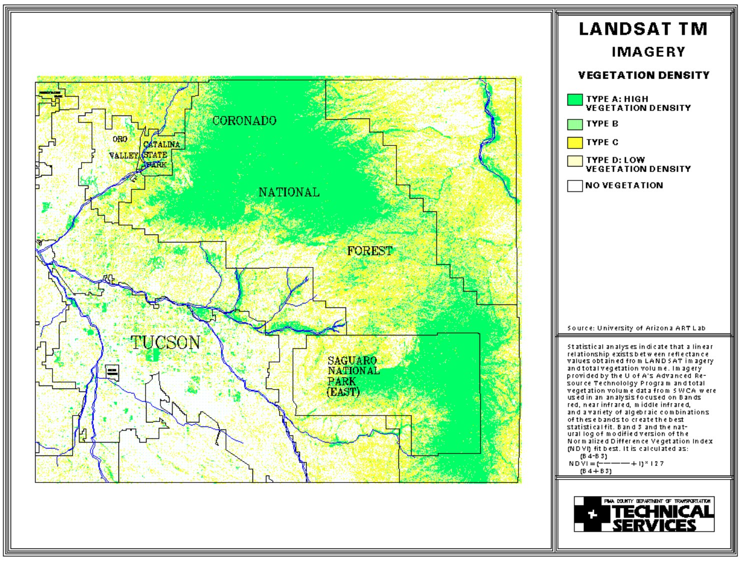
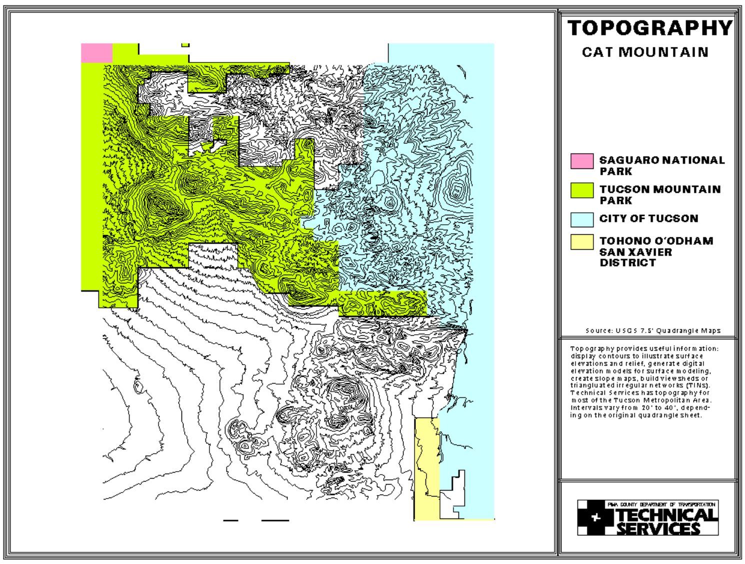
Räumliche Modellierung und Visualisierung



Landsat TM Imagery
Statistical analyses indicate that a linear relationship exists between reflectance values obtained from LANDSAT imagery and total vegetation volume. Imagery provided by the University of Arizona's Advanced Resource Technology Program and total vegetation volume data from SWCA were used in an analysis focused on bands red, near infrared, middle infrared, and a variety of algebraic combinations of these bands to create the best statistical fit. Band 3 and the natural log of modified version of the Normalized Difference Vegetation Index (NDVI) fit best.

http://www.dot.co.pima.az.us/gis/projects/

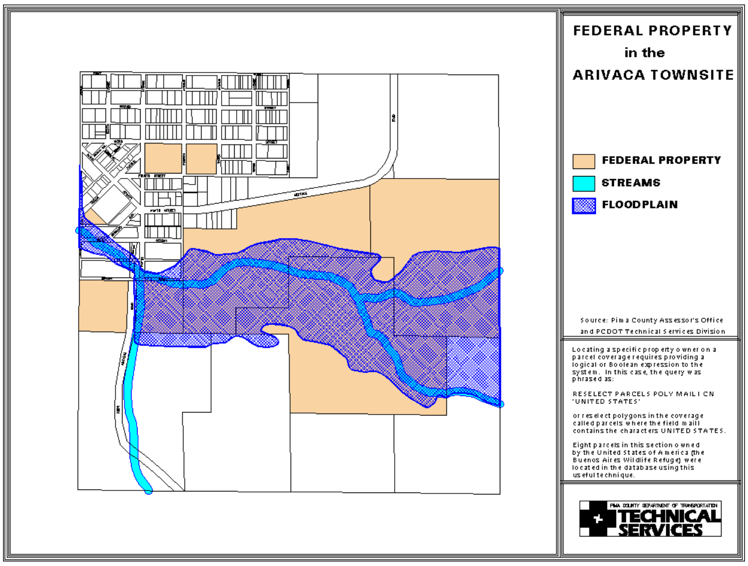
Räumliche Modellierung und Visualisierung



Topography - Cat Mountain
Topology provides useful information: display contours to illustrate surface elevations and relief, generate digital elevation models for surface modeling, create slope maps, build viewsheds or triangulated irregular networks (TINs). Technical Services has topography for most of the Tucson Metropolitan Area. Intervals vary from 20' to 40', depending on the original quadrangle sheet.

http://www.dot.co.pima.az.us/gis/projects/

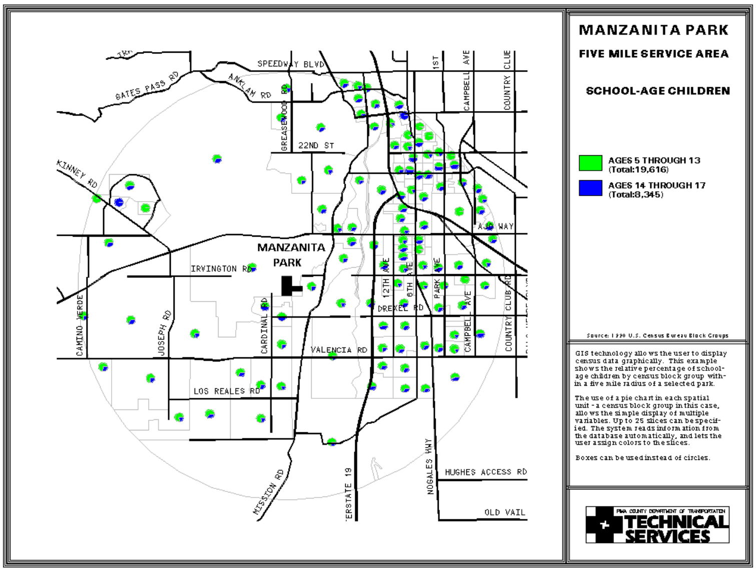
Räumliche Modellierung und Visualisierung



Federal Property
Locating a specific property owner on a parcel coverage requires providing a logical or boolean expression to the system. In this case, the query was phrased as: RESELECT PARCELS POLY MAIL1 CN 'UNITED STATES' or reselect polygons in the coverage called parcels where the field mail1 contains the characters UNITED STATES. Eight parcels in this section owned by the United States of America (the Buenos Aires Wildlife Refuge) were located in the database by this useful technique.

http://www.dot.co.pima.az.us/gis/projects/

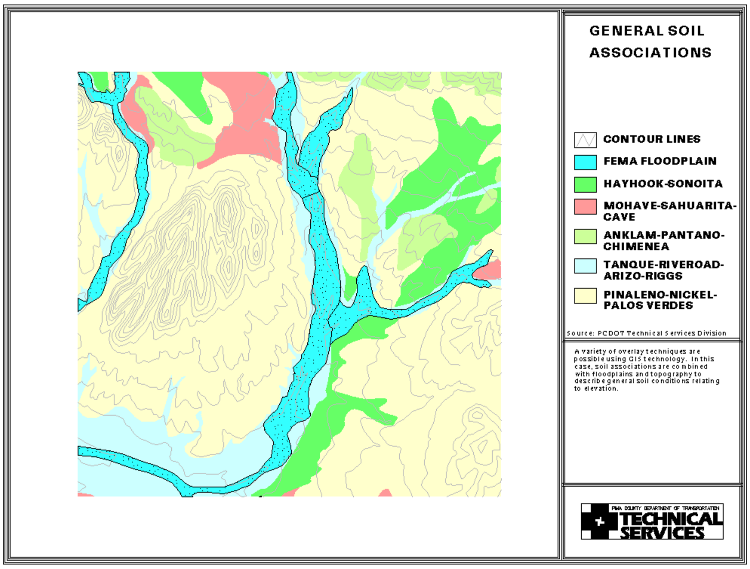
Räumliche Modellierung und Visualisierung



Manzanita Park
GIS technology allows the user to display census data geographically. This example shows the relative percentage of schoolage children by census block group within a five mile radius of a selected park. The use of a pie chart in each spatial unit - a census block group in this case, allows the simple display of multiple variables. Up to 25 slices can be specified. The system reads information from the database automatically, and lets the user assign colors to the slices. Boxes can be used instead of circles.

http://www.dot.co.pima.az.us/gis/projects/

Räumliche Modellierung und Visualisierung



General Soil Associations
A variety of overlay techniques are possible using GIS technology. In this case, soil associations are combined with floodplains and topography to describe general soil conditions relating to elevation.

http://www.dot.co.pima.az.us/gis/projects/

Räumliche Modellierung und Visualisierung

Modellierung der Naturnähe aktueller und künftiger Bestockung auf der Basis standortsgerechten Waldgesellschaften

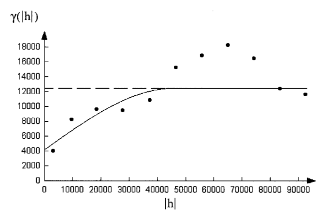


Fig. 5.13. Semivariogram model for GLS-residuals of precipitation in July in the Mountainous Region; nugget = 4200, sill = 8300, range = 45550

Table 5.14. Resulting semivariogram models and GLS regression coefficients after iteration for monthly and annual precipitation in the Mountainous Region (DWD and HWW)

	intercept	elevation	*LEEWHIRL*	*LEE50*	nugget	sill	range
Jan	378	1.11	0.46		4480	15120	9300
Feb	295	0.85	0.32		2850	4450	9000
May	599	0.41			2375	2640	18000
Jul	791			-0.38	4200	8300	45550
Aug	762			-0.28	2400	7600	48650
Sep	623			-0.33	3600	7690	44640
Nov	383	1.15	0.44		10200	2800	78000
Dec	433	1.36	0.52		18000	6860	52100

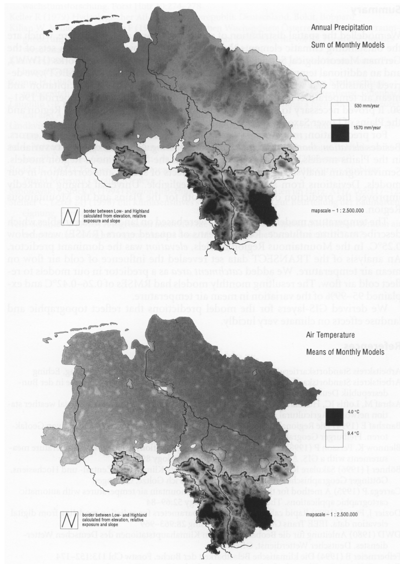


Fig. 5.15. Regionalized annual mean air temperature and annual precipitation in Lower Saxony; cities are outlines, large lakes are white (see fig. 3.1)

Mues, V., M. Jansen, B. Sloboda, K. Radler u. J. Saborowski (2002): Regionalization of climatic elements in Lower Saxony. In: Jansen et al. (eds.) Spatial modelling in Forest Ecology and Management, Springer Verlag, Berlin Heidelberg New York, S. 41-67

Räumliche Modellierung und Visualisierung

Modellierung der Naturnähe aktueller und künftiger Bestockung auf der Basis standortsgerechten Waldgesellschaften

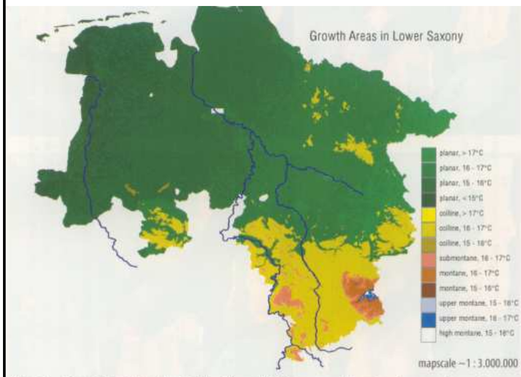


Plate 4: Growth districts delimited by Görges (1969) compared to natural geographic regions (upper) and growth areas derived from atlanticity and altitude belts (lower, chap. 6.2)

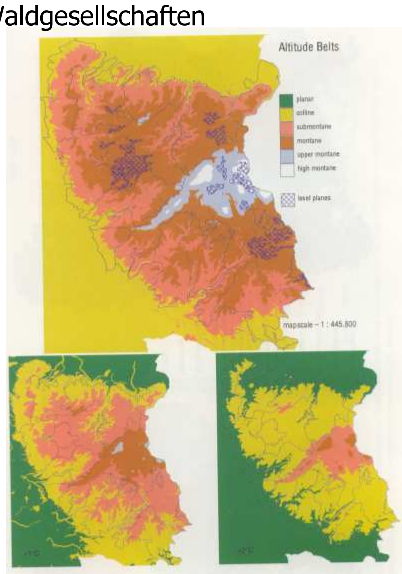


Plate 5: GIS-based modelled altitude belts in the Harz mountains (upper) and their changes corresponding to air temperature increase of 1° and 2°C respectively (lower left and right, see chap. 6.2)

Jansen, M., V. Stüber, H. Wachter, R. Schulz, W. Schmidt, J. Saborowski, V. Mues, C. Eberl, B. Sloboda (2002): Modelling of forest growth areas in Lower Saxony. In: Jansen et al. (eds.) Spatial modelling in Forest Ecology and Management, Springer Verlag, Berlin Heidelberg New York, S. 143-161.

Räumliche Modellierung und Visualisierung

Modellierung der Naturnähe aktueller und künftiger Bestockung auf der Basis standortsgerechten Waldgesellschaften

Table 6.9. Zonal woodland communities of the Harz mountains according to indices of the Lower Saxony site mapping and elevation belts based on climatic models (see chapter 6.3.4 for a key of woodland communities)

		WHZ	continuously moist[a]	19,9,20,23 damp	10,11,24,26 slightly damp	25,27 (mo) slightly dry	27 (co, sm) dry
colline, submontane, montane	SZ 41-44	NZ 4+ to 6	3.1/3.2	3.1/3.2	3.3	4.1/4.3	4.1/4.2
	SZ 1-7 (without 41 -44)	WHZ	continuously moist[c]	19,9,23 damp	10,20,24,26 slightly damp	11,25 slightly dry	27 dry
		NZ 1	1.1/1.2				
		NZ 2	1.3	1.1/1.2		1.1	
		NZ 3-, 3	1.4/1.5	1.3/1.5		1.3	
		NZ 3+, 4-	2.1	2.1		2.1/1.5	
		NZ 4	2.3	2.2		2.1/2.2	
		NZ 4+ to 6	2.3	2.2/2.3		2.2	
upper montane	SZ 1-7	NZ 1	7.1				
		NZ 2 to 3-	5.0				
		NZ 3	5.0				
		NZ 3+, 4-	5.0				
		NZ 4	5.0				
		NZ 4+ to 6					
high montane	SZ 1-7	NZ 1	7.1				
		NZ 2 to 3-	6.2	6.1/6.2		7.1	
		NZ 3	6.2	6.1/6.2		7.1	
		NZ 3+, 4-	6.2	6.1/6.2		7.1	
		NZ 4					
		NZ 4+ to 6					

WHZ, water budget index (range 1–29); *NZ*, nutrient index (range 1–6); *SZ*, substratum index (range 1x–7x, 41–44 calcareous sites, see chapter 3.2); *co*, colline; *sm*, submontane; *mo*, montane; gray cells are not defined in the model

a. WHZ 1–4, 7, 7t, 8, 9f, 13, 14, 17, 18, 21, 22

Jansen M., W. Schmidt, V. Stüber, H. Wachter, C. Naeder, M. Weckesser, F.J. Knauft (2002): Modelling of natural woodland communities in the Harz mountains. In: Jansen et al. (eds.) Spatial modelling in Forest Ecology and Management, Springer Verlag, Berlin Heidelberg New York, S. 162-175

Table 6.10. Azonal woodland communities of the Harz mountains according to indices of the Lower Saxony site mapping and elevation belts based on climatic models (see chapter 6.3.4 for a key of woodland communities)

WHZ	elevation belt		NZ 1	2	3-	3	3+	4-	4	4+	5	6
1	sm, mo		(Table 6.9, zonal wood communities)						lower slopes: 8.2 along brooks: 10.1			
5, 7f, 13f,15	co				1.3–1.6 or 10.2/10.3				10.3/8.2			
	sm, mo				1.3–1.6 or 10.2/10.3				10.1/8.2			
	um, hm				6.2							
6	co–mo						no tree veg. or 10.1					
	um, hm		no tree veg. or 6.2									
16	co, sm		9.2		9.3			9.4				
	mo		swamps, no tree veg.	9.2		9.3		9.4				
	um, hm		swamps, no tree veg.	9.1								
28	um, hm		7.1									
	co–mo	SZ 41 sunny slope							4.2			
	co–mo	SZ 41 shady slope							4.1 or 4.3			
	co–mo	SZ 42-44							4.1			
	co–mo	all other substrates	7.2 or 1.1/1.2							4.1		
29	um, hm		7.1									
	co, sm	SZ 41 sunny slope							8.1			
	co, sm	SZ 41 shady slope							4.1 or 4.3			
	co, sm	SZ 42-44 sunny slope						8.1				
	co, sm	SZ 42-44 shady slope						4.1 or 4.3				
	co, sm	all other substrates	7.2 or 1.1-1.3									
	mo	all substrates	7.1		7.2							

WHZ, water budget index (range 1–29); *NZ*, nutrient index (range 1–6); *SZ*, substratum index (range 1x–7x, 41–44 calcareous sites, see chapter 3); *co*, colline; *sm*, submontane; *mo*, montane; *um*, upper montane, *hm*, high montane; gray cells are not defined in the model

Räumliche Modellierung und Visualisierung

Modellierung der Naturnähe aktueller und künftiger Bestockung auf der Basis standortsgerechten Waldgesellschaften

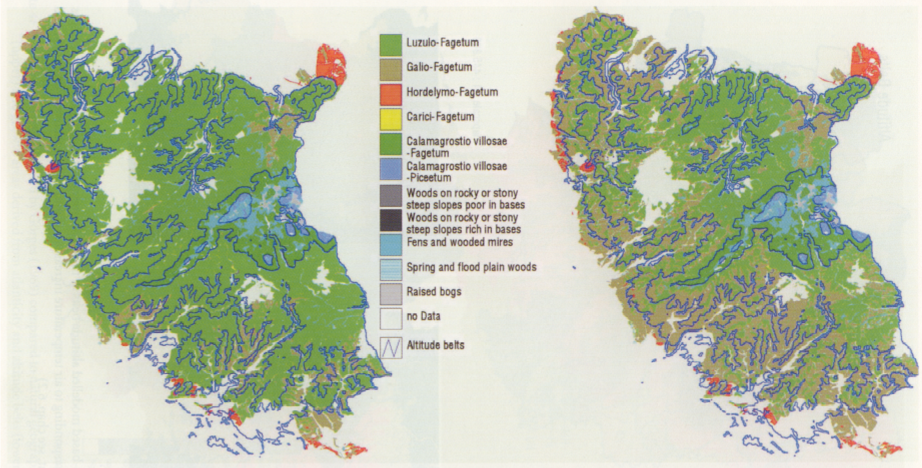


Plate 6: Representation of natural woodland communities (associations only) of the Harz mountains (right: model; left: variant with Galio-Fagetum at nutrient index 4-, see chap. 6.3)

Jansen M., W. Schmidt, V. Stüber, H. Wachter, C. Naeder, M. Weckesser, F.J. Knauft (2002): Modelling of natural woodland communities in the Harz mountains. In: Jansen et al. (eds.) Spatial modelling in Forest Ecology and Management, Springer Verlag, Berlin Heidelberg New York, S. 162-175

Räumliche Modellierung und Visualisierung

Modellierung der Naturnähe aktueller und künftiger Bestockung auf der Basis standortsgerechten Waldgesellschaften

Table 6.11. Tree species proportions (constancy of principal (P) and secondary (S) tree species) of natural woodland communities of the Harz mountains.

wood community	Picea abies	Fagus sylvatica	Quercus petraea	Quercus robur	Fraxinus excelsior	Acer pseudoplatanus	Acer platanoides	Tilia platyphyllos	Alnus glutinosa	Prunus padus	Sorbus aucuparia	Prunus avium	Betula carpatica	Betula pendula	Betula pubescens	Sorbus torminalis	Acer campestre	Ulmus glabra	Salix alba	Populus tremula	percentage P [%]
1.1[a]		P[b]	S[c]																		95
1.2		P	S																		95
1.3		P	S	S																	95
1.4		P																			100
1.5		P	S																		95
1.6		P	S	S																	95
2.1		P	S			S															95
2.2		P																			100
2.3		P			S	S															90
3		P			S	S	S					S						S			90
4		P			S	S	S									S	S				50
5	P	P				S					S										90
6	P										S		S								90
7.1	P					S					S		S								90
7.2		S	P											S							95
8.1		S	S		S	P	S	P									S	S			90
8.2		S		S	P	P	S	S										S			90
9.1	P										S				P					S	90
9.2	S										S				P					S	90
9.3									P												100
9.4									P												100
10.1		S			P	S			S		S							S			50
10.2		S		S	S	S			P		S							S	S		90
10.3				S	P	S				S	S							S	S		50

a. Key for the woodland communities in chapter 6.3.4
b. P = principal tree species: constancy >40%
c. S = secondary tree species: constancy 10-40%

Table 6.14. Comparison of percentage of tree species groups in the Harz mountains between present state and natural woodland communities

	natural woodland composition		present state of forest stands: composition		present state of forest stands: natural		naturalness[a]
	[ha]	[%]	[ha]	[%]	[ha]	[%]	[%]
oak	1960	2.7	700	1.0	53	0.3	7.6
beech	63659	86.4	15159	21.6	14559	79.8	96.0
dlrp[b]	2724	3.7	1368	1.9	295	1.6	21.6
dsrp[c]	2029	2.8	2243	3.2	123	0.7	5.5
spruce	3325	4.5	49093	69.9	3224	17.7	6.6
douglas fir	0.00	0.0	385	0.5	0.0	0.0	0.0
pine	0.00	0.0	149	0.2	0.0	0.0	0.0
larch	0.00	0.0	1115	1.6	0.0	0.0	0.0
	73696	100.0	70212	100.0	18254	100.0	26.0

a. natural in % of present composition
b. dlrp: Deciduous trees with long rotation periods, e.g. elm, ash
c. dsrp: Deciduous trees with short rotation periods, e.g. alder, birch

Jansen M., W. Schmidt, V. Stüber, H. Wachter, C. Naeder, M. Weckesser, F.J. Knauft (2002): Modelling of natural woodland communities in the Harz mountains. In: Jansen et al. (eds.) Spatial modelling in Forest Ecology and Management, Springer Verlag, Berlin Heidelberg New York, S. 162-175

Räumliche Modellierung und Visualisierung

Modellierung der Naturnähe aktueller und künftiger Bestockung auf der Basis standortsgerechten Waldgesellschaften

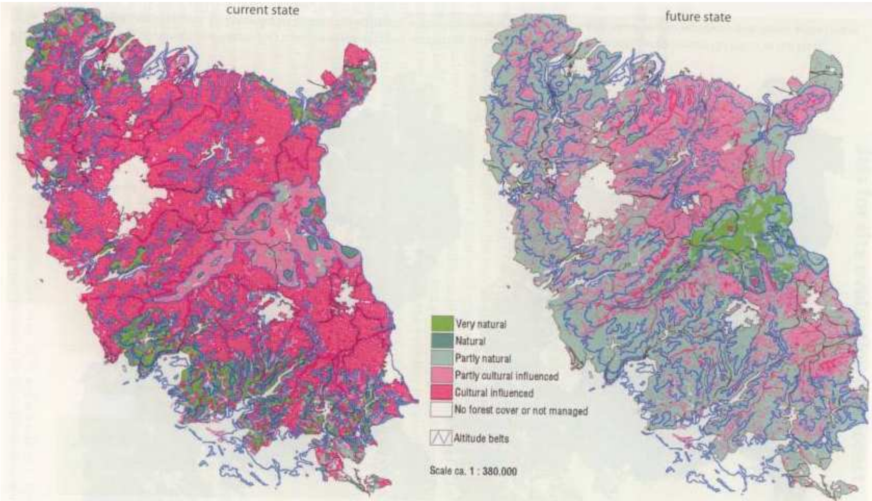
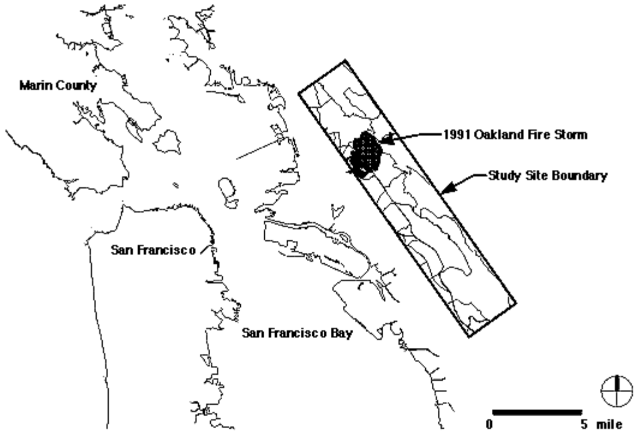


Plate 7: Naturalness of actual tree species composition of forest stands in the Harz mountains (left, see chap. 6.3) and of modelled future tree species composition according to LÖWE-development alternative 1(right, see chap. 7.1)

Jansen M., W. Schmidt, V. Stüber, H. Wachter, C. Naeder, M. Weckesser, F.J. Knauft (2002): Modelling of natural woodland communities in the Harz mountains. In: Jansen et al. (eds.) Spatial modelling in Forest Ecology and Management, Springer Verlag, Berlin Heidelberg New York, S. 162-175

Räumliche Modellierung und Visualisierung

A Spatial Decision Support System for Urban/Wildland Interface Fire Hazards



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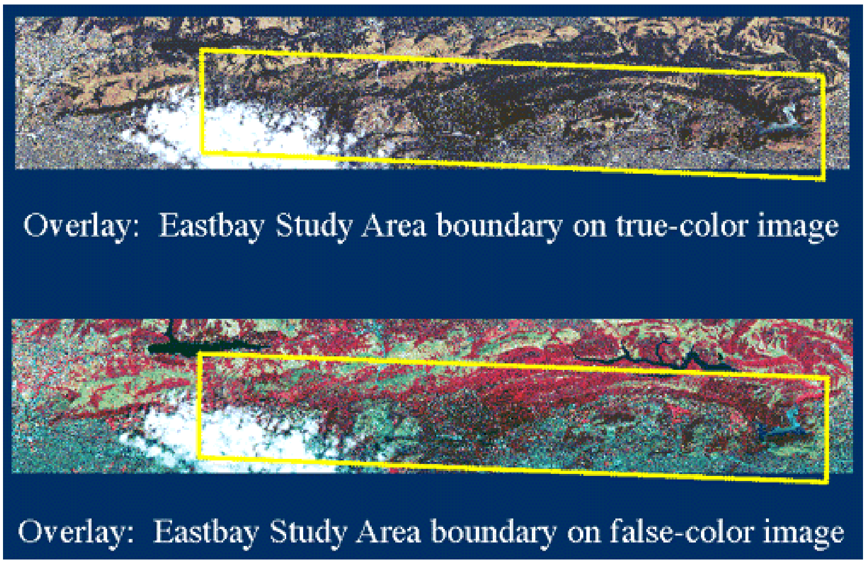
Räumliche Modellierung und Visualisierung

A Spatial Decision Support System for Urban/Wildland Interface Fire Hazards



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Räumliche Modellierung und Visualisierung

A Spatial Decision Support System for Urban/Wildland Interface Fire Hazards

The Potential for Fire

Three conditions: weather, topography and fuel type, effect the intensity of fire... fuel type, can be modified and managed to reduce risk.

Vegetation Type		
No Vegetation	Alameda Mazanita	Eucalyptus - 5 to 20 yr
Serpentine Grassland	Successional Scrub	Eucalyptus -1 to 5 yr
Grassland	Mixed Hardwood Woodland	Eucalyptus - >20 yr mature
Oak Savannah	Mixed Hardwood Forests	Acacia
Wet North coastal scrub	Riparian Forests	Cypress
Dry North coastal scrub	Pine Forest Plantation	Mature Pine/Eucalyptus Mix
French Broom	Pine Forest Mature	Treated Forest with slash
Diablan Sage Scrub	Redwood/Douglas Fir Forests	Other Vegetation
North mixed charparral		

Fuel Model Categories (for the BEHAVE Model)	
No Fuel Model	Southern Rough
Short Grass	Closed Timber Litter
Timber/Grass	Hardwood Litter
Tall Grass	Timber Litter/Understory
Charparral	Light Slash
Brush	Medium Slash
Dormant Brush	Heavy Slash
	Heavy Slash
	Other - not labeled (none in this category)

http://gis.esri.com/library/userconf/proc95/to200/p175.html

Räumliche Modellierung und Visualisierung

A Spatial Decision Support System for Urban/Wildland Interface Fire Hazards

The Potential for Fire

Three conditions: weather, topography and fuel type, effect the intensity of fire... fuel type, can be modified and managed to reduce risk.

Development Stage	Crown Potential	Tree Height
None Development Stage	None -- default	None -- default
Low Development Stage	Low	Short 20-30 ft
Moderate Development Stage	Moderate	Early Mature 30-50 ft
High Development Stage	High	Mature 50-70 ft
Extreme Development Stage	Extreme	Dominant 70-90 ft
		Overmature > 90 ft

„**Weather conditions** play a **critical role** in the risk of fire and the potential damage a fire can do once initiated. Temperature, wind velocity and relative humidity impact fuel moisture, ignition potential, flame length and rate of spread. Warm, dry easterly **Diablo winds**, regularly reach **velocities** in excess **of 20 miles per hour**, bring **temperatures** in excess **of 80 degrees Fahrenheit** and drop the **humidity** to **less than 20 percent**. Diablo winds occur on average **4 to 6 days a year** usually in **late September or early October** and are the ideal weather conditions for a firestorm."

http://gis.esri.com/library/userconf/proc95/to200/p175.html

Räumliche Modellierung und Visualisierung

A Spatial Decision Support System for Urban/Wildland Interface Fire Hazards

TABLE 2: Residential Neighborhood Fire Hazard Data Dictionary

	Fuel Characteristics	Measurement	Low	Moderate	High	Extreme
Structural Fuels:	combustible roof materials	% structures with wood roofs	None	<20%	20-50%	>50%
	Siding, decking and fencing	%Structures with combustible siding, decking or fencing	None visible	<20%	20-50%	>50%
Vegetation Fuels:	Surface Fuel Density	%Surface area supporting combusitible surface fuels	<20%	20-50%	50-70%	>70%
	Aerial Fuel Density	%Surface area covered by tree canopy	0-10%	10-30%	30-70%	>70%
	Vertical Continuity	Presence of ladder fuels and crown fires potential	None	Isolated ladder fuels, Individual trees to crown	Widespread ladder fuels, Stand-wide crown fire expected	
	Tree Height	Tree height	Short=<50 ft	Intermediate=50-90 ft	Tall =>90 ft	
	Flammability	Overall flammability of fuels	Irrigated grass, Ornamental hardwoods	Cured grasses, Native hardwoods, Cultivated landscapes	Pyrophytes (Juniper, pine, eucalyptus, etc.)	
	Fuel Clearance	Clearance distance of combustible material from structure	Poor =<10ft	Moderate =10-30ft	Good =30-100ft	Excellent =>10ft
Risk Value Assignment			1	2	3	4

http://gis.esri.com/library/userconf/proc95/to200/p175.html

Räumliche Modellierung und Visualisierung

A Spatial Decision Support System for Urban/Wildland Interface Fire Hazards

TABLE 3: Relative Weighting of Factors to Assess Urban Wildland Intermix Hazard

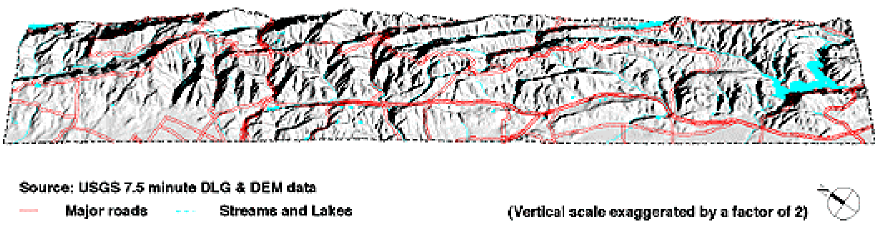
Vegetation Type		
	Fuel Characteristics	Weighting Factor
Structural Fuels	Combustible Roof Materials	75%
	Siding, decking & fencing	25%
Vegetation Fuels	Surface Fuel Density	25%
	Aerial Fuel Density	10%
	Vertical Continuity	20%
	Tree Height	10%
	Flammability	10%
	Fuel Clearance	25%

http://gis.esri.com/library/userconf/proc95/to200/p175.html

Räumliche Modellierung und Visualisierung

A Spatial Decision Support System for Urban/Wildland Interface Fire Hazards

The Database



•Digital Line Graphs (DLG), hypsography, hydrography and a Digital Elevation Model (DEM)

•Wildland vegetation layer was delineated using aerial photographs and images obtained from a NASA low altitude data gathering flight in August of 1993 and visited in the field for identification using a Trimble Navigation Differential Global Positioning System (DGPS).

http://gis.esri.com/library/userconf/proc95/to200/p175.html

Räumliche Modellierung und Visualisierung

A Spatial Decision Support System for Urban/Wildland Interface Fire Hazards

The Results

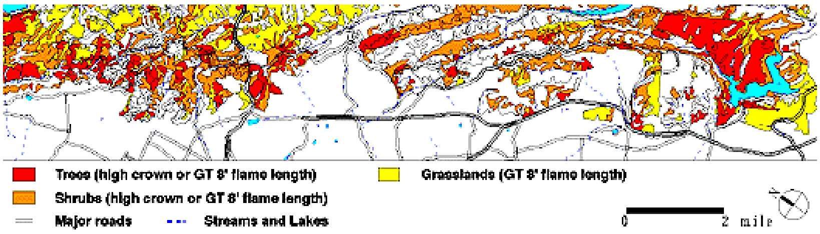


Figure 4 Hazard assessment maps with patterns of polygons which indicate spatially cumulative risk

Approximately 10,500 acres or over half of the wildlands in the study area have the ability to fuel and produce a firestorm in Diablo wind conditions.

http://gis.esri.com/library/userconf/proc95/to200/p175.html

Räumliche Modellierung und Visualisierung

A Spatial Decision Support System for Urban/Wildland Interface Fire Hazards

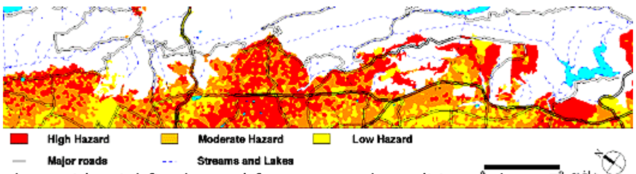


Figure 5 maps the residential fire hazard for structural conditions where 5,664 acres or 35% of the residential region is in the high hazard category for structural fuels and would likely contribute to the development of a firestorm in Diablo wind conditions.

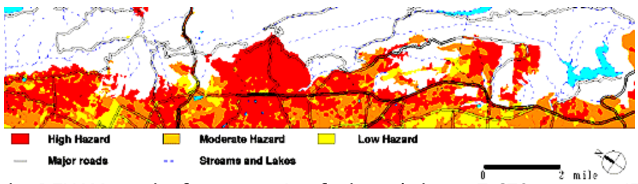
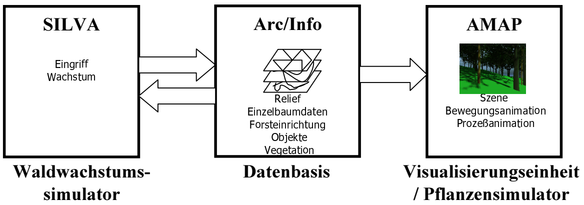
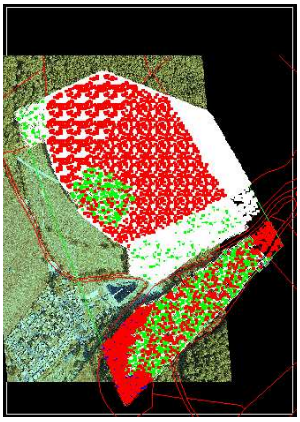


Figure 6 maps the RFHAM results for vegetation fuels and shows 7,679 acres or 47% of the residential region labeled as high hazard. This high hazard acreage is almost five times the area burned by the Oakland Firestorm and would potentially fuel another firestorm given the right weather conditions.

http://gis.esri.com/library/userconf/proc95/to200/p175.html

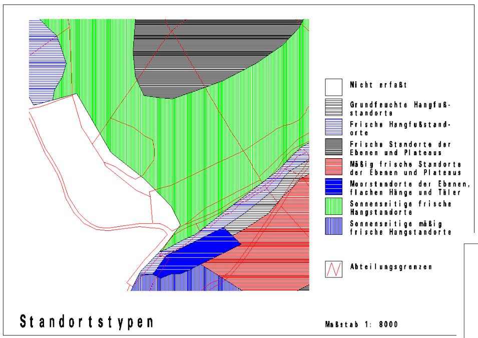
Räumliche Modellierung und Visualisierung
GIS-gestützten Visualisierung von Waldentwicklungsszenarien

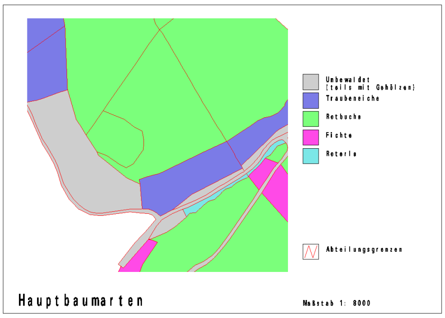




Knauft, F.-J. (2000): Entwicklung von Methoden zur GIS-gestützten Visualisierung
von Waldentwicklungsszenarien. Doctoral thesis at the Faculty for Forest Science and

Räumliche Modellierung und Visualisierung
GIS-gestützten Visualisierung von Waldentwicklungsszenarien





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