Capability Statement

MathEcology, LLC

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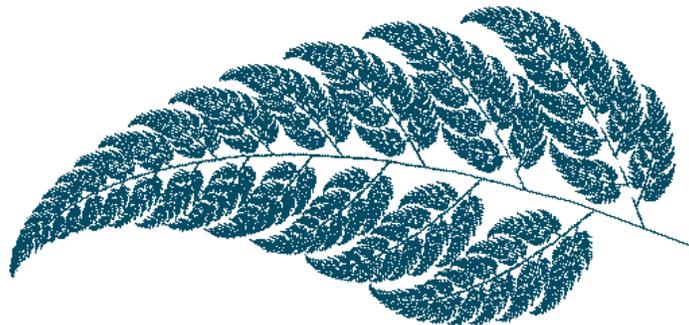Phone: (623) 581-9955

Company Background

MathEcology, LLC is a technical and mathematical services firm and small woman-owned business, dedicated to assisting policy-makers and planners in academia, industry, government and international organizations. Our core value is to give our clients the tools and the information to make their job easier by putting the power of mathematical modeling and simulation in the customer's hands to help them solve their most pressing problems and then visualize and communicate those solutions in the clearest manner possible. At MathEcology we work hard to focus on quality, reliability and value in all our activities, and have a proven track-record of customer satisfaction.

In the following pages we've provided a brief overview of our expertise and capabilities, along with some samples of our previous work. We're excited to learn about your needs and how MathEcology can help make your job easier. Give us a call at +1 (623) 879-8331 or drop us an email at info@mathecology.com, and let us put the power of modeling into your hands. We look forward to building a relationship with you!

Mission

"Math Systems for Better Science"

Founded to serve government, industry, and academia with mathematical and technical solutions to their research challenges.

Areas of Expertise

MathEcology specializes in the mathematical modeling and simulation of biological systems. We develop applied mathematical models to help solve policy issues in epidemiology and ecology, with special emphasis on the development of simulation models to predict the impact of infectious diseases, vaccinations and other interventions on structured populations. Through these services, MathEcology offers clients the ability to address complex issues through the use of applied mathematical modeling and simulation tools.

The professional staff at MathEcology has a broad range of expertise in a variety of fields, including mathematical epidemiology, applied mathematics and predictive modeling, mathematical software development, and ecology. We recognize that complicated problems often require solutions uniting the strengths of many disciplines. Our skill at integrating multiple subject areas into seamless solutions for our clients, allows us to offer our clients the state-of-the-art at the best possible value.

Our major areas of expertise include:

- Mathematical Epidemiology

- Applied Mathematics & Predictive Modeling

- Mathematical Software Development

- Ecology

Mathematical Epidemiology

One of our main focus areas at MathEcology is epidemiological modeling and research. Through extensive medical and epidemiological study and the development of disease transmission and intervention models, we can help you elucidate patterns, causes and control strategies for diseases occurring in groups of organisms.

Since 2003, we have developed epidemiological models for dozens of projects in collaboration with academic institutions, international and private organizations, and government agencies, and our work in this area continues to grow.

Our Epidemiology Services include:

Transmission Systems:

- Human populations, structured and unstructured
- Vector-borne, foodborne, and waterborne diseases
- Respiratory, gastro-intestinal, and sexually-transmitted diseases
- Animal populations, including livestock and wildlife
- Plant populations, including agricultural and natural systems

Modeling Techniques:

- Uncertainty analysis
- Population modeling
- Model validation

We can also bring in partner organizations to combine our epidemiological models with economic and cost analyses.

Applied Mathematics & Predictive Modeling

At MathEcology, a passion for applying mathematics to the real world drives everything we do. Through the application of mathematical techniques to the study of the physical, biological and social world, we can help you gain valuable insight into theories, processes and outcomes which may not have been otherwise evident. Particularly in areas where policy-makers must base important decisions on limited information, the value of applied mathematics and modeling in elucidating patterns and guiding policy can strengthen theories and observations -- and even provide a window into potential future outcomes.

Within MathEcology, our main focus is on biological systems, with emphasis on epidemiology and ecology, but mathematics can be applied to help solve problems in almost any field. We go out of our way to work with our clients to develop systems of mathematical equations appropriate to their unique applications. How can we apply our mathematical expertise to meet your project needs?

Our Applied Mathematics Services include:

Modeling Techniques:

- Custom model development
- Model adaptation, analytic solutions, and scenario simulation
- Stability and sensitivity analyses
- Model fitting to historical and field-gathered data sets
- Model validation and review

Mathematical Software Development

In some cases, clients need more than just the results from a model -- they need the model itself, in order to run additional simulations and scenarios, or to test new parameter values and ranges. But at the same time, not everyone wants to deal with cumbersome mathematical equations and simulation code. The perfect solution in this case is to wrap the model into a freestanding software application that is both powerful and user-friendly, putting the strength of mathematical models into the user's hands.

MathEcology is unique in our field in that we offer end-to-end capabilities, all in one place. We can perform the biological, ecological, and epidemiological analysis, develop the mathematical models, and incorporate all of it into a freestanding software application customized for the individual needs of our clients. Our software engineering and systems architecture capabilities are world-class. Let us help you with your challenges and develop a mathematical and software solution just for your individual needs.

Our Custom Software Application Development Services include:

Software Engineering:

- Custom model development or adaptation, validation and analysis, and coding for incorporation into freestanding application
- Software application development driven by user-friendly GUIs in a variety of architectures and operating systems
- Web-based content management interfaces for data storage, retrieval, and analysis
- Creating, manipulating, and analyzing biological databases
- Servicing a wide range of modeling and software special requests

Ecology

At MathEcology we focus on applying our unique combination of capabilities to the solution of biological problems. Our experience in ecological and environmental modeling allows us to help our clients communicate information about their biological settings and ecosystems, and expand that information by developing theoretical and numerical systems to describe these applications.

At the heart of MathEcology's expertise is our skill at modeling populations and their interactions, which is the very essence of ecology. Let us help you with your ecological and environmental project needs!

Our Ecological Modeling Services include:

Ecological Systems:

- Multi-species predator-prey, multi-trophic, and competition community modeling
- Habitat destruction and connectivity modeling, and wildlife corridors
- Endangered species and extinction studies
- Application of ecological theories to additional settings
- Animal populations, including livestock and wildlife
- Plant populations, including agricultural and natural systems

Modeling Techniques:

- Uncertainty analysis
- Population modeling
- Model validation

Expertise, Experience & Services Overview

Applied Mathematics

- Differential / Difference Equations
- Stochastic / Deterministic Systems
- Agent-Based Modeling
- Interpolation, Extrapolation, Parameter Estimation
- Numerical Analysis
- Stability, Phase-Plane, Perturbation Analysis
- Curve-Fitting
- Model Validation
- Uncertainty Analysis

Ecology

- Extinction Analysis, Habitat Destruction
- Ecosystem Health Analysis, Ecological Risk Analysis
- Trophic Interactions
- Toxicology, Risk Assessment, PK-PD Modeling
- Gene Expression

Epidemiology

- Mathematical Model Development
- Human, Animal, Plant Systems
- Vector-borne, Waterborne, Food-borne Systems
- Literature, Model Review and Research
- Parameter Research
- Population Studies
- Intervention Optimization Modeling

Mathematical Software Development

Software Packages

- Software Engineering
- Systems Architecture
- Geographic Information Systems – ESRI ArcGIS Products (ESRI Certified)
- EVS / MVS (CTech)
- Matlab, Mathematica, Maple, Fragstats
- Adobe Photoshop, ImageReady, Icon Editor
- Microsoft Suite, Access, Visual Studio
- Oracle

Programming Languages

- C, Visual C++
- JAVA
- PERL
- Visual BASIC
- Javascript, VBscript
- FORTRAN
- ESRI Avenue
- HTML

Operating Systems

- Microsoft Windows
- Unix, Linux, IRIX, Solaris
- Macintosh

MathEcology maintains strong business relationships with a host of other individuals and small businesses in a variety of fields, whose experience can be brought to bear on projects requiring outside expertise.

Government Solutions

MathEcology currently holds a Technology Services contract through the US General Services Administration (GSA), contract number GS-35F-0183Y, for delivery of services in the fields of human, animal, and environmental health; epidemiology and transmission of infectious diseases; biology and ecology of structured populations and their interactions; and environmental science. This contract enables us to provide federal, state and local government agencies with rapid access to a wide range of services, including:

- Program management
- Subject matter expertise
- Technical specialization in:
    - Programming
    - Software development
    - Data analysis
- Technical writing

MathEcology offers cutting-edge services, which can greatly benefit our government clients by giving them the ability to address pressing biological issues and develop effective solutions. Our GSA contract can bring our company and government clients closer together in a more stream-lined and efficient manner, enabling us to help our customers more effectively.