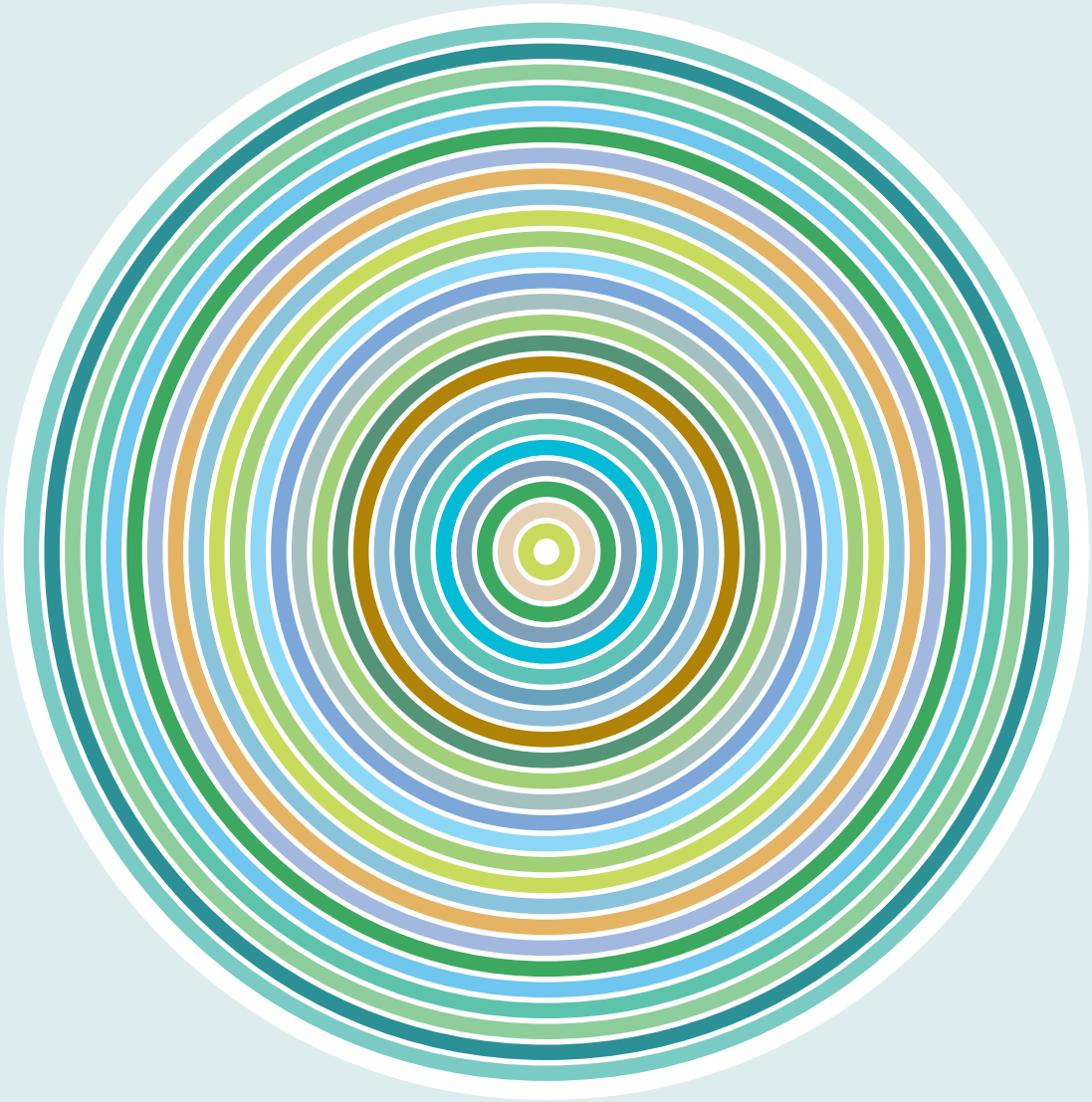
harmeny simply necessary



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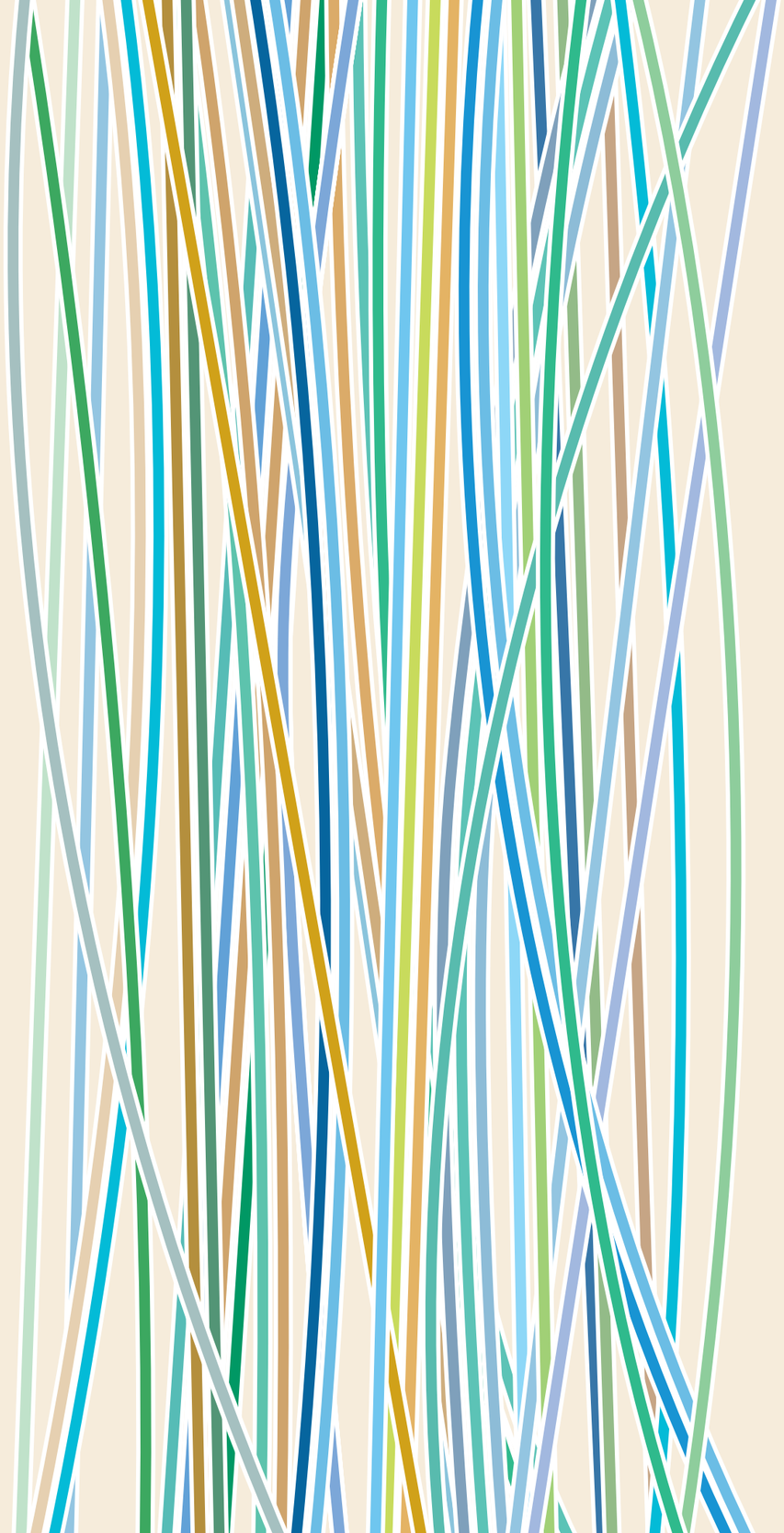


simplify complexity

Harmeny Systems builds tools for making better decisions when managing information in complex environments. Systems Thinking is used to aid integration of data from a wide variety of sources into decision support frameworks. We build models and software to simplify complexity.

Who are we?

Harmeny is a partnership of ForesTree Dynamics (Ian Moss) and Scientificals Design (Mishtu Banerjee) established in 2002. We are located in Richmond, British Columbia. We bring together many years of experience developing custom solutions for the forest industry. Ian advises clients on the use of information for strategic and tactical purposes; he develops systems models for strategic and tactical decision support, bridging biology and economics. Mishtu specializes in the design and development of information systems and supporting software. We focus on building working systems to solve practical problems.

Ian Moss

Mishtu Banerjee

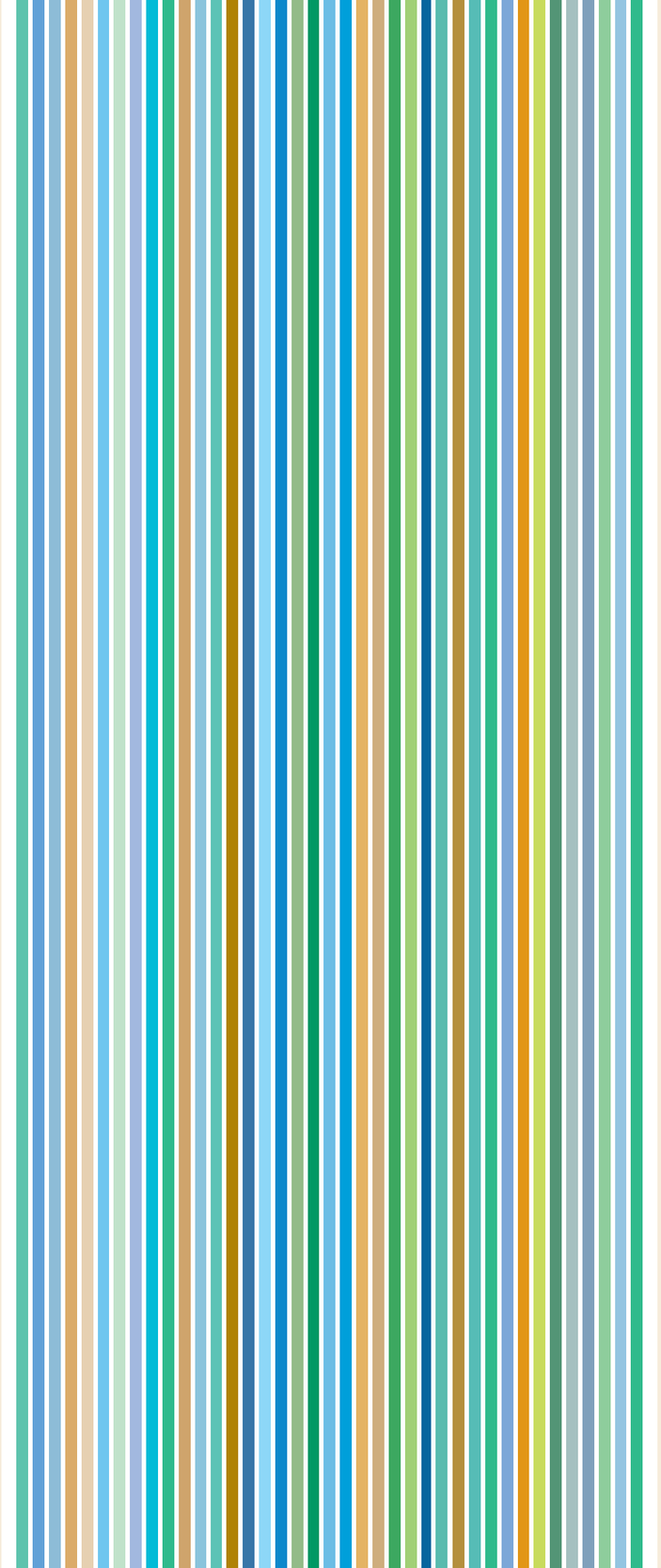
What have we got to offer?

We offer tools, training, and consulting to help you make better decisions every day. We focus on extending your experience, intuitions and intelligence through data synthesis, modeling, and decision support systems development.

Our tools and services respect the multi-faceted nature of complex environments. Each product or service can be applied alone or in combination. All our tools and services share broad concepts and modular design principles. This approach allows you to incrementally grow the management system that meets your needs. Such flexibility allows for more cost effective development of systems and allows you to realize a higher rate of return for your efforts.

We work on three related fronts: **Data**—providing practitioners easy access, enabling simple to do analyses, and providing useful information concerning complex environments, **Modeling**—supporting better management decisions and reducing complex environments to manageable proportions, and **Decision Support**—assisting our clients in using data and models to make more effective decisions.

We strive to create the simplest systems and tools necessary to reflect the complex environments you are dealing with. We believe in continuously improving our products and services, deploying the latest advances in technology and business processes.



data

Providing practitioners easy access, enabling simple to do analyses, and providing useful information concerning complex environments.

Lifeline

LifeLine allows managers to work directly with complex data via developing management scenarios, with the system taking care of the underlying data querying mechanics.

LifeLine includes:

- A set of object oriented and network-theory based design principles that simplify and expedite data modeling, ensuring complete integrity of the final database.
- Software tools for data organization, validation, and reporting based on the LifeLine design principles.
- An easily accessible standardized user interface that allows the user to organize, and analyze subsets of data.

Order out of chaos

The Forest Inventory Warehouse provides an example of the challenges present when working in complex environments.

The Forest Inventory Warehouse provides a single access point to multiple resource inventories. It includes:

- Linked LifeLine format data models that encompass a wide variety of inventory data from plot establishment programs (growth and yield, ecosystem description, inventory adjustment) to aerial photo based inventories (landform, vegetation, forest cover).
- Modules to calculate traditional forestry statistics such as site index, stand volumes, and stand and stock tables, including automated processes for rolling up plot and tree level details to produce average stand or polygon statistics.
- Links to the ForesTree growth model and Stand Structure Classification (described below) that allow one to grow the inventory *in silico* for a specified period of time, and create stand and stock tables for the future forest.

modeling

Supporting better management decisions and reducing complex environments to manageable proportions.

Stand Structure Classification

Supporting better management decisions

The stand structure classification supports better forest management, provides a unified framework for strategic and operational planning on the forest land base. Stand structure models are designed to reduce the cost, and increase the reliability and precision, of estimating numbers of trees and basal areas per hectare with respect to diameter. This information underwrites the development of stand and stock tables used in stand and forest level decision-making. It provides the basic inputs for forecasting future forest and stand conditions using individual tree growth models.

Reducing complex environments to manageable proportions

Stand structures have many dimensions: according to species, distribution of tree sizes, live and dead trees, etc. People can learn to rapidly and reliably classify similarities and differences among stands. Stand structures can be used in both the field and the office, and applied to both ground plots and air-photos. The resulting system reduces complexity, is more intuitive, and bears a clear connection with reality.

Differences in stand structure are important for: species habitat assessment, log supply forecasting, growth and yield projections, simulating impacts of natural disturbance agents, sustainable Forest Management plans and developing silviculture and harvesting prescriptions.

ForesTree Growth Model

Supporting better management decisions

The ForesTree Growth Model aims to make more reliable forecasts of future forest and stand conditions to support better forest management planning. Foresters are creating stands with a wide variety of stand structures; to succeed in creating desired future forest conditions new kinds of growth models are needed to better accommodate these stand structures. The ForesTree growth model is being developed to better account for the influence of microsites on individual tree growth, and to better accommodate the wide variety of stand structures already existing in nature as well as those produced after harvesting.

Reducing complex environments to manageable proportions

- The ForesTree Growth Model Version 1.0 has been produced as a software package. In the first implementation:
- A reliable individual tree basal area equation was developed to represent the growth of Lodgepole Pine and Douglas-fir in pure and mixed species stands across a variety of structures.
- The influence of site is represented via differences in individual tree Height, Diameter, and Age.

- Mortality is forecast in relation to competition (stand level Basal Area) and individual tree vigour (Diameter Increment) and Age.
- Individual tree Species, Height, Diameter and Age are required as basic input.
- Can be calibrated for other locations using temporary plot data that include the collection of tree ages and basal area increments.

  The ForesTree Growth Model Version 2.0 has been developed (ready for implementation). Additional features in ForesTree 2.0 include:

- Individual tree Species, Height, Diameter and Live Crown are required as basic input.
- A Site Tree is required to represent each species. For the Site Tree, in addition to the basic inputs, Age is required.
- The ForesTree model is unique in that Site Trees do not necessarily have to be dominant trees in the stand.
- Ages are predicted separately for each tree based on its site parameters and individual tree Species, Height, Diameter and Live Crown.

  The ForesTree Growth Model emphasizes individual trees and their growing environment. It is designed to be more consistent with biological realities and thus provide more reliable forecasting of future forests and stand conditions. The ForesTree Growth Model, in conjunction with the Stand Structure Classification allows you to forecast strategic and operational consequences of decisions made today.

Forest Stand Financial Analyst

Supporting better management decisions

In forest and stand management there are two basic accounting frameworks. One tracks biological growth—"the future of the forest;" the other tracks revenue growth—"the future of the company." On the biological side, increases in growth are obtained through silvicultural treatments applied to existing stands. The Forest Stand Financial Analyst translates the costs and revenues accrued from those treatments into Net Present Value (NPV) and Internal Rate of Return (IRR). This enables managers to make more strategic investments relative to alternative treatment and harvesting schedules. The Forest Stand Financial Analyst translates between the biological and financial accounting systems by relating biological growth to internal rates of return.

Reducing complex environments to manageable proportions

- Effective stand management decisions are supported by:
- Dominant tree height growth curves representing different site productivities.
- A base set of yield tables. Yield tables for Douglas-fir, Loblolly and Slash Pines are already in the program, and others can be added.
- Treatment/Response impact on yield.
- Treatment costs and harvest revenues.

  This information is used to underwrite wise investments at both the stand and forest levels of decision-making.

  Users of the Forest Stand Financial Analyst may input dominant tree height growth curves and yield tables representing any species of interest from anywhere in the world. Yield response functions can be calibrated by the user to represent different kinds of treatments and their responses. Such treatments include tree improvement, brushing and weeding, site preparation, thinning, and fertilization, among others.

  Forest Stand Financial Analyst has been used to undertake financial analyses comparing:

- Conventional tree improvement programs with somatic embryogenesis (an advanced cloning technique).
- Benefits associated with different wood products (log quality).
- Potential value of stands in terms of their carbon uptake for the purpose of reducing the effects of climate warming.

Actuarial System for Operational Plantation Performance Prediction

Supporting better management decisions

The actuarial system helps you to leverage standard silviculture survey and monitoring data that are part of plantation establishment programs to make better decisions. The actuarial system uses methods similar to those in the insurance industry to determine performance standards and thresholds for taking management actions. It provides a framework to evaluate costs and benefits of alternate silvicultural treatment options. You choose those treatments that have the greatest likelihood of success in reaching your targets for both performance and cost.

- There are two components to the actuarial approach:

  Developing Actuary Tables: These tables are like Life Insurance tables for stand growth. Actuary tables characterize how stock under particular management conditions performs in the long run. Just as in Life Insurance, one develops a set of standard curves, representing typical management scenarios in terms of stock size, treatment regime, vegetation competition, etc.
- Making Operational Predictions: This involves using data from operational surveys, processed through actuary tables, to predict the performance of individual stands; determining whether the stand is on a trajectory to success with respect to performance targets; and comparing how alternative management regimes (with different associated costs) can move the stand towards performance targets.

Reducing complex environments to manageable proportions

The actuarial system has been used in the following contexts:

- Defining long-term performance standards for ecosystem, stock-type, and silviculture regime practices.
- Defining plantation standards for management regimes in terms of acceptable and unacceptable risk with respect to reaching performance standards.
- Developing Integrated Pest Management programs for silviculture in terms of risks due to vegetation competition, based on identifying vegetation competition thresholds above which mortality rapidly increases.
- Streamlining the process of allocating resources to young plantations—so resources are only allocated to plantations that are at risk and are likely to respond positively to management inputs (fertilization, brushing, and weeding).

decision support

Assisting our clients in using data and models to make more effective decisions.

So far we have talked about data and models. But data and models don't make decisions. People do. We build tools to help professionals extend and augment their judgment with the best information available. We provide a framework for integrating data into models, so one can—to gnarl an old phrase—see both the forest and the trees. Decision-making is a human activity balancing wisdom, experience and judgment. We'd like to talk about our experience, our interests, and how we support people to develop the knowledge and experience needed for wise, documented, and defensible decisions on the land base.

Company founders

Ian Moss, analytical methods for natural resource inventories, forestry specialist

Ian Moss has worked in the forest industry for over 20 years, spanning a diverse range of issues from silviculture, forest policy, forest economics, to forest inventory, and growth and yield.

Ian's scientific interests are in developing mathematical models that simulate complex biological dynamics such as forest stand development and succession. He has developed a unique expertise in computationally intensive statistical methods that work on very large and complex data sets, and can succeed where traditional statistical approaches fail.

Ian's scientific and practical interests combine to integrate his mathematical models of biological processes fundamental to forestry with econometric models of the pay-offs and costs associated with growing and managing forests. Ian's long-term effort has been towards constructing a new kind of forest estate model that can truly integrate high-level strategic analysis with the data and on-the-ground decision-making typical of forest operations.

Out of the office, Ian can be found on the squash court and performing with local theatre companies.

Mishtu Banerjee, software designer and data analysis

Mishtu Banerjee has worked in the forest industry for over 15 years, focusing primarily on building monitoring based decision support systems in various aspects of forestry: nursery, silviculture, and woodlands inventory.

Mishtu's scientific interests focus on the characterization of complex developing systems, ecosystem dynamics, data visualization, and the design of logic based analysis systems.

His scientific and practical interests combine in developing a generalized approach to interpreting complex systems based on logic and database modeling. These ideas are implemented in the LifeLine software that captures the complexity of our natural world *in silico*.

Increasingly Mishtu's focus is on generalizing our software models initiated within a forestry framework to apply to other complex operating environments, such as epidemiology, large-scale distributed control systems, oil and gas, and finance.

Out of the office Mishtu can be found photographing bogs, people, and anything else not moving too fast, as well as writing very long poems that resemble very short stories.

How we work together

We are committed to combining our expertise in natural resources and information management to enable our clients to routinely access knowledge important to achieving strategic and tactical goals. We focus on turning services into systems that our clients can use themselves with a minimal need for technical support.

We both share a common interest in large-scale systems, modeling and data analysis. Ian tends to focus more on forest management, econometric, and inventory design issues. Mishtu focuses more on IT, software usability, and rapid application development management issues.

We make a point of cross-learning each other's specialties, and so are continuously teaching and learning from each other. We test each other's perceptions against our own perspectives. Harmeny represents the essential creative tension of our continual exploration and refinement of each other's ideas.

How we work with you

We begin together. You've approached us with a problem, or set of problems.

We begin with a broad strategic view but rapidly focus down into tangible outcomes that can be delivered as clear products built in a defined timeline. We build large systems out of modular pieces and activities that can be rapidly created and incrementally improved. You get functionality three months from now, not three years from now.

Our strategic approach allows us to understand what parts of your problems need to be packaged into a system. We try to make the system development transparent to you via clear landmarks, using internal software development best practices that focus on the client as part of the development team, and by maintaining regular and frequent communication as to our progress.

We work with you at the program management level, and often assemble multi-disciplinary teams including your staff, ourselves, and Harmeny associates. We are experienced project managers. If clients require project management support, we take on the planning, coordination and administration tasks necessary to make progress as a team.

We provide support in training and mentoring staff in the use of our products and services. We recognize that learning new tools and new skills can be stressful, so we work on keeping the learning process open-ended, exploration focused, and fun. You learn. We learn. We learn together.

Client profile

Our clients have been major forest licensees and government agencies, primarily in British Columbia. We have worked in the areas of Forest Inventory, Silviculture monitoring systems, and Forest Estate Valuations, combining consulting and custom software development.

Our background servicing natural resource clients has given us a unique perspective in dealing with large complex systems. The software and analysis methods we have developed can be applied in other domains where information is multi-faceted, and involves a degree of uncertainty. Examples of related areas to which our tools could be extended are: epidemiology, financial services, oil and gas exploration, and distributed control systems.

Where we are going

We have continually innovated, developing a new software/analysis system every two years. We are constantly seeking to bring the latest research and technology to bear on practical problems. And we continue to refine and simplify our existing systems. Our emphasis over the next two years is to make our existing tools simply necessary by increasing their flexibility and their integration. To that end we are developing two new tools that consolidate and extend our past experience in turning data into models you can use to make better decisions every day.

XAYA: LifeLine Next Generation

The development of XAYA is focused on the following features:

- For People who need to work with data but are not programmers, XAYA provides a small set of commands that allow the user to rapidly model, manage, and transform data, as well as do custom statistical calculations on large and complex data sets. In particular, XAYA will support incorporating business rules and business logic into flexible data driven models.
- For Software Developers who need to rapidly build and deploy information applications, XAYA provides a library of core functions that integrate database functionality, logic, and statistical processing capabilities.
- Internally we are currently using the XAYA toolkit to build the next generation of LifeLine . You can use the XAYA toolkit to build your own lifeline.

Integrated Inventory And Forest Estate Model: unified data access, modeling, and decision support

The Integrated Inventory and Forest Estate Model brings together LifeLine (XAYA) technology with the Inventory Warehouse Data Model, Stand Structure Classification, and ForesTree growth model. It has the following features:

- Combines individual-tree and stand growth and yield models with inventory info to represent the dynamics of large landscapes.
- Used for modeling natural disturbances, seral stages, habitat, wood supply, cash flow projections and other kinds of forest management interpretations.
- Provides stand and stock table level detail for all polygons
- The model is open to incorporating new sources of inventory information.
- All you will need on your end is a web browser.

The Integrated Inventory and Forest Model is the focal point for all of Harmeny's key technologies. Like all good complexity, the sum will be greater than the parts. We hope to create a new kind of Forest Estate Model that is simply necessary.

We hope to create it together with you.

harmeny

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