Urban growth model of Gorgan (Iran) through Cellular Automata (SLEUTH)

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Gorgan is a city in the Golestan Province in Iran. The economic growth in this area was accompanied by an increase in population, driving dramatic urban expansion and land use change. we used a cellular automaton dynamic urban-growth model, SLEUTH, which applies geospatial data themes to study the process of urbanization change in the Gorgan area. Each parameter reflects a type of spatial growth. For Gorgan City, the diffusion coefficient is very low, which reflects a low likelihood of dispersive growth. The low value for the breed coefficient reinforces it, given low probability of growth of new detached urban settlements. The spread coefficient stimulates growth outwards of existing and consolidated urban areas. The high value of the road gravity coefficient denotes that the growth is also highly influenced by the transportation network, occurring along the main roads. Slope resistance affects the influence of slope to urbanization. As value increases, the ability to urbanize ever steepening slopes decreases , but in Gorgan is inverse that meanes the topography is not a barrier to urban development in the region, and most of the hilly areas are likely to urbanise.

Appendix1. Best results for the coarse calibration of urban growth parameters -UGM model, Gorgan City

Run	Product	Compare	Pop	Edges	Clusters	ClusterSize	Leesalee	Slope
29	0.05747	0.99958	0.99794	1	0.99999	1	0.32175	0.99987
152	0.0521	0.99927	0.99774	1	0.99988	1	0.32112	0.99945
27	0.05187	0.99834	0.99737	1	0.99987	1	0.32078	0.99925
155	0.04313	0.99829	0.99737	1	0.99986	1	0.32069	0.99901
156	0.03242	0.99793	0.99723	1	0.99986	1	0.32069	0.99793
28	0.02941	0.99772	0.99719	1	0.99986	1	0.32007	0.99793
154	0.02898	0.99772	0.9971	1	0.99986	0.98684	0.31964	0.99627
34	0.02898	0.99766	0.99708	1	0.99984	0.98684	0.31962	0.99553
25	0.02869	0.99756	0.99706	1	0.99982	0.98684	0.31951	0.99281
26	0.02869	0.99756	0.99702	1	0.99976	0.98684	0.31951	0.99132

%Urban	Xmean	Ymean	Rad	Diff	Brd	Sprd	Slp	RG
0.9767	1	1	0.9982	1	1	25	1	100
0.97647	0.99997	1	0.99819	1	25	25	1	50
0.97639	0.99997	0.99999	0.99817	1	1	25	1	50
0.97617	0.99997	0.99999	0.99815	1	25	25	25	1
0.97617	0.99996	0.99998	0.99811	1	25	25	25	25
0.9742	0.99996	0.99998	0.99811	1	1	25	1	75
0.9742	0.99993	0.99995	0.998	1	25	25	1	100
0.97384	0.99987	0.99995	0.99783	1	1	25	25	100
0.97368	0.99985	0.99991	0.99783	1	1	25	1	1
0.97345	0.99979	0.99985	0.99777	1	1	25	1	25

Appendix2. Best results for the fine calibration of urban growth parameters -UGM model, Gorgan City

Run	Product	Compare	Pop	Edges	Clusters	ClusterSize	Leesalee	Slope
656	0.00339	0.99997	0.98884	0.98394	0.99999	0.94231	0.32045	0.08048
1107	0.00335	0.99997	0.98878	0.98314	0.99998	0.94231	0.32044	0.07213
651	0.00333	0.99995	0.98876	0.98299	0.99998	0.94231	0.32033	0.07031
1093	0.00322	0.99994	0.98876	0.98262	0.99998	0.94231	0.32031	0.06975
443	0.00309	0.99992	0.98875	0.98253	0.99997	0.94231	0.32025	0.0697
1090	0.00308	0.9999	0.98872	0.98239	0.99995	0.94231	0.32025	0.06838
436	0.00306	0.9999	0.9887	0.98238	0.99993	0.94231	0.3202	0.06779
1088	0.00304	0.99989	0.9887	0.98237	0.99991	0.94231	0.32013	0.06722
1087	0.00301	0.99989	0.98869	0.98231	0.99988	0.94231	0.32012	0.06706
217	0.00301	0.99985	0.98869	0.9823	0.99988	0.94231	0.32008	0.06664

%Urban	Xmean	Ymean	Rad	Diff	Brd	Sprd	Slp	RG
0.88237	0.36962	0.88976	0.99289	1	15	25	5	70
0.88126	0.3683	0.88963	0.99283	1	25	25	20	80
0.88119	0.3663	0.8896	0.99281	1	15	25	1	80
0.88095	0.35948	0.88944	0.99281	1	25	25	10	60
0.88083	0.35709	0.88939	0.9928	1	10	25	5	100
0.8807	0.35683	0.8889	0.99279	1	25	25	5	90
0.88049	0.356	0.88885	0.99279	1	10	25	1	90
0.88048	0.35487	0.8888	0.99279	1	25	25	5	70
0.88023	0.35447	0.88867	0.99279	1	25	25	5	60
0.88004	0.35439	0.88862	0.99278	1	5	25	1	60

Appendix3. Best results for the final calibration of urban growth parameters -UGM model, Gorgan City

Run	Product	Compare	Pop	Edges	Clusters	ClusterSize	Leesalee	Slope
753	0.0098	0.99999	0.99041	0.96904	0.95635	0.88603	0.31868	0.08268
377	0.00965	0.99991	0.99039	0.96903	0.95034	0.87928	0.31867	0.08021
332	0.00939	0.99989	0.99038	0.96903	0.94508	0.87182	0.31863	0.08017
309	0.00914	0.99988	0.99035	0.96902	0.9439	0.86903	0.31862	0.08014
479	0.00913	0.99985	0.99035	0.96891	0.94154	0.86763	0.31861	0.07973
554	0.00909	0.99984	0.99034	0.96883	0.94131	0.86537	0.31859	0.07956
329	0.00878	0.99964	0.99033	0.96882	0.9409	0.86537	0.31858	0.07943
401	0.00868	0.9996	0.99032	0.96875	0.94021	0.86502	0.31858	0.07939
1104	0.00865	0.99948	0.99032	0.96875	0.93965	0.86502	0.31857	0.07939
351	0.00843	0.9994	0.99032	0.96869	0.93907	0.86502	0.31856	0.07935

%Urban	Xmean	Ymean	Rad	Diff	Brd	Sprd	Slp	RG
0.75663	1	0.8653	0.99306	2	15	22	1	75
0.75596	0.99999	0.86506	0.99304	1	20	25	1	70
0.75586	0.99945	0.86473	0.99303	1	20	23	5	70
0.75586	0.99723	0.86471	0.99302	1	20	22	5	80
0.75586	0.99682	0.86451	0.99302	1	25	23	1	80
0.75579	0.99361	0.86445	0.99302	1	25	26	1	80
0.75566	0.99339	0.86443	0.99301	1	20	23	1	80
0.75564	0.99098	0.86436	0.993	1	20	26	1	65
0.75561	0.95102	0.86434	0.993	2	25	24	1	80
0.75554	0.93104	0.86427	0.99299	1	20	24	1	65

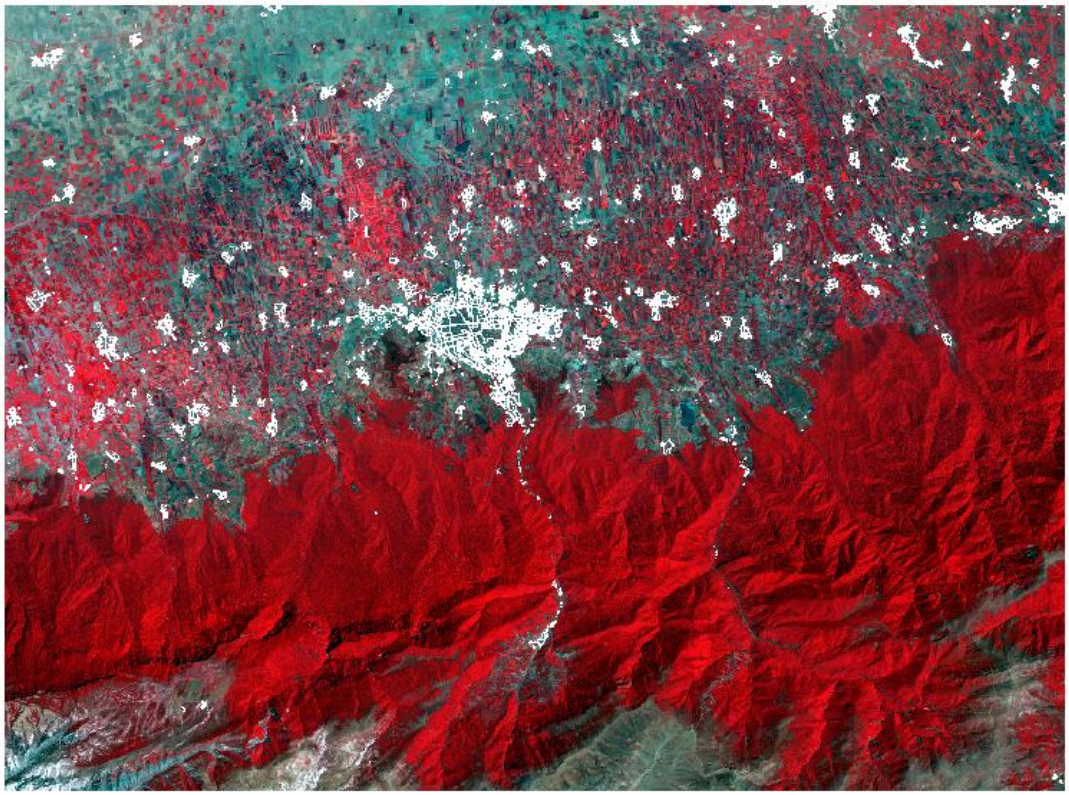

Figure3. Above figure is visible green, visible red and near-infrared bands color composite of ETM+ sensor of Landsat satellite in 30th July 2001. The white regions shows the residential areas

Calibrated and averaged best parameter values for prediction of urban growth in Gorgan City

***** Monte Carlo iteration in Derive Forecasting Coefficients = 100 according to Dietzel and Clarke (January,2006)**

Growth Parameters	Best value for prediction
Diffusion	2
Breed	17
Spread	25
Slope resistance	1
Road gravity	76

Related Paper:

- **Change Detection in Gorgan City Extent Using Landsat Imagery and Its Application to Cumulative Effects Assessment.**

Dr. Abdolrassoul Salman Mahiny, Engineer Mehdi Gholamalifard .

3th National Convention of Environmental Impact Assessment, Iran, February 2006.