Realism & Beauty: A Growth Engine

By Jennifer Dritt Wight

The stunning beauty of natural objects simulated using pure math—fractals, graftals, etc.—is of as much use to the serious agronomist as an impressionist painting. He might hang it in his living room, but use it for research? No.

Thus, in 1976 a young agronomist, Philippe de Reffye of CIRAD (Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement), developed a model for simulating the growth of coffee trees. His work caught the attention of Jean Francon and Claude Puech, directors of the Strasbourg and Paris Universities' computer graphics laboratories. The project grew in scope as Marc Jaeger, a graduate student, and botanist Claude Edelin of the National Center for Scientific Research (CNRS) became involved.

With the sponsorship of CIRAD and the commercial expertise of SESA, a software company, this core group of researchers developed AMAP, a modeling system for plant architecture.

CIRAD is a public research body specialized in tropical agronomics, with activities in applied research, project development appraisal, and technical assistance. The agency has a staff of 1750, including 900 researchers and technicians in France and 500 expatriate staff in about 40 countries.

Commercial Development

CIRAD licensed SESA early on to develop a commercial product from the research done by Reffye et al, market and sell that product, and negotiate with vendors who would integrate AMAP with other applications packages (such as Wavefront software).

Unlike pure-math systems that seek to mimic nature, AMAP recreates it—from seed to bud, to full fruit, to death; from winter to spring, to summer, to fall—using general botanical laws. The AMAP "growth engine" also allows the user to modify the age, shape, and size of a plant with what SESA calls "an immediate visual check of the consequences."

The $20,000 system currently runs on the Iris workstation and a version for IBM ATs and compatibles is planned. AMAP, notes Alain Weil, CIRAD industrial liaison, is actually a family of software that can be adapted to different levels of image complexity and calculation power. Written in both Fortran and C, the program can display wireframes, polygons, or a combination of both modes. The models can be combined with scene editing, animation, and rendering software. Plant images created within AMAP, says SESA, can generally be ported to "most other" 3D applications—CAD, audiovisual production, etc.

AMAP has a menu-driven interface that enables the user to allow for random phenomena, choose mutation patterns, and even simulate the growth of a plant. Evolutionary animation of forests, fields, and plantations is also possible—with no two plants alike.

According to CIRAD, there are only about 20 different models encompassing every type of tree. Within AMAP, each model can be characterized by a dozen parameters. Within each of these models, another set of parameters defines a given species. SESA also sells a library of predefined plants representing 50 different species.

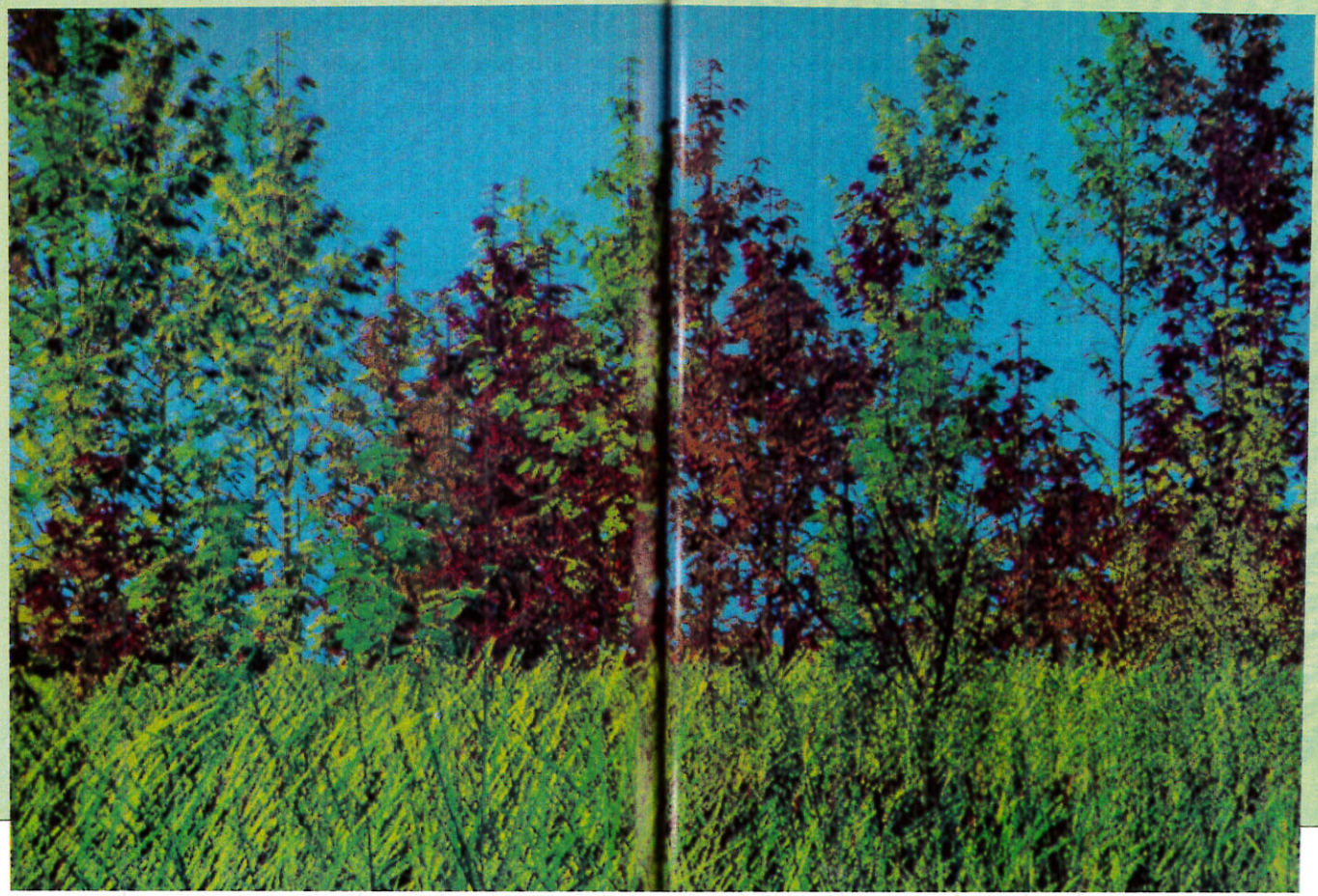
Genetic Research

Research applications for AMAP include a rubbertree hybridization program in the Amazon. Without botanically accurate modeling, it takes seven to 10 years to fully evaluate the qualities of an adult tree. AMAP enables researchers to extrapolate an older tree from a younger one and evaluate the success of different hybrids before they mature.

Researchers are also thinking about generalizing AMAP's model to other natural growth phenomena, be they populations, storms, or crystallizations. CGW

Jennifer Dritt Wight is an associate editor for *CGW*.

Botanically correct, the spruce at the top is 10 years older in the lower image. Using AMAP, such growth can be extrapolated to whole scenes. **Right:** one stage in the life of a poplar grove.



With just 20 models for growth, highly accurate images of a given species can be created with a dozen or so parameters. **Above:** narcissus and herbs and wildflowers.