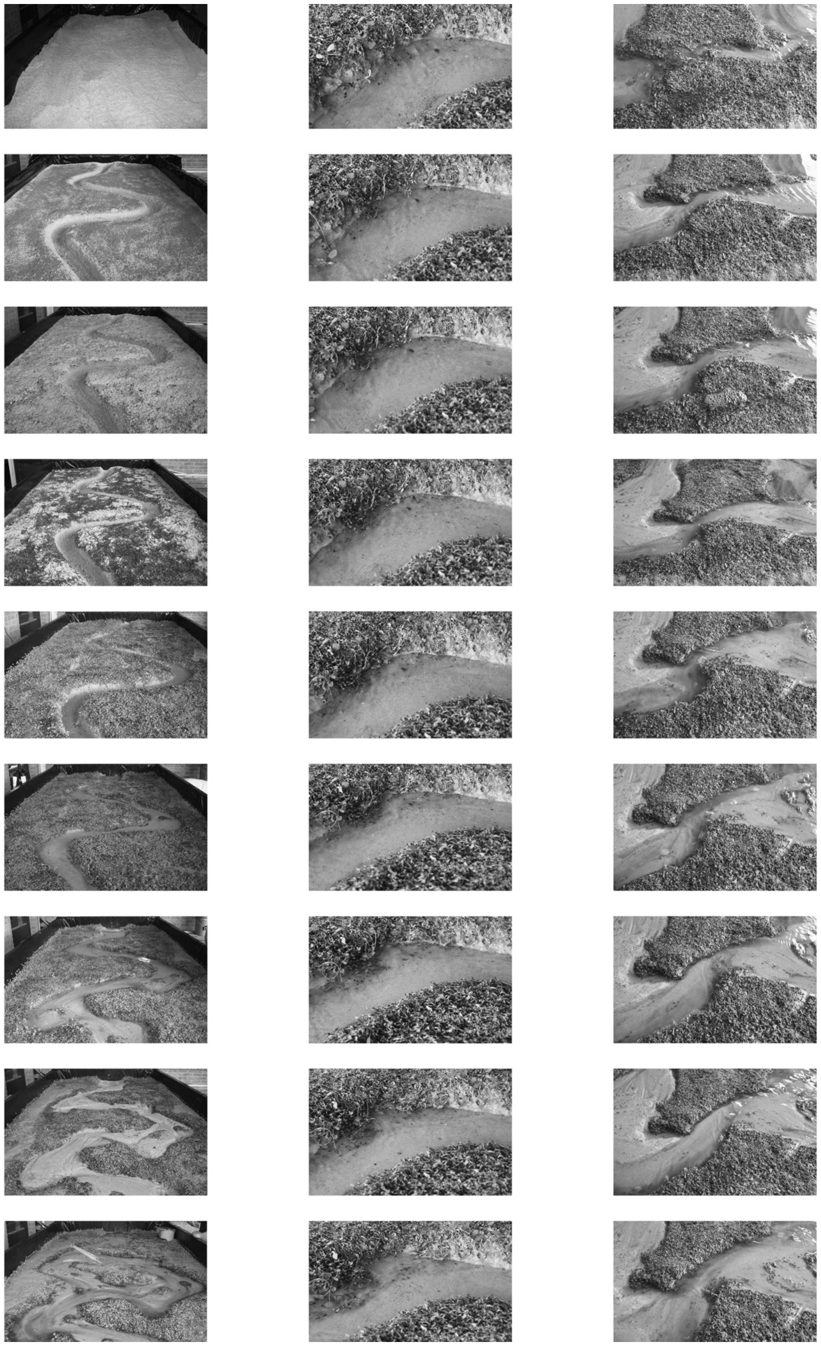
Andrew Baum and Alex Ramirez

The water flow of the Mississippi has many factors that influence where it turns, bends, rises, falls, increases or decreases in speed. These factors are known as levees, dams, spur dikes, and locks. There are 29 locations where these locks/dams are located along the Mississippi, 27 of which are north of St. Louis. This means that the river is controlled at many points. These locks and dams help maintain a stable water flow for navigational purposes.

Not only do man-made factors affect the river system, but the natural environment of the river can affect how the river fluctuates. Some of these factors include its depth, width, and volume. From St. Louis south, the levee system becomes more prominent due to elements such as settlements and the increasing volume of water. Within this area of focus, the group studied how the water was affected by these structures. Objects like soil sediment and debris are shifted around, while the river continues to



River channel digital models, Alex Ramirez and Andrew Baum



River channel analog simulation sequence, Alex Ramirez and Andrew Baum

cut and fill the surrounding land, the emphasis placed on the ecological system being created and disturbed over a period of time.

There are major elements that must be studied to understand how the river flow became an ecological system. The river began its course as a fluctuating structure that has evolved to become a channelized element. To understand this system, the group explored how the river once was, and how it has transformed over the years into a more controlled and manipulated ecological system.

The Mississippi river was once an untamed force that carved the land in any direction the geomorphology and water flow wanted it to go. It was in a world where nothing hindered the river system, allowing it to have its way with the landscape as it created the shortest route to its outlet in the Gulf of Mexico. Over time, it became a controlled force due to man creating settlements and providing the proper way for the river to flow. Furthermore, there are factors that man and nature still present that affect the way the river fluctuates. The main focus of the framework was how the river fluctuated from the past, to the present, and even to possibilities of the future.

The fluctuation of the river depends on sediment deposition, water levels, and the addition/subtraction of land along the river. By investigating these factors, the research group became interested in studying the ideas of how a meandering river forces itself upon the land, ultimately affecting settlements, different ecologies, and the ways that humans interact in these diverse environments. The river fluctuation was explored through digital modeling, animation and analog simulation techniques.

The digital models helped strengthen the ideas behind the physical river model as it was in the construction stages. The models show more detail of how the river fluctuates and changes due to erosion and sediment. The group attempted to incorporate the rendering of the models with particle flows and a realistic ground plane. The animation gradually showed the changing of the river and its fluctuations.

By exploring different situations the water encounters, the group began to understand how the river runs its course and is controlled at the same time. The situations that are simulated reveal the river's systems and more detailed aspects not fully understood or shown yet. This pattern can be seen as the water moves laterally across its down-valley axis (flood plain). Oxbow lakes are formed when these meanders are cut off from the main stem of the river. Specifically, oxbow lakes are formed when two concave banks have eroded away the sediment so much that they are immediately adjacent to each other. Once the two banks have finally been cut through, a newer, straighter channel is created and the abandoned meander loop is formed. An oxbow lake is formed when there has been enough deposition of the sediment at each end of the abandoned loop that it seals off the loop from the river.

The analog simulation prototype parallels the study of the meandering rivers. The group attempted to duplicate the work of Christian Braudrick, William Dietrich, and their fellow colleagues at the University of California at Berkeley. They successfully constructed a scaled down version of a meandering river that maintains meanders in the river. By adding light-weight plastic particles used in sandblasting to the water that flows through this model, and alfalfa sprouts as the deep-rooted vegetation of the riverbanks, the stream was able to maintain one main stem. Other studies similar to this have resulted in a system of braided streams that have no regularity and no significance in studying the effects of meandering rivers. The hope was to successfully duplicate what was produced in California, and study the effects that meandering rivers have across the nation.

This exploration of the river's sediment deposition process begins to set up a story that explains what happens in the changing course of the river. The sediment plays a significant role that causes the river to fluctuate the way it does. As observed in a more detailed view through the process, the experience begins to widen its influence across the larger aspect of the landscape. It creates situations that alter the land and how local people benefit or suffer from the decisions the river has chosen. Even though portions of the ecological system become cut off from its original foundation, wildlife and ecology will settle into their new role in the landscape. The program has multiple settings through which to demonstrate a time-lapse illustration across the reconstructed landscape, the fluctuating river.

The diagrams at left represent the scheme of how the final experience will tell the story over a period of time. It looks at how the meandering river changes courses, creating an oxbow lake, and how the river affects the overall land and ecology patterns surrounding it. The final simulation system was implemented and documented through a large analog physical model. The model simplified the geomorphological conditions by representing soil strata with sand of varying coarseness. Vegetation was introduced using fast growing alfalfa to represent forest massing. The simplicity of this system simulated a low fidelity of a meandering stream ecosystem.

Algae Power Economies
Joaquin Martinez, Andrew Collins, Lauren Fasic

This project is, like any other farming ecology, an economy of trade, efficiency of production, and implementation of an alternate energy source. The ecology is based on the production of algae at a large scale, achievable through technological advances. In order to produce enough biofuel to sustain the production of algae (so that algae production is not dependent on fossil fuels), political support through laws and bills that provide certain incentives and tax exceptions to manufacturers, distributors, and consumers are required, as well as a social acceptance driven by the availability and easy access made possible by political, economic and technological advances.

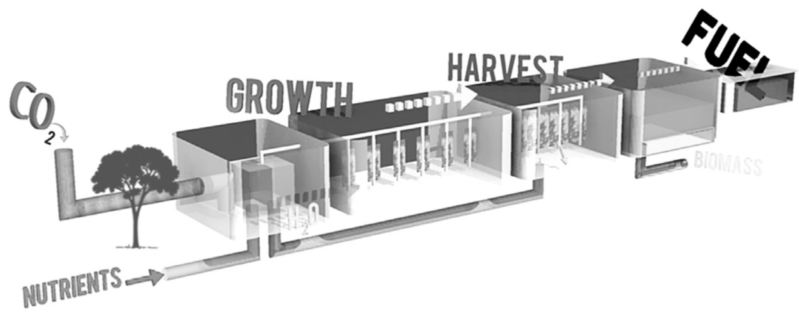
The project's relationship to the Mississippi River can be interpreted as a design intervention that takes advantage of riverfront areas that have been neglected or that are defunct due to the abandonment of industrial plants. Again, political support through tax exemption, land price considerations or other economic incentives for investors and energy companies may open up a market through the Mississippi's riverfront, which could create an identity and establish the waterfront as a prime energy-producing location.

The process for this ecology would be the conversion of algae from biomass to a biofuel. On a larger scale, it would deal with the process (at this point a speculation) about the role of algae biofuel within the energy market—specifically, the process of conversion from a fossil fuel economy to a sustainable energy source.

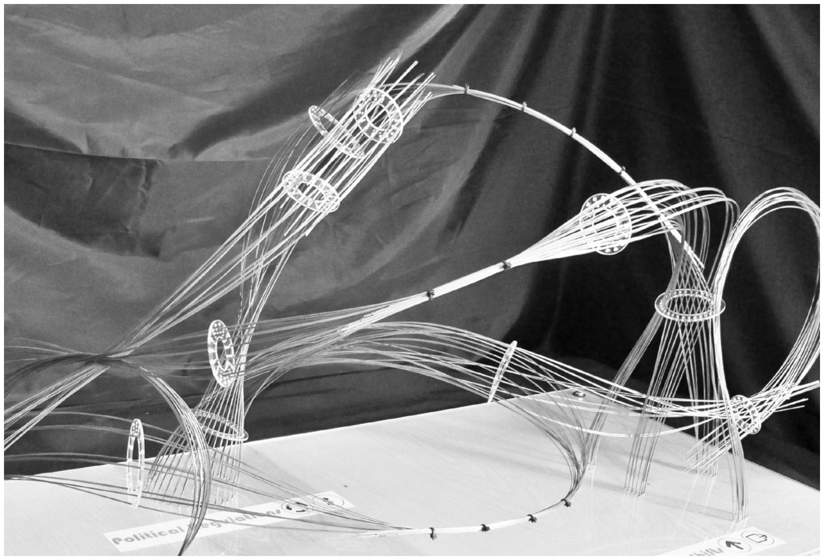
Algae convert sunlight into energy via the process of photosynthesis, whereby carbon dioxide + light = glucose + oxygen. Algae quickly reproduce, allowing for harvest in as little as ten days. When compared to corn growth cycles (used for ethanol production), it is clear that algae are superior for fuel production.

Algae may be grown in PhotoBioreactors, where nutrient filled water is pumped through plastic tubes that are then exposed to sunlight to allow photosynthesis to occur.

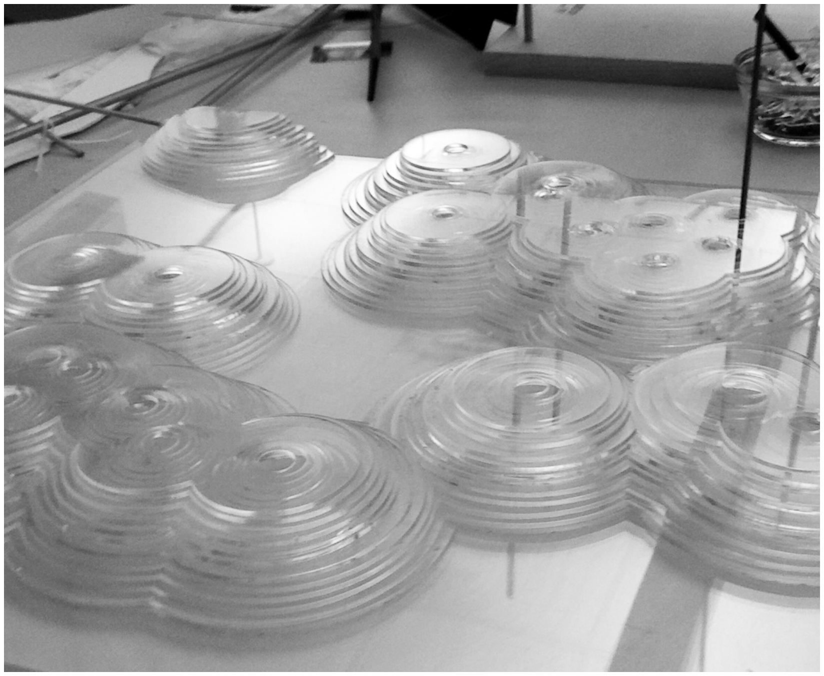
Closed Loop Systems are expensive because they require heavy infrastructural costs. They are designed to isolate the algae, and feed pollutant-free, pure CO2, usually from a smokestack.



Algae power sequence model and animation (1 frame), Joaquin Martinez, Andrew Collins, Lauren Fasic



Wire bundles representing economic, political and cultural issues, Joaquin Martinez, Andrew Collins, Lauren Fasic



Oil and gas volumes, Andrea Galinski

Open Ponds are extremely hard to cultivate because they deal with many outside forces, precisely those that the closed loop system is designed to eliminate. Elements like change in water temperature and PH levels, competition from other algae, and the exposure to bacteria make the process of cultivating in an open pond, extremely difficult, with high variance algae biofuel extracted.

The representation of this system was developed into a sculptural piece that attempted to portray the overall complexities of the adjoining elements. The ecological system was construed loosely as an economy of commercial power generation visualized through sculpture and animation.

Oil Infrastructure
Andrea Galinski

The ecology of the oil and gas infrastructure is an extremely complex system. In order to develop a coherent simulation, it is necessary define the particular area of inquiry. Specifically, this project studied how the petrochemical infrastructure is inserted into Louisiana's Gulf Coast wetland's landscape. Many processes could be included—cutting of canals, insertion of pipelines, puncturing of wells, extracting hydrocarbons—which all alter the physical dimensions of the wetland ecosystem. This project focused on possibly the most spatially extensive and hydrologically profound process of the oil and gas infrastructure—the incision of canals. The network of canals leaves a powerful geometric imprint on the landscape and the processes involved are fundamental to understanding how the industrial ecology has been woven into the natural ecology.

Three resulting dynamics occur in the model:

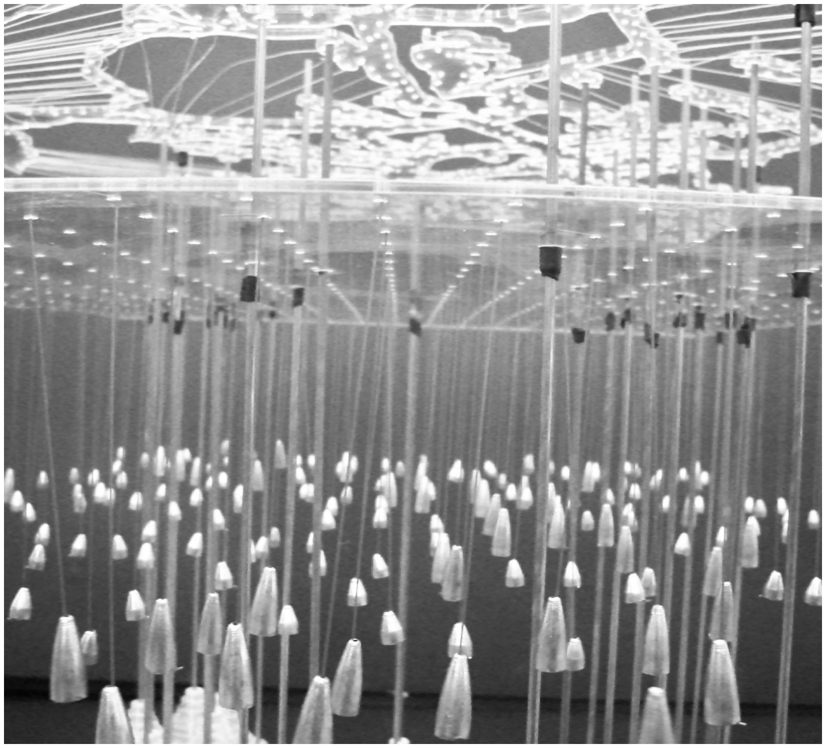
{1} dredging canals in terrain
(incision / altered topography)

{2} intrusion of salt water
(infiltration / altered hydrology)

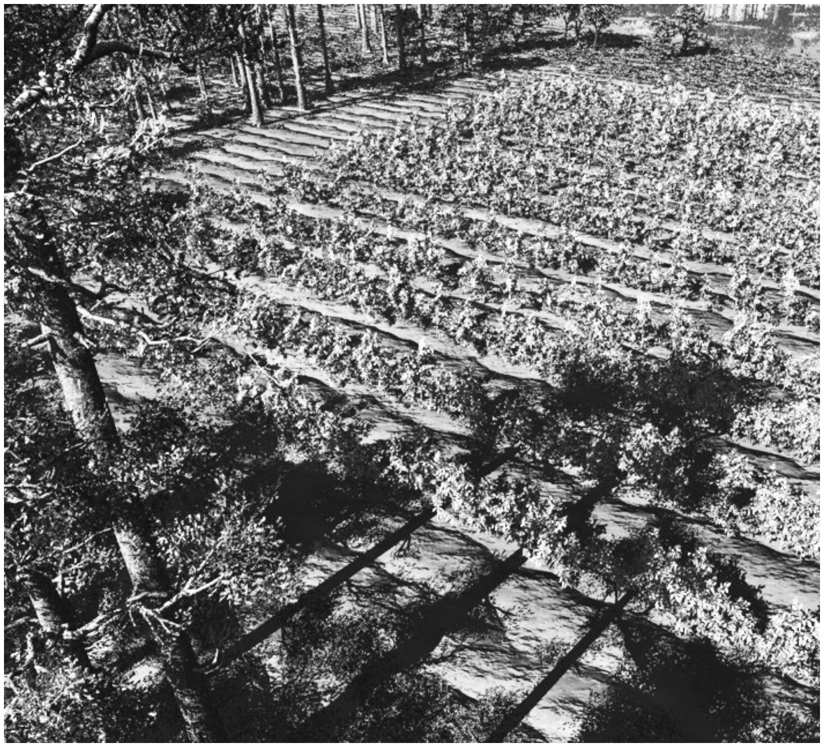
{3} fragmentation of vegetation
(disintegration / altered ecology)

The latter was the most ephemeral component of the project. It attempted to capture the experience of the dynamic processes involved, condensing time to express one location at various moments so that systems that operate at a humanly imperceptible speed may become visible. For example, the infrastructure connects larger cycles of geologic time, ecological scales of time, as well as fleeting environmental conditions.

Louisiana's oil and gas infrastructure is a complex system. As a physical entity, it consists of wells, pipes, off-shore oil rigs, refining stations, submerged barges and other technologies. This research attempted to better understand the intersection between these built and natural ecologies and explored the dynamic processes that result from the evolving interface between the two.



Composite analog model of oil and gas strata, Andrea Galinski



Overview of agricultural and runoff potential, Kristen Lonon and Patrick McGannon

{threads} pipes, canals, channels

{islands} wells, off-shore rigs

{mats} refining plants, oil fields, wetland vegetation, submerged aquatic vegetation

Agricultural Runoff

Patrick McGannon and Kristen Lonon

Framework

In order to establish a point of reference for modeling various methods of combating contamination of runoff and filtration processes, the research group modeled existing conditions of a watershed within an agricultural region. The agriculture practices modeled in this section considered base agricultural situations with no consideration of runoff treatment or control.

First, a typical watershed was constructed in 3ds Max. Then the hydrologic properties of the watershed were modeled using the 3ds Max Particle Flow system. Finally, fertilizer type contaminants (nitrogen, phosphorous) were distributed on the site and both the groundwater infiltration and watershed infiltration. Other factors that were modeled were soil porosity, crop type, rainfall/irrigation frequency and amount, and vegetation density and type.

Process

The process portion consisted of small-scale modeling of the contamination and filtration process of runoff and river systems using a particle-flow simulator. The focus in this model was the exploration and experimentation of various runoff containment and filtration strategies. Some examples that were modeled include on-site detention, vegetated filters, and synthetic filtration systems. The effectiveness of each model was analyzed to determine the strengths and weaknesses of each method.

Experience

The information gathered from analysis of the first two sections was synthesized into the basis for a comparative model. This model was presented so as to clearly represent the difference in impact on watershed ecosystems when exposed to both untreated and effectively treated agricultural runoff. This model gives viewers a firsthand demonstration of the dispersing of contaminants and the chain of effects these contaminants create on a watershed.