

# How should the light pollution be controlled – an experience from the Czech Republic

Jenik Hollan, N. Copernicus Observatory and Planetarium in Brno

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Light pollution:

the only pollution growing exponentially everywhere.

The rise should be stopped and reversed to go sustainably.

Similarities with fossil carbon emissions.

Both pollutants considered harmless 30 years ago, both are very dangerous.

Common solution: energy efficiency.

For that, rules imposed by law are needed:

- Shine below horizon only.
- Use just the amount of light demanded by safety standards and not more than  $1 \text{ cd/m}^2$  or 10 lux otherwise.
- Ensure that the amount of light can be lowered at night substantially.
- Put a limit for illuminated advertisements (like luminance  $L = 150 / S^{0.8}$  for areas  $S$  between 1 and  $500 \text{ m}^2$ ).
- Apply emergency measures for the most vulnerable sites.
- Enable communes to proceed more rapidly.

Exceptions:  
traffic lights,  
short-time lighting,  
faint sources (1500 lm or less)

















Good experience from Lombardy since 2000.

Failure of laws using just a declaration.

[http://svetlo.astro.cz/darksky/cz\\_law](http://svetlo.astro.cz/darksky/cz_law)

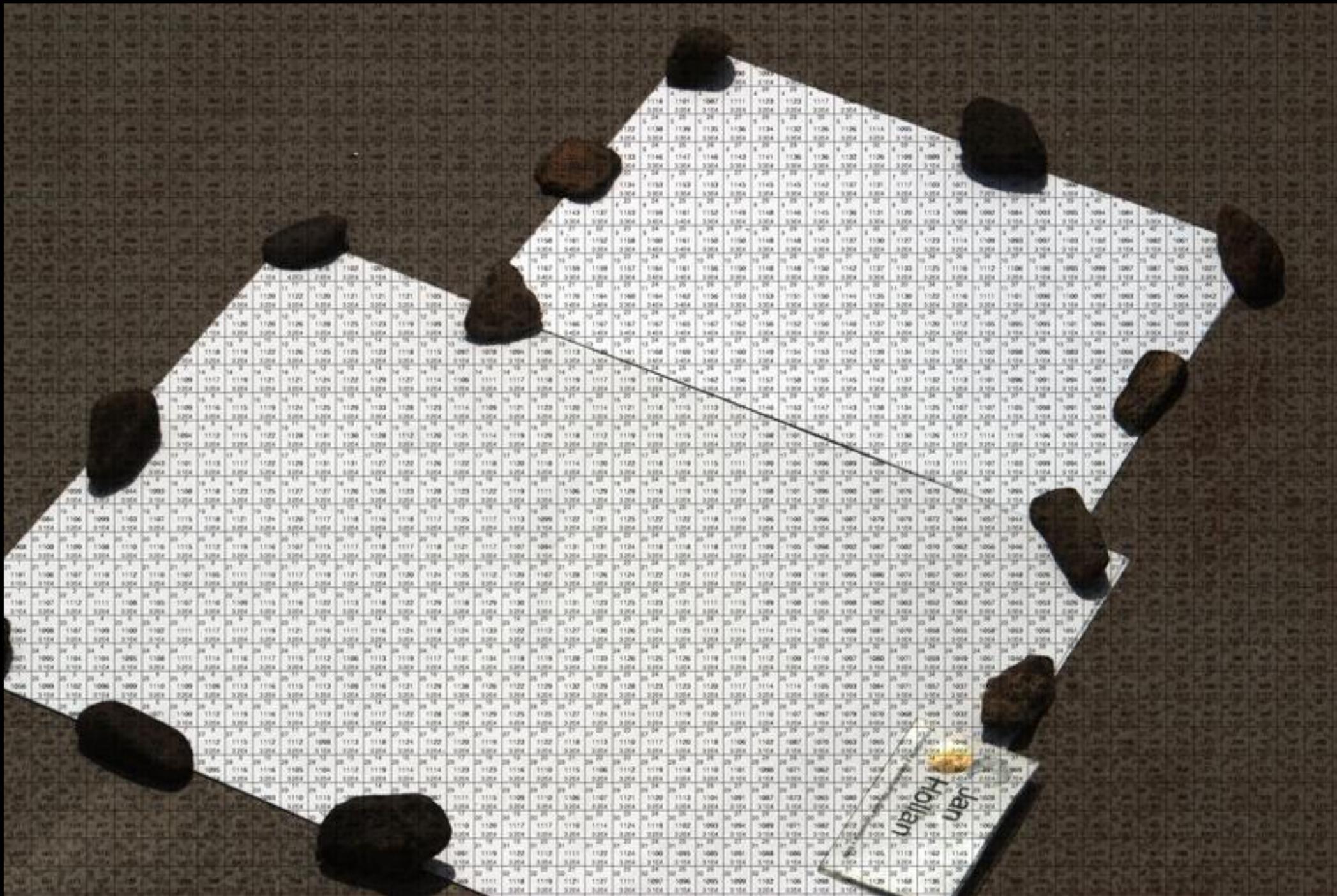


MV, MH, LPS, HPS, fluorescent



## Digital imaging photometry

<http://amper.ped.muni.cz/light/luminance>



Jan  
Hollan

1156	1150	1148	1148	1150	1142	1137	1133	1125	1116	1112	1106	11
3.3E4	3.2E4	3.2E4	3.2E4	3.2E4	3.2E4	3.1						
11 <sup>26</sup>	11 <sup>27</sup>	11 <sup>28</sup>	11 <sup>29</sup>	11 <sup>30</sup>	11 <sup>31</sup>	11 <sup>32</sup>	11 <sup>33</sup>	11 <sup>34</sup>	11 <sup>35</sup>	11 <sup>36</sup>	11 <sup>37</sup>	11 <sup>3</sup>
1156	1153	1153	1151	1150	1144	1135	1130	1122	1116	1111	1101	10
3.3E4	3.2E4	3.2E4	3.2E4	3.2E4	3.1E4	3.1						
12 <sup>26</sup>	12 <sup>27</sup>	12 <sup>28</sup>	12 <sup>29</sup>	12 <sup>30</sup>	12 <sup>31</sup>	12 <sup>32</sup>	12 <sup>33</sup>	12 <sup>34</sup>	12 <sup>35</sup>	12 <sup>36</sup>	12 <sup>37</sup>	12 <sup>3</sup>
1167	1162	1156	1152	1150	1140	1137	1130	1120	1112	1105	1095	10
3.4E4	3.3E4	3.3E4	3.3E4	3.3E4	3.3E4	3.3E4	3.2E4	3.2E4	3.2E4	3.1E4	3.1E4	3.1
13 <sup>26</sup>	13 <sup>27</sup>	13 <sup>28</sup>	13 <sup>29</sup>	13 <sup>30</sup>	13 <sup>31</sup>	13 <sup>32</sup>	13 <sup>33</sup>	13 <sup>34</sup>	13 <sup>35</sup>	13 <sup>36</sup>	13 <sup>37</sup>	13 <sup>3</sup>
1167	1160	1149	1154	1153	1142	1139	1134	1124	1111	1102	1098	10
3.4E4	3.3E4	3.2E4	3.2E4	3.1E4	3.1E4	3.1						
14 <sup>26</sup>	14 <sup>27</sup>	14 <sup>28</sup>	14 <sup>29</sup>	14 <sup>30</sup>	14 <sup>31</sup>	14 <sup>32</sup>	14 <sup>33</sup>	14 <sup>34</sup>	14 <sup>35</sup>	14 <sup>36</sup>	14 <sup>37</sup>	14 <sup>3</sup>
1162	1156	1157	1158	1155	1145	1143	1137	1132	1113	1101	1096	10
3.3E4	3.2E4	3.2E4	3.1E4	3.1E4	3.1							
15 <sup>26</sup>	15 <sup>27</sup>	15 <sup>28</sup>	15 <sup>29</sup>	15 <sup>30</sup>	15 <sup>31</sup>	15 <sup>32</sup>	15 <sup>33</sup>	15 <sup>34</sup>	15 <sup>35</sup>	15 <sup>36</sup>	15 <sup>37</sup>	15 <sup>3</sup>
1113	1117	1146	1153	1147	1143	1138	1134	1125	1107	1107	1105	10
3.2E4	3.2E4	3.3E4	3.3E4	3.3E4	3.3E4	3.3E4	3.3E4	3.2E4	3.2E4	3.2E4	3.1E4	3.1
16 <sup>26</sup>	16 <sup>27</sup>	16 <sup>28</sup>	16 <sup>29</sup>	16 <sup>30</sup>	16 <sup>31</sup>	16 <sup>32</sup>	16 <sup>33</sup>	16 <sup>34</sup>	16 <sup>35</sup>	16 <sup>36</sup>	16 <sup>37</sup>	16 <sup>3</sup>
1114	1112	1108	1101	1113	1131	1131	1130	1126	1117	1114	1110	11
3.2E4	3.2E4	3.2E4	3.1E4	3.2E4	3.1							
17 <sup>26</sup>	17 <sup>27</sup>	17 <sup>28</sup>	17 <sup>29</sup>	17 <sup>30</sup>	17 <sup>31</sup>	17 <sup>32</sup>	17 <sup>33</sup>	17 <sup>34</sup>	17 <sup>35</sup>	17 <sup>36</sup>	17 <sup>37</sup>	17 <sup>3</sup>
1115	1111	1109	1104	1096	1089	1088	1111	1113	1111	1107	1103	10
3.2E4	3.2E4	3.2E4	3.2E4	3.1E4	3.1E4	3.1E4	3.2E4	3.2E4	3.2E4	3.1E4	3.1E4	3.1
18 <sup>26</sup>	18 <sup>27</sup>	18 <sup>28</sup>	18 <sup>29</sup>	18 <sup>30</sup>	18 <sup>31</sup>	18 <sup>32</sup>	18 <sup>33</sup>	18 <sup>34</sup>	18 <sup>35</sup>	18 <sup>36</sup>	18 <sup>37</sup>	18 <sup>3</sup>
1116	1110	1108	1101	1096	1090	1081	1076	1070	1077	1097	1095	10
3.2E4	3.2E4	3.2E4	3.1E4	3.1E4	3.1E4	3.1E4	3.1E4	3.0E4	3.1E4	3.1E4	3.1E4	3.0
19 <sup>26</sup>	19 <sup>27</sup>	19 <sup>28</sup>	19 <sup>29</sup>	19 <sup>30</sup>	19 <sup>31</sup>	19 <sup>32</sup>	19 <sup>33</sup>	19 <sup>34</sup>	19 <sup>35</sup>	19 <sup>36</sup>	19 <sup>37</sup>	19 <sup>3</sup>
1118	1110	1106	1100	1096	1087	1079	1079	1072	1064	1057	1044	2



110	111	112	113
114	115	116	117
118	119	120	121
122	123	124	125

1	20 226 0.14	21 254 0.18	22 270 0.20	23 266 0.18	24 322 0.27	25 366 0.32	26 382 0.33	27 206 0.17	28 178 0.073	29 172 0.15	30 188 0.082	31 234 0.14
2	20 276 0.21	21 274 0.11	22 240 0.16	23 358 0.33	24 334 0.30	25 514 0.57	26 1304 1.7	27 240 0.16	28 210 0.12	29 230 0.14	30 194 0.092	31 212 0.12
3	20 396 0.40	21 376 0.36	22 452 0.47	23 582 0.65	24 814 0.98	25 1108 1.4	26 1094 1.4	27 474 0.49	28 316 0.27	29 354 0.34	30 300 0.28	31 246 0.18
4	20 506 0.58	21 528 0.62	22 662 0.82	23 852 1.1	24 1036 1.4	25 1188 1.6	26 1274 1.8	27 502 0.58	28 294 0.25	29 254 0.20	30 356 0.34	31 256 0.19
5	20 810 1.1	21 1006 1.4	22 1166 1.6	23 1288 1.8	24 1564 2.2	25 1372 1.9	26 1436 2.0	27 730 0.94	28 560 0.65	29 226 0.14	30 216 0.11	31 262 0.19
6	20 678 0.79	21 736 0.88	22 848 1.1	23 774 0.94	24 782 0.96	25 766 0.94	26 906 1.2	27 692 0.84	28 544 0.61	29 520 0.57	30 288 0.21	31 266 0.18
7	20 668 0.77	21 686 0.79	22 720 0.85	23 740 0.88	24 716 0.85	25 740 0.88	26 874 1.1	27 778 0.95	28 602 0.68	29 514 0.55	30 502 0.54	31 310 0.24
8	20 704 0.81	21 700 0.80	22 758 0.89	23 742 0.87	24 702 0.81	25 760 0.90	26 896 1.1	27 850 1.0	28 676 0.78	29 560 0.62	30 486 0.51	31 454 0.47
9	20 618 0.69	21 688 0.79	22 714 0.83	23 680 0.78	24 650 0.74	25 720 0.84	26 856 1.0	27 870 1.1	28 730 0.85	29 592 0.66	30 508 0.54	31 448 0.45
10	20	21	22	23	24	25	26	27	28	29	30	31



9	12	20	12	21	12	22	12	23	12	24	12	25	12	26	12	27	12	28	12	29	12	30	12	31
41		360		357		340		343		403		440		379		337		327		355		344		325
0		2.1		2.1		1.9		2.0		2.5		2.9		2.3		1.9		1.8		2.1		2.0		1.8
9	13	20	13	21	13	22	13	23	13	24	13	25	13	26	13	27	13	28	13	29	13	30	13	31
57		363		364		350		353		426		459		408		366		360		370		362		295
1		2.2		2.2		2.0		2.1		2.7		3.0		2.6		2.2		2.1		2.2		2.2		1.5
9	14	20	14	21	14	22	14	23	14	24	14	25	14	26	14	27	14	28	14	29	14	30	14	31
71		380		380		364		365		436		465		437		398		391		404		396		331
2		2.3		2.3		2.2		2.1		2.8		3.1		2.8		2.5		2.4		2.5		2.5		1.9
9	15	20	15	21	15	22	15	23	15	24	15	25	15	26	15	27	15	28	15	29	15	30	15	31
80		395		399		386		384		461		484		469		416		420		444		430		390
3		2.5		2.5		2.4		2.3		3.1		3.3		3.1		2.7		2.7		2.9		2.8		2.4
9	16	20	16	21	16	22	16	23	16	24	16	25	16	26	16	27	16	28	16	29	16	30	16	31
93		403		429		404		401		501		520		505		449		450		476		466		462
4		2.5		2.8		2.5		2.5		3.4		3.6		3.5		3.0		3.0		3.2		3.1		3.1
9	17	20	17	21	17	22	17	23	17	24	17	25	17	26	17	27	17	28	17	29	17	30	17	31
91		415		441		425		427		532		562		554		496		482		516		539		538
4		2.6		2.9		2.7		2.7		3.7		4.0		3.9		3.4		3.3		3.6		3.8		3.8
9	18	20	18	21	18	22	18	23	18	24	18	25	18	26	18	27	18	28	18	29	18	30	18	31
09		556		603		571		656		686		720		691		575		526		566		618		637
5		3.9		4.4		4.1		4.8		5.2		5.5		5.2		4.1		3.7		4.1		4.6		4.8
9	19	20	19	21	19	22	19	23	19	24	19	25	19	26	19	27	19	28	19	29	19	30	19	31
17		574		544		495		498		556		578		587		532		553		576		630		650
6		4.1		3.9		3.4		3.4		3.9		4.1		4.2		3.7		3.9		4.2		4.7		4.9
9	20	20	20	21	20	22	20	23	20	24	20	25	20	26	20	27	20	28	20	29	20	30	20	31
20		446		466		463		488		549		547		582		541		509		545		591		621
7		2.9		3.1		3.1		3.3		3.9		3.8		4.2		3.8		3.5		3.9		4.3		4.6
9	21	20	21	21	21	22	21	23	21	24	21	25	21	26	21	27	21	28	21	29	21	30	21	31

Dimming the light sources  
(a good example from Brno)

Who minds?

# Cancers and Sleep





Nature, glare, light trespass

**PARK HOURS**  
OPEN FROM:  
SUNRISE UNTIL  
1/2 HOUR AFTER  
SUNSET

**NO  
TRESPASSING  
AT OTHER  
TIMES**

















Vanished heavens:

stars never noticed among strong luminaires

Deprived childhood and rise of crime

Bad rules worse than none at all.

Good rules, like in Lombardy:  
a hope to restore the night again

<http://www.darksky.cz>

<http://www.darksky.org>