Computer Graphics and Ecological Informatics

Faculty of Mathematics and Computer Science

Faculty of Forest Sciences and Forest Ecology

Study course:
Applied Computer Science
M.Sc.

Winfried Kurth
Workgroups at the Department of Ecoinformatics

Department Ecoinformatics, Biometrics and Forest Growth

permanent staff:
Winfried Kurth
Jürgen Nagel
Wilfried Hakes
Reinhold Meyer

Workgroup 1: Computer graphics and ecological informatics

Workgroup 2: Statistical models, sampling, spatial statistics and inventories

Workgroup 3: Spatial information systems in ecology

Workgroup 4: Local computing centre for the Forestry Faculty, consulting in statistics, computation and e-learning

Workgroup 5: e-learning in life sciences, geoinformatics and statistics

Workgroup 6: Forest growth modelling (with NW-FVA)
Research activities
(and possible topics for projects and M.Sc. theses...)

Computer graphics

and

ecological informatics
(= computer science, applied to ecology)
Functional-structural models of organisms and adequate ways to formalize them

formalism \( \text{RGG} \) $\rightarrow$ language \( \text{XL} \) $\rightarrow$ software \( \text{GroIMP} \) $\rightarrow$ model

\[ j \, k, \, l \, m \rightarrow j \, m, \, l \, k; \]

part of a regulatory network (biosynthesis of gibberellic acid)
Functional-structural plant models - Examples

rice: Xu et al. 2011

tomato: Buck-Sorlin et al., unpubl.

cut-rose: Buck-Sorlin et al. 2011

wheat: Evers et al. 2010
at a higher scale level: simulations of forest stands

\[ CCL_j = \sum_{i=1, i \neq j}^{n} \beta_{ij} \cdot \frac{cA_i}{cA_j} \cdot k_i \]

**CCL** - Crown Competition light

**F** = \{0, 1\}  
\[ f(y_{it}, RED, RF) \] for \( M_i = 0 \) and \( P_i = 0 \)

**VRML- Virtual Reality Output**

**Ecological site classification**

**DAYS**

**N2O**

**TAMP**

**CO2**
Improved rendering of 3-d scenes and simulation of radiation

raytracing: basic principle

Cooperation partners

- Ecole Centrale de Paris (Laboratoire MAS – Optimization)
- INRIA + CIRAD Montpellier (Plant simulations)
- Agrocampus Ouest, Angers (transport & competition models)
- Czech University of Life Sciences, Prague (forest modelling & management, decision support)
- University of Bonn (Dep. of Computer Science – laser scanner data evaluation)
- TU Zvolen, Slovakia (3D data analysis)
# Offered Classes (Summer Term)

<table>
<thead>
<tr>
<th>Modules</th>
<th>Hours per Week</th>
<th>ECTS</th>
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</thead>
<tbody>
<tr>
<td>Image Analysis and Image Understanding</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Functional-Structural Plant Models</td>
<td>4</td>
<td>6</td>
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<tr>
<td>Forest Dynamics</td>
<td>2</td>
<td>3</td>
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<tr>
<td>Simulation Models</td>
<td>3</td>
<td>4</td>
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<tr>
<td>Biometric Data Analysis and Experimental Design</td>
<td>2</td>
<td>3</td>
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Additionally: projects, colloquium for doctoral students.


*Department Ecoinformatics, Biometrics and Forest Growth*
# offered classes  (winter term)

<table>
<thead>
<tr>
<th>modules</th>
<th>winter/summer term</th>
<th>hours per week</th>
<th>ECTS</th>
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</thead>
<tbody>
<tr>
<td>Seminar on Computer Graphics</td>
<td>W</td>
<td>2</td>
<td>6</td>
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<tr>
<td>Ecological modelling with C++</td>
<td>W</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Modelling of population dynamics and biodiversity</td>
<td>W</td>
<td>4</td>
<td>6</td>
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<td>(in German)</td>
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<tr>
<td>Project Forest ecosystem analysis and information processing</td>
<td>W, S</td>
<td>2</td>
<td>12</td>
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current topics for projects or theses:

- Specification and interactive manipulation of spline curves and surfaces in two modelling platforms, and their exchange between the platforms (cooperation with INRIA Montpellier)

- Implementation and application of a numerical solver for differential equations describing water and carbon transport in trees, using the rate assignment operator of XL (cooperation with Finnish Forest Research Institute, Vantaa / Helsinki)

- Χονστρυχτικόν οφ συρφαχέ μεσης φρομ διγιτιζεδ ποιντ χλουδσ οφ τρεε τρυνκσ (cooperation with Czech University of Life Sciences, Prague)

- Ρυλε−βασεδ σιμυλατιον οφ δενδριτιχ Στρυχτυρεσ φρομ Χυπριχ Χηλοριδε Δι−ηψδρο (cooperation with Faculty of Agriculture, Witzenhausen, University of Kassel)
to contact us:

wk@cs.uni-goettingen.de


see also:
http://www.grogra.de

physically:
Büsgenweg 4, Abteilung Ökoinformatik, Biometrie und Waldwachstum, 1st floor, room 90