the
Creative Learning
EXCHANGE

Volume 7, Number 2 - Spring 1998

SUCCESSION FROM SAND DUNE TO MARITIME FOREST ON A BARRIER ISLAND

A Maryland Virtual High School Instructional Activity by Aili Carlson and Sarah Clemmitt

The Fall 1997, issue of "The Exchange" featured an article about the Maryland Virtual High School. The following excerpt is an example of the terrific work being done there. This instructional activity is written by two students in the High School Elective in Earth Science pertaining to Coastal Processes or Oceanography. The complete paper is available from the CLE and the web site <http://sysdyn.mit.edu/cle>. The 8 character title is DUNEC-C.

Unit Purpose

By building a computer model of a complex dynamic system, the student develops an understanding of the relationships among the many contributing variables. At first glance, asking high school students to design a model representing such an intricate system may seem inappropriate. However, the decisions they make about the relationships among variables enhances their understanding of barrier islands and develops their modeling skills.

Unit Objective

The objective of this lesson is to develop a model which will simulate the succession from sand dune to maritime forest on a barrier island. Barrier islands are found off the east coast of North America. They develop from sand dunes into a complex ecological system involving sand dunes, barrier flats which frequently include a maritime forest, and salt marshes. This exercise deals not only with the design of a model, but also with the problems that arise when trying to model a complex set of interactions which are not completely understood by the scientific community and for which mathematical relationships are not readily available.

Materials

STELLA, a modeling language for Mac and Windows platforms—High Performance Systems, Inc.

Links to State Science Outcomes

Learning Outcomes in Science for Maryland School Performance Assessment Program, Maryland State Department of Education (1994). Earth Science Concept Indicators, K-12 Progression.

- earth is changed over time by different natural and human forces.

Student Outcomes

The student will gain an understanding of the development of a barrier island system, sand dune to maritime forest. By adding additional variables to the model, such as salt spray, the student will further define the growth of a barrier island. Although the model may not correlate well with the development of an actual barrier island, the student will begin to be able to predict the effects of various contributing factors on the system.

***Dune** continued on page 3*

1998 Systems Thinking and Dynamic Modeling Conference
June 28-30
New England Center, Durham, NH

For information and registration form, contact

Andi Miller, The Creative Learning Exchange
1 Keefe Rd., Acton, MA 01720
(978) 287-0070 • FAX (978) 287-0080 • milleras@cle.tiac.net

Double rooms still available at the New England Center

Updates. . .

Catalina Foothills School District

The Catalina Foothills district maintains its concentration on System Dynamics with the help of a grant from the Waters Foundation. With the assistance of the equivalent of five full time mentors, the district offers an impressive array of training and opportunity for any staff members who are interested in incorporating systems concepts and tools into their work. My recent visit there showed diverse interest from teachers, such as a sixth grade teacher desiring to add an individual mapping piece to *The Giver* simulation, a sixth grade literature simulation used by many of the sixth grades throughout the district. The individual mapping by the students was added last year in a few classes. After the students have read *The Giver* and worked through the simulation, the teacher, usually with the help of a mentor, guides the children through the steps to making their own stock-flow diagrams of a segment of an ideal society or a segment of the world as it is now.

Another discussion centered on how to use systems tools with the book *I Know Why the Caged Bird Sings*. A ninth grade literature teacher was working with the high school mentor to see the possibilities of behavior-over-time graphs, causal loops, and, perhaps, in the future, a computer simulation based on the book. She felt the tools would be useful to track such concepts as attitude toward self, opportunities, awareness of discrimination, and personal anguish.

Another interesting foray into the world of incorporating system dynamics in K-12 education is the prospect of group modeling with sixth graders. After finishing *The Giver* simulation and doing their individual maps, two classes of sixth grade students wished to do their own working model of another novel, *The Outsiders*. The challenges of working with 24 eleven year olds to create a working model span the gamut from classroom management skills to the conceptual and mathematical skills necessary to create a working model. If anyone else in the country has attempted anything similar, please notify me and I will pass on that information to the Catalina Foothills District.

Within the next few weeks, many new and revised Catalina Foothills units incorporating system dynamics will be put onto the web site <http://sysdyn.mit.edu/cle/>. Most of these have been generated during the summer by teachers who are compensated for their time. Although not many school systems can offer that option, the Gordon Brown Fund offers the same opportunity to any teacher in the country who has a curriculum unit they wish to put into a form usable by others. Please see the box on page 8 for details, or e-mail me for more information. *Lees Stuntz <stuntzln@tiac.net>*

Chelmsford Public Charter School

The Chelmsford Public Charter School, located in Chelmsford, MA, is a public middle school serving 178 students in grades 5-8. The students are selected for the school in a double-blind lottery; there are no entry requirements. The student body is representative of the full range of students normally attending a public middle school. Students with wide ranges of academic strengths and challenges are represented. The school is committed to meeting the needs of all students in a full-inclusion model.

The students are served by 15 full-time staff members. There are eight home base teachers, one Spanish teacher, one student support services director, one librarian, one health professional, two inclusion specialists, and one director/principal.

The CPCS Student Performance Objectives are: Effective Communicators, Self-directed Learners, Problem Solvers, and Successful Members of Multiple Communities.

CPCS's academic, organizational, and instructional practices are aimed at assuring that all students achieve these objectives to the highest level possible. All students are in multi-age classes and remain with the same

Updates *continued on page 11*

From the Editor . . .

Even in New England, it is beginning to look like spring! The crocuses are out and the air has lost some of its chill. Here at the CLE, spring means getting ready for the conference at a rather hectic pace. You will find the draft program enclosed in this issue. I urge anyone who plans to attend to register soon. We are getting registrations every day now and the New England Conference Center has a maximum in the auditorium and dining room of 270 people.

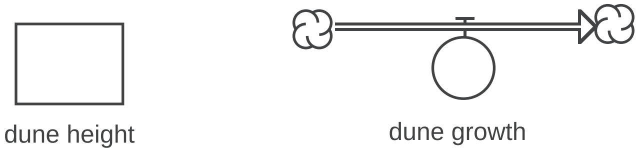
Our second enclosure this month is a long list of new materials, especially from the Catalina Foothills District. Many of these curricula are results of their summer workshops in which teachers are paid to write up appropriate uses of system dynamics which fit their curriculum. We are all the beneficiaries of their work. If those of you who are not in CFSD wish to have the same support for writing up curricula, the Gordon Brown Fund is available. E-mail me if you wish more information.

We look forward to seeing many of you in June, and wish everyone a restful and productive summer.

Lees Stuntz *<stuntzln@tiac.net>*

Sand Dune to Maritime Forest on a Barrier Island, continued from page 1

Figure 1: Stock and Flow for a Dune



Student Assessments

- Ask the students to design a basic model relating sand dune growth, vegetation growth, and forest growth. Since the relationships among these three variables are not well defined, the goal is to simulate the general trend of barrier island development.

- Ask the students to add a variable that contributes to the growth of the island, such as salt spray. How does this addition affect the model? What needs to be taken into account when this variable is added?

- Ask the students to evaluate the model. What are the benefits of this model? What are the limitations? What information is needed to improve this model? Why is the information difficult to gather?

Barrier Island Model A

The first model will focus on the general relationships between dune growth, vegetation growth, and forest growth. Assume that dune growth is linear at 4 meters per year. When the dune reaches 5 meters, vegetation begins to grow behind the dune at a constant rate. For example, with an initial dune height of 0 meters it will take 1 1/4 years for vegetation to begin to grow. When the dune reaches 15 meters, the environment behind the dune is suitable for a maritime forest to grow. Assume that the forest's growth rate is also linear.

A STELLA model can be built to represent this simplistic view of the growth of a barrier island.

The height of the dune is a STOCK (see figure 1). A STOCK, or reservoir, is something that gains and loses value. The growth of the dune is a FLOW, the rate of change which affects the stock.

See figure 2 for a sample STELLA model of this simplistic system.

Exercises and Discussion Questions

1a. Using a calculator, determine what the height of the dune would be for the first 5 years of the model and sketch a graph of dune height as a function of time.

b. Using your STELLA model, run it for 5 years with a dt = 1 and create a graph of the results. Do your graphs match?

2. Calvin Calculator thought that the amount of vegetation after 5 years could be determined by the formula:

final_vegetation = initial_vegetation + rate_of_growth * 5

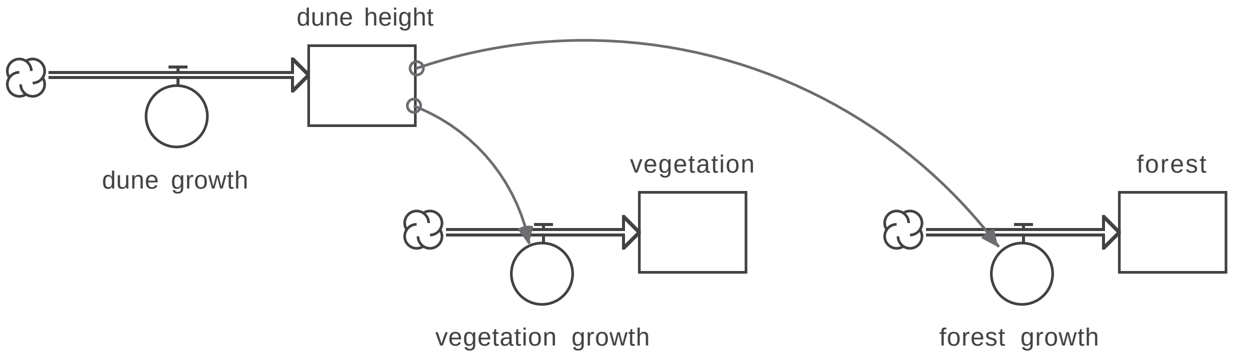
which would yield 0 + (2)*5 = 10. Explain the error in Calvin's logic.

3. Create a graph showing dune height, vegetation, and forest over 10 years.

4. How large does the dune become in 5 years? In 10 years? Is this realistic? Why or why not?

Dune *continued on page 4*

Figure 2: Model Diagram of Barrier Island Development Assuming Linear Growth



Sand Dune to Maritime Forest on a Barrier Island

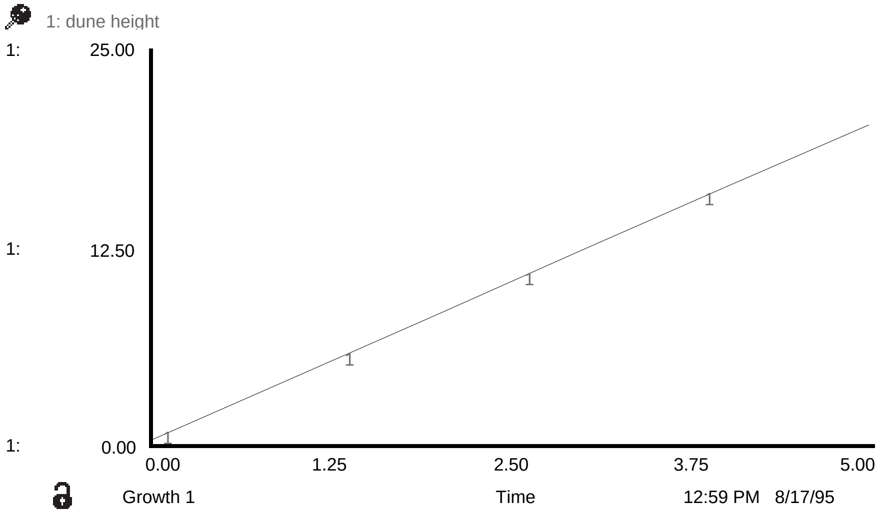
, continued from page 3

Sample Solutions

1. Figure 4: Dune Height Over Time

Time	Dune Height
0	0.00
1	4.00
2	8.00
3	12.00
4	16.00
Final	20.00

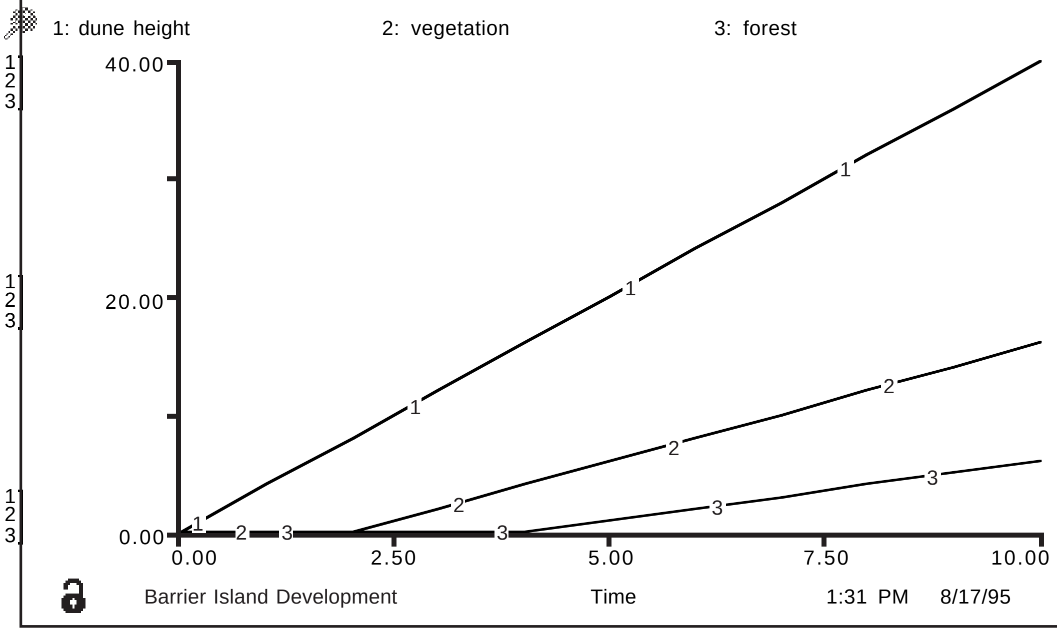
Figure 5: Dune Height Over Time



2. Calvin Calculator did not take into account that the vegetation does not start growing until the dune height is greater than 5 meters. Instead, Calvin Calculator needs to determine at what time, t, the vegetation starts growing. Then, the following equation will hold for all times after t:

final_vegetation = initial_vegetation + rate_of_growth * (5 - t)

3. Figure 6: Barrier Island Development Assuming Linear Growth



Students should notice that the vegetation graph does not begin to grow until time = 2 years, when we predicted that growth would occur at time = 1.25 years. The reason for this discrepancy is that setting dt = 1 means that values are only calculated at whole years. Suggest to the students that they change the dt to 0.25 to see if the vegetation will start to grow at the predicted time.

4. The dune height increases infinitely because nothing in the model prevents it from doing so. In reality, dunes reach some maximum height that is determined by the energy within the system.

Barrier Island Model B

Model A assumes that all of the relationships are linear. You need to alter the model to simulate the actual trends in growth. As the dune gets taller, its growth rate decreases. Therefore, dune growth is inversely proportional to dune height:

dune_growth = 4 / dune_height

This is also true for the vegetation and the forest, except that the relationship is reversed. The more vegetation there is behind the dune, the easier it is for more vegetation to grow. So vegetation increases slowly at first and proceeds more rapidly with time. Vegetation growth is directly proportional to the amount of vegetation:

vegetation_growth = 0.03 * vegetation

Assume that once the vegetation begins to grow, it increases by a factor of 0.03. Assume that once the forest begins to grow, it also increases by a factor of 0.03.

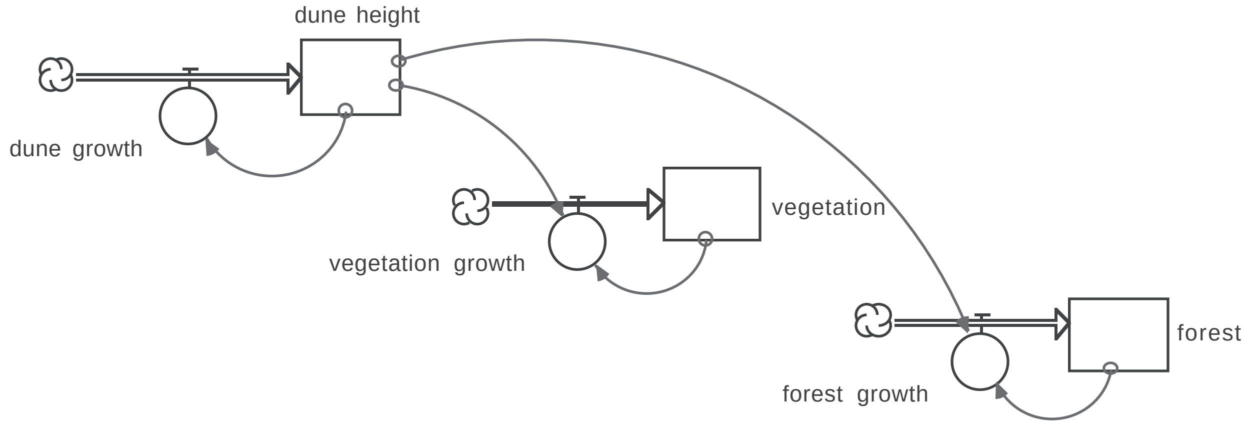
Exercises and Discussion Questions

1. Alter your model to include the above considerations.
2. Run the model and graph the dune height, vegetation, and forest. How have these changes affected your graph?
3. Create a table of dune height, vegetation, and forest. At what point does vegetation occur? At what point does the forest begin to grow? Does this time sequence make sense? Why or why not?

Sample Solutions: (These results were obtained by using a dt = 1.)

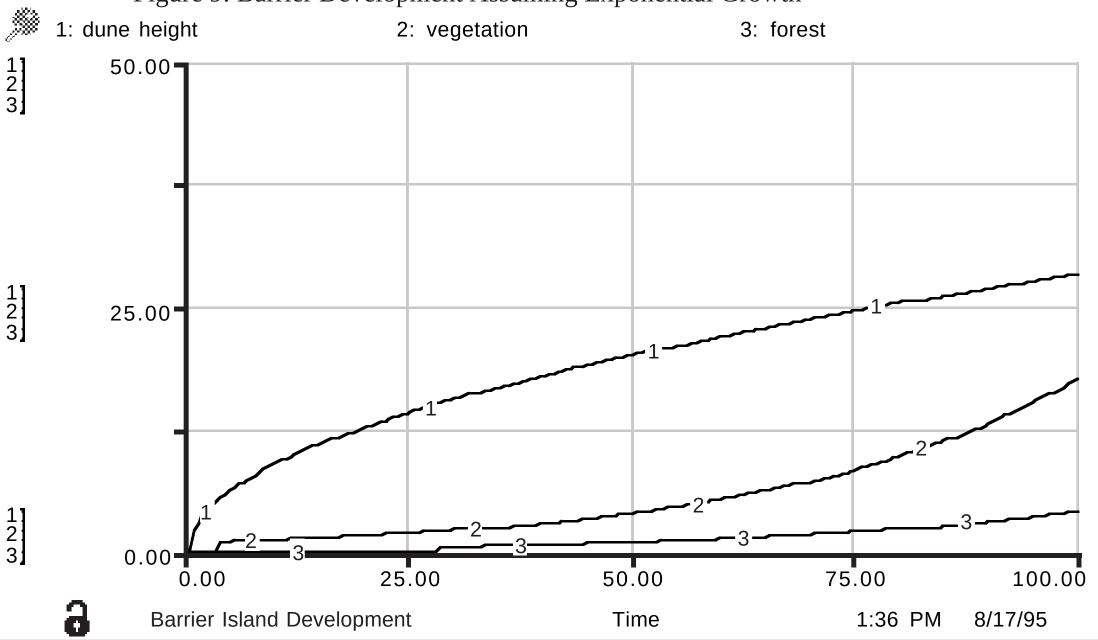
1.

Figure 7: Barrier Island Development Assuming Exponential Growth



2.

Figure 9: Barrier Development Assuming Exponential Growth



Notice that the growth is no longer linear. For instance, by making the dune growth inversely proportional to the dune height, the graph has become logarithmic. Vegetation and forest growth are now affected by their previous levels. Therefore, their curves are exponential.

Dune *continued on page 6*

Sand Dune to Maritime Forest on a Barrier Island

, continued from page 5

3. Figure 10: Barrier Island Development Assuming Exponential Growth

Time	Dune	Vegetation	Forest
0.0	0.00	0.00	0.00
10.0	9.13	**1.21**	0.00
20.0	12.81	1.63	0.00
30.0	15.63	2.20	**0.52**
40.0	18.02	2.96	0.70
50.0	20.12	3.99	0.95
60.0	22.03	5.38	1.28
70.0	23.78	7.24	1.72
80.0	25.40	9.76	2.32
90.0	26.94	13.14	3.12
Final	28.38	17.70	4.20

Vegetation begins at 10. Forest growth begins at 30.

Yes, this time sequence makes sense. In an actual barrier island system the dune would grow first. The dune then creates a protected environment which allows vegetation to grow. The vegetation then produces nutrients allowing the forest to grow.

Suggest to the students that they could modify the model to have vegetation directly affect forest growth rather than having dune height affect it. If the arrow from the dune height stock to forest growth is removed and an arrow from the vegetation stock to forest growth is inserted, the students could experiment with equations to see the results.

Barrier Island Model C

Now that approximate trends for dune growth, vegetation growth, and forest growth have been established, you need to introduce one of the following variables to the model: salt spray, wind velocity, accumulation of suitable topsoil, crowding of plants, storm surges and overwash.

Here is an example. Salt spray will affect the area behind the dune and is harmful to vegetation growth. Vegetation growth will increase as salt spray decreases. Assume if there is no vegetation then vegetation grows at a rate of (2 minus the salt spray) square meters per year. Salt spray is inversely proportional to dune height. When the dune height equals 20 meters, assume that salt spray no longer reaches the area behind the dune.

Exercises and Discussion Questions:

1. Create a new model incorporating one of the variables listed above. Run the new model and look at the graphs. You may need to adjust the equations, the graph scale, or the constants to achieve a realistic model. Try graphing the new variable and see how it relates to the development of a barrier island.
2. In a paragraph, explain the equations and constants you used as well as the results you achieved.
3. Your model probably does not realistically demonstrate the development of a barrier island. What are some of the factors missing from your model?
4. What problems did you encounter modeling a complex system such as this?
5. What is gained from creating a model where many of the equations and mathematical relationship are not well defined?

Sample Solutions

1. The model below is one interpretation. Depending on which factor the students choose to introduce, their models will differ.

Figure 11: Barrier Island Development Including Salt Spray as a Variable

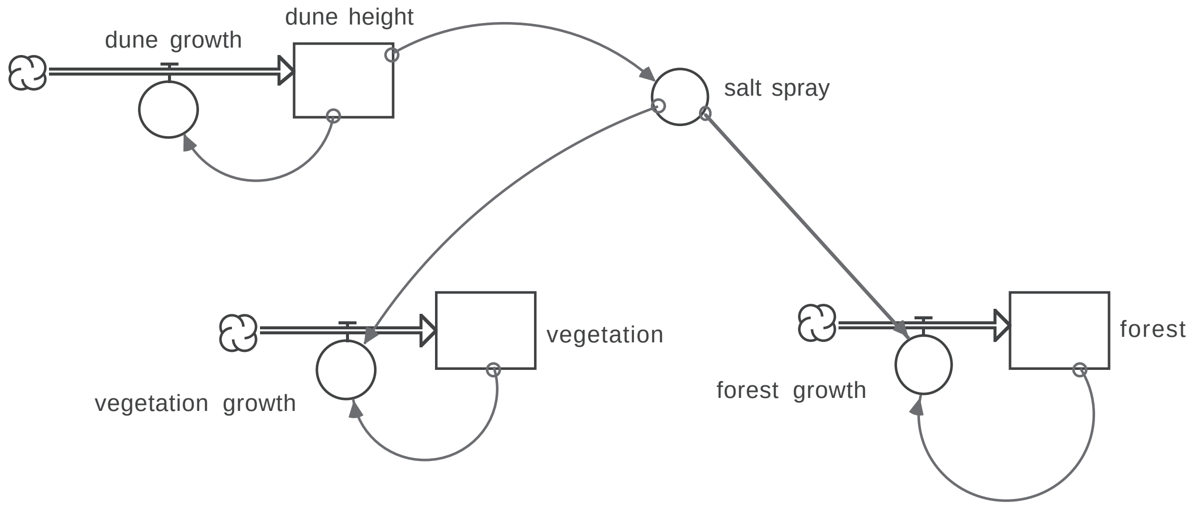


Figure 13: Barrier Island Development Including Salt Spray as a Variable

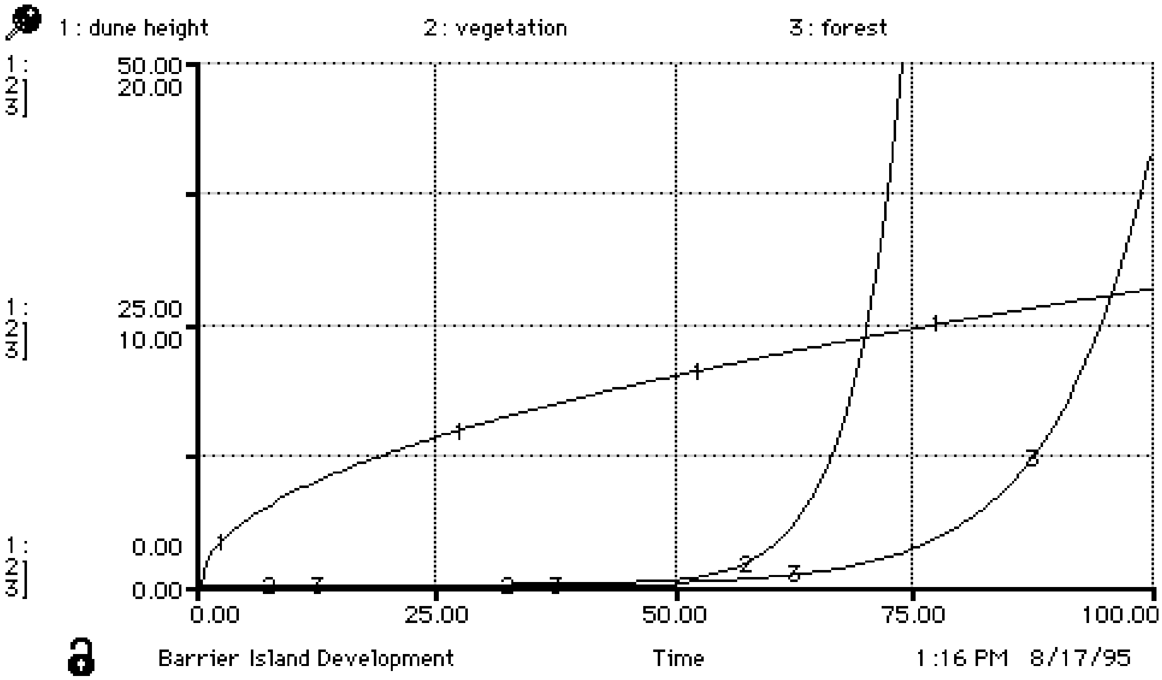
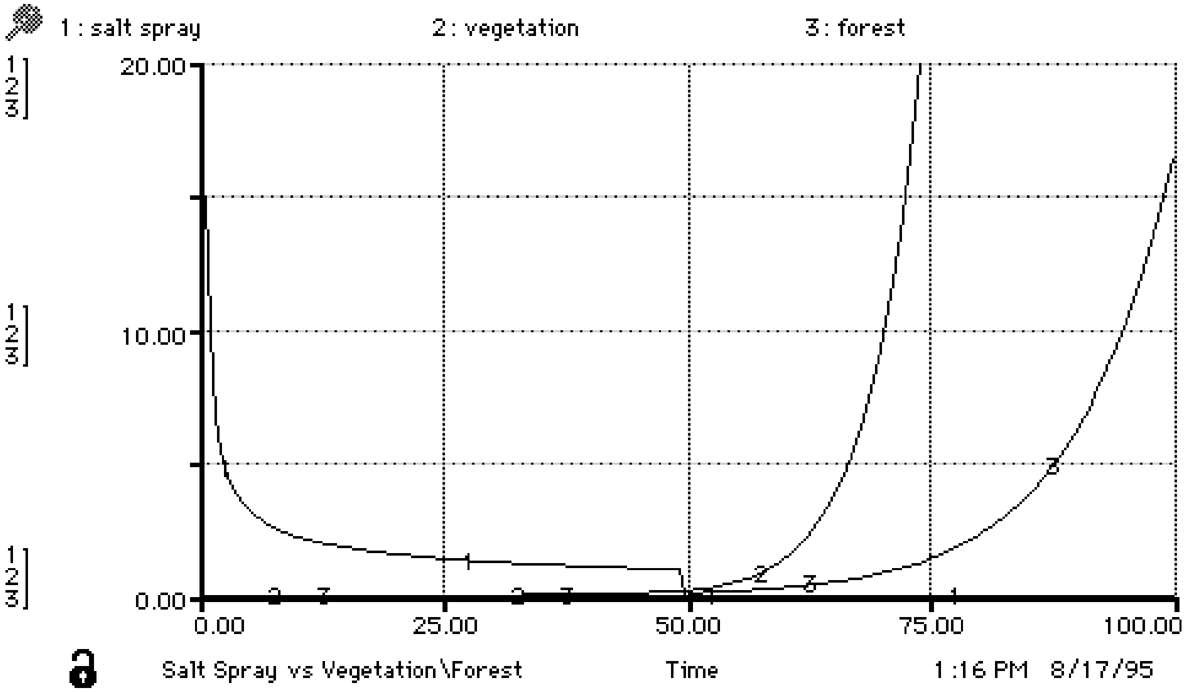


Figure 14: Comparison of Salt Spray and Vegetation/Forest Growth



2. Because the relationships used in this model are not well understood by the scientific community, the equations used to introduce salt spray into the model are not accurate. The equation 20/dune height was used because the relationship between salt spray and dune height is inversely proportional. As the dune height increases the amount of salt spray decreases. The value 20 was arbitrarily chosen.

3. There are many other variables that contribute to the growth of a dune system besides salt spray. For example, the velocity of the wind, the accumulation of topsoil that will en-

Dune *continued on page 8*

Sand Dune to Maritime Forest on a Barrier Island

, continued from page 7

courage plant growth, the crowding of plants which will inhibit plant growth, and storm surges that will overwash the dune and decrease its height.

4. The main problem with modeling complex systems is the lack of mathematical equations relating the variables. Without these, the model can be constructed from only sparse data and/or a rudimentary understanding of the trends. This, of course, greatly limits the accuracy of the model. In addition, there are so many factors to consider that the model quickly becomes complicated. Many relationships have been overlooked. In a real world situation an apparently small variable which was overlooked can have a large impact on the system.

5. Although this model may seem to have little practical application, modeling simplified systems is an important step toward understanding complex systems. This rudimentary model should not be used to make crucial political and engineering decisions; however, by creating such a model you begin to understand the factors involved in the system. This provides a solid starting point for building a model that eventually can be used for practical applications.

◆

Survey on Revision of Classic Text

One of the classic system dynamics textbooks, *Introduction to Computer Simulation: A System Dynamics Modeling Approach*, by Roberts, *et. al.*, originally published by Addison-Wesley, will be revised. The current target audience is students and teachers at the High School and Undergraduate College levels.

A survey to help in this endeavor is available on the web at: <**http://plato.lesley.edu/faculty/Roberts/survey/Default.html**> (This address is case sensitive.)

Feel free to respond to the electronic "web form" version using your web browser. Lacking web access, ask for an email version of the survey. Please email any comments to Hank Taylor at <htaylor@mit.edu>.

◆

Systems Thinking in Action® Conference

Pegasus Communications is sponsoring a conferencewhose theme is *Learning Communities: building* ENDURING *capability*. The conference will be held in San Francisco, September 16 to 18, 1998. Presenting one of four large forums will be Joan Yates, assisted by students from the Catalina Foothills School District, where Joan is the System Dynamics Project Manager. Joan's forum is titled *Starting Early: How K-12 Students Are Becoming Systems Thinkers.*

Author and lecturer Peter Senge is one of the keynote speakers.

For more conference information, telephone Pegasus at 800-272-0945 or visit <www.pegasuscom.com> .

GORDON STANLEY BROWN FUND

To support preparation for distribution of materials for using system dynamics in K through 12 education

May 1, 1998 is the application deadline for funding for Summer 1998 activities.

Be sure to submit your proposal prior to the deadline.

The Gordon Brown Fund can support teachers for:

- Released time or summer time used to put into transmittable and usable form, materials and methods that have already been used in schools and that could be of help to others,
- Communicating experiences that did not meet expectations so that others can be forewarned.

Work supported by the Fund is to be available for distribution through the Creative Learning Exchange and any other channels that the author arranges.

There is no standard application form. Address applications, with an outline of the proposed project, to:

Lees N. Stuntz, Creative Learning Exchange
1 Keefe Road
Acton, MA 01720
stuntzln@tiac.net

Systems Thinking and System Dynamics in K-12 Education

A study supported by the Waters Foundation—School Year '95-'96—by Mary Scheetz

The Spring 1997 issue of the Creative Learning Exchange newsletter featured Mary Scheetz's study of twelve school districts around the country which are integrating systems thinking and system dynamics into their programs. In that issue (Volume 6, Number 2) we included the summary from the Carlisle, MA, Public Schools. Our Late Fall 1997, Winter 1998, and Late Winter '98 issues (Vols 6.4, 7.1, and 7.2) held the summaries from the Lawton Elementary School in Ann Arbor, MI, Harvard, MA Public Schools, and Glynn County Schools, Brunswick, GA. Following is the summary from the Maumee Valley Country Day School, Toledo, OH.

Maumee Valley Country Day School Toledo, OH

Setting

Maumee Valley Country Day School is a college preparatory, coeducational, independent school for preschool through Grade 12 located on 70 acres in south Toledo, Ohio. The total population of 468 students is organized into 3 year-olds, pre-school (4 & 5 year-olds), primary (grade 1 & 2), lower intermediate (grade 3 & 4) , upper intermediate (grades 5 & 6), middle school (grade 7 & 8), and upper school (grades 9 through 12). The school attracts motivated, able students who have a range of academic interests and diverse backgrounds, and whose families value education. Its challenging curriculum, student-centered school life and supportive community inspire and equip students for a lifetime of learning.

School Philosophy

The school’s mission is to enable students to become enlightened, compassionate and contributing citizens of our global community, while preparing graduates for their best opportunities in higher education.

Project Philosophy/Goals

Project goals include integrating systems thinking and system dynamics into the Maumee Valley classrooms and organization, and utilizing systems thinking and system dynamics to positively influence the educational goals of the school. Long term goals focus on having all children think in terms of circular causality as well as linear causality and to have systems thinking/system dynamics so ingrained in the school that a mentor will no longer be needed and that the staff will be able to assume a leadership role in providing workshops for others.

History of Project

In June of 1994, the new head of the school came to Maumee Valley familiar with systems thinking, and encouraged a math teacher, who was also head of the middle school, to attend the Systems Thinking and Dynamic Modeling Conference in Concord, MA. Excited about the use of computer models, the middle school head introduced the K-12 faculty at Maumee Valley to systems thinking at the beginning of the year faculty meetings in the fall of 1994.

During the 1994-95 school year, a faculty/administrative reading group met two times each month to discuss readings from *The Fifth Discipline*, ”Roadmaps,” and other sources. The group included teachers and administrators from the lower school, the middle school and the upper school. Interest in systems thinking, system dynamics, and dynamic modeling continued to grow.

During the summer of 1995, a group of faculty, students, and administrators attended a STELLA modeling workshop at Maumee Valley, facilitated by trainers from Trinity College in Burlington, VT. Teachers from the lower school, the middle school, and the upper school were in attendance, as well as students from the middle school. Participants had an opportunity to learn about STELLA and to begin the development of a model, or to learn about or adapt existing models that were developed in other K-12 projects.

The group reconvened for a day-long workshop in October to complete work on models. Computer models were used in upper school English and chemistry classes during the first semester of the 1995-96 school year. Students and staff were excited about the results and were motivated to locate, design, and implement additional computer models as well as other strategies for systems thinking. In December of 1995, a team of teachers and administrators from the lower school attended a workshop on systems thinking in elementary education in Ann Arbor, Michigan.

During the second semester of the 1995-96 school year, the systems reading group members continued to meet and added new members. A full semester modeling class was implemented for upper school students. Members of the class have learned about STELLA modeling and have developed models to demonstrate required skills for the modeling class as well as for use in presentations in other classes. Students from the modeling class help other students as well as teachers to design models that are related to the curriculum of various classes.

Members of the Systems Reading Group are working together to plan the next steps in terms of group meetings, collaborative mentoring, summer conferences and training, and plans for the 1996-97 school year. Future plans include the use of systems thinking and system dynamics in both the classrooms and the organization at all levels, pre-school through upper

Maumee *continued on page 10*

ST and SD in K-12 Education at Maumee Valley

continued from page 9

school. Plans are in place to acquire a full-time mentor for the staff, who would undertake the following tasks: become familiar with the school's curriculum, K-12; do a nationwide search for STELLA computer models that can supplement the MV curriculum; work with teachers to introduce STELLA computer models to their classes; develop with teachers STELLA computer models that teachers want; support teachers in their efforts to create and/or maintain learner-centered learning environments; run workshops for teachers and administrators on modeling and the application of systems thinking in the school.

Quotations from Project Participants

Notable Results

• "Students are thinking about and questioning the interrelationships of changes in their environment."

• "I think there is a greater willingness on the part of my fellow administrators to weigh the impact of their decisions on areas other than those for which they are directly responsible. It has provided the language for dealing with issues that might previously have been seen as really not concerning me. Retention and recruitment of students, in particular, have been more readily seen to be affected by other seemingly unrelated decisions throughout the school."

• "When using system dynamics models, there is an immediate student interest and facility in learning. There is a willingness on the part of students to recognize and talk about complexity and interdependency of issues."

• "Systems thinking has helped us to discover a large number of hidden balancing loops within the organization."

• "Self-interest is a strong motivation to resist change. . .those who seek change as a means towards growth will emerge to set a positive example. This I hope will move the cautious from behind the fence and into the game."

• "Prior to incorporating systems thinking, the administrators were clearly focused on their divisions, as opposed to their first focus being the school in its entirety. The introduction of systems thinking has provided division heads a broader framework in which to operate. They are now talking systems, and influencing others to look at the whole, to see that specific decisions have impact beyond the immediate problem or concern."

Individual Learnings

• "Though our initial experiments with modeling were successful and the students most enthusiastic, we have hardly touched the surface in utilizing systems in our school. We are going to undertake additional training this summer, but it is clear that we need on-going year around support."

• "The introduction of systems must be a slow and a steady process. Monies must be allocated for training during the summer and during the school year to sustain development of projects. A systems mentor at the school is essential to make constant, forward progress."

• "The important learning from modeling is that you must identify what is significant in a situation or a system."

• "Numbers aren't the whole answer. Lots of exploration and questioning is needed and evolves from student interaction."

• "Learning the beginning stages of modeling using STELLA has been quite interesting. Even though I don't use modeling at this time, going through the process of writing a model has helped me to visualize how systems work. In addition, by practicing systems within the organization, I have more confidence that we are cooperating more and competing less internally. This has the result of helping me to trust my colleagues more."

• "I have realized how hard it is to get to a level where I can comfortably use STELLA, but I am learning how systems thinking applies to nearly everything."

• ". . .hard to distinguish those learnings that have occurred because of my efforts to understand systems thinking and those that have occurred simply because I am new. My endeavor to understand systems has led me to view organizations in a more objective manner. This I hope will help me become less reactive to peoples' resistance to change and to better understand their motivations, which will allow me to mend fences and to build better bridges. Confrontations seem to be inevitable during periods of change, and understanding is a means of defusing people's fear and anger."

Challenges

• "There is a list of 7 levels of systems thinking and I'm only at level 2/3. I would like to identify what readings and activities will help us move upward on the levels."

• "Our approach to systems involved computers so much that those not inclined toward technology were scared off. Our biggest challenge is to help the teachers in non-math/science classes to see the ways that systems can be applied in their disciplines. Mostly, I think we need a team leader in systems who can help teachers find ways to integrate systems into what they are already doing."

• "There is a need for a facilitator or mentor to help us with modeling skills."

• "We need more equipment and/or convenient use of a computer lab."

Updates...

cont. from page 2

teachers for two years. The staff at CPCS has created academic standards based on the MA Curriculum Frameworks and The New Standards. CPCS Standards specify what all students need to know and be able to do in the areas of mathematics, language arts, social studies, science, Spanish, and health. (All students study Spanish.) Systems Thinking and System Dynamics are a foundation for the continuous development of the school and curriculum.

The four teachers on the 7/8 team have been using models in their interdisciplinary units. They have created some interesting problems for students to work through. The four teachers on the 5/6 team have been using BOT graphs and have done activities from The Systems Thinking Playbook. All eight of them are committed to learning more and using systems in the classroom. As a staff, we have used several archetypes in staff meetings to examine assumptions and actions.

The role of the teacher is that of facilitator in hands-on, project based classrooms. Parents receive frequent and detailed reports through weekly Feedback Forms, monthly parent meetings, and trimester assessment report cards.

CPCS uses the latest technology to support teaching and learning. Each classroom has a minimum of four internally networked computers with direct Internet access and a voice mail system with a Homework Hotline. Students are also trained to use Internet, fax, photocopy, video, and telephone technologies.

Sue Jamback, Chelmsford Public Charter School, Chelmsford, MA
978-250-8815, Fax 978-250-5975
<sue.jamback@cpcs.chtr.k12.ma.us>

Portland, Oregon

The CC-STATUS project funded by NSF has metamorphosed into the CC-SUSTAIN project. They have expanded their focus to include other areas of the country. Anchorage, Alaska, teachers joined the summer training session last summer, and this summer a group of teachers from the Systems Education Consortium in Massachusetts will be taking advantage of the system dynamics training. As part of the NSF grant, the training materials will be available from the CLE when they are in polished form.

The availability of systems education has burgeoned in Oregon because of the CC-STADUS/SUSTAIN training. The Portland Public schools have started two magnet programs in systems education. Franklin High School is drawing students who are interested in systems in math and science. Wilson is drawing those interested in systems in science and social studies.

The number of students taking system dynamics modeling classes has expanded dramatically. Franklin is offering three modeling classes this year and plans to offer a second year modeling class next year. Wilson is offering both a modeling class and a Science, Technology and World Issues course. LaSalle High School, under the mentorship of Tim Joy, is offering a modeling class as well. The goal in all of these schools is to have systems education be a pervasive part of all subject areas, rather than being restricted to just modeling classes.

The SymBowl competition in Portland, going into its 3rd year, has stimulated interest in dynamic modeling at the high school level. Since this is the first year that all students who wish to participate can not do so, SymBowl and the teachers of system dynamics have come to a watershed. Now they will take a hard look at how to use SymBowl to further the goals of systems education across the board.

Many teachers in other schools and districts in the Portland area are working in the field of systems education. Because of this large pocket of activity, the next Systems Thinking and Dynamic Modeling conference run by the CLE will be held in Portland in the summer of 2000.

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ST and SD in K-12 Education at Maumee Valley

continued from page 10

- “There is a need to make STELLA output more “catchy” than just graphs and tables.”

- “We are still new at it. I believe enthusiasm for the idea remains strong. The biggest challenge is writing a proposal to secure local funding for a mentor and training. The next challenge is helping the K-4 group of teachers understand how to apply systems concepts in their classrooms.”

- “. . .trying to convince people that STELLA is not systems thinking but rather a tool through which we are able to demonstrate, model, and perhaps even reveal systems. The fear of technology is overpowering for some, so the need to help them keep things in perspective is important. This remains a challenge.”

Please note: The complete article from which this excerpt comes is available from the CLE and the web site <http://sysdyn.mit.edu/cle/>. The 8-character title is SUMMARMS.

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Summer Institutes in Systems Thinking and Dynamic Modeling

The Waters Center in Colchester, Vermont, has scheduled three five-day institutes designed to provide educators with the opportunity to explore the thinking skills and tools that permit students to conceptualize, construct, simulate, and alter the behavior of complex systems. Accommodations and graduate credit are available for participants.

July 6-10

THE WATERS CENTER MIDDLE SCHOOL INSTITUTE: Using Systems Thinking and Systems Tools in the Middle School

A 5-day Institute for middle-school teachers/teams designed to address the use of System Dynamics in meeting the needs of teaching in an interdisciplinary format. The focus will be on utilizing System Dynamics to enhance students' critical thinking, problem solving, and communication skills, with a specific focus on addressing the needs of the middle school. Topics include: An Introduction to Systems Thinking, The Demo Dozen, and Generic Systems. Participants will download and evaluate ST/DM material available on the Internet, and develop systems-based materials for use in schools. Participants will complete projects to bring back to their programs.

July 27-31

THE WATERS CENTER HIGH SCHOOL INSTITUTE: Using Systems Thinking and Systems Tools for Addressing Curriculum and Standards

A 5-day Institute for secondary school teachers/teams focusing on the use of systems thinking and modeling tools in addressing curricular needs and education standards. The focus will be on demonstrating student thinking using the systems approach. Sessions will include: An Introduction to Systems Thinking and Dynamic Modeling, Standards and Modeling, Generic Systems, ST/DM curricula available on the Internet, and the building of one or more System Dynamics applications. Attention will be given to building basic models, troubleshooting problems in teacher and student-generated models, evaluating pre-existing materials, and developing powerful experiences for your students.

August 3-7

THE WATERS CENTER INSTITUTE FOR ORGANIZATIONAL INNOVATION: Using Systems Thinking and Dynamic Modeling To Address Organizational Issues

A 5-day Institute for educational administrators and teachers to explore the potential of using System Dynamics in addressing a variety of organizational issues surrounding the educational process. This Institute provides an initial exploration of a variety of educational sub-systems, focusing on those that most directly affect student learning, their interconnections, and the often inadvertent or unforeseen feedbacks which inhibit or undermine the achievement of desired goals. This Institute provides participants with a set of tools to assist in the task of developing and sustaining an effective learning institution.

For Further Information: See the Waters Center web-site <www.trinityvt.edu/waters> or **write us** at: The Waters Center for System Dynamics, 208 Colchester Avenue, Burlington, VT 05401 (Phone: 802-658-0337 ext. 353/ Fax:802-656-5446/e-mail: wat-cent@charity.trinityvt.edu)

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