

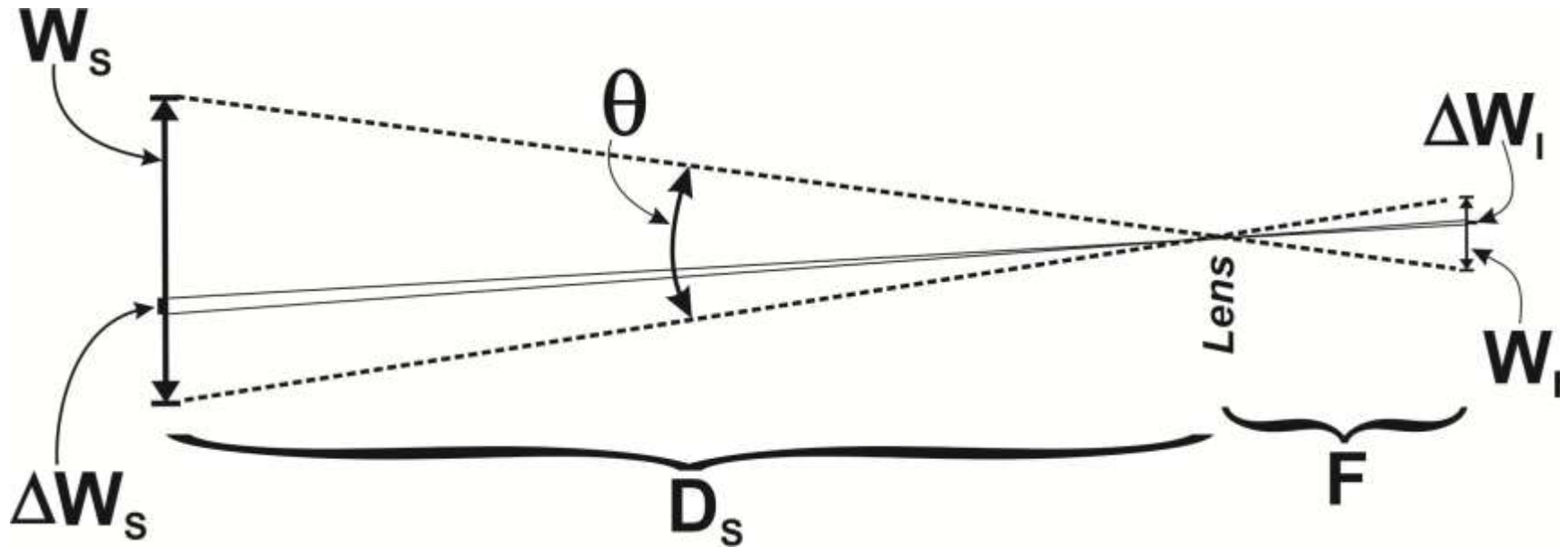
How large are small things?

What is the smallest object a camera can detect at a given distance?

How close should the camera be for a particular lens focal length?

What are the actual sizes of some small things found in nature?

Size of object that occupies one pixel



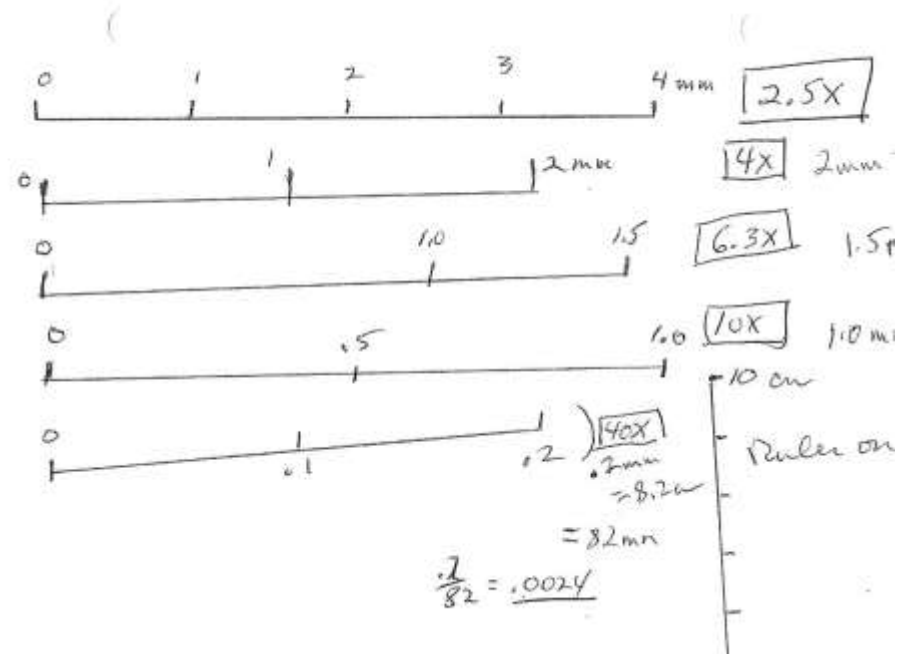
Calculate with spreadsheet *Size of things.xls*

Spreadsheet ... Insert sensor size, pixels and lens focal length

	A	B	C	D	E	F	G	H	I
1	Distance and size for a subject that subtends one effective pixel								
2	Sensor width in mm =				36	$\theta =$	39.6		
3	Effective pixels in sensor EFFpix =				5616	$\tan(\theta/2) =$	0.35996		
4	Lens focal length in mm =				50	$C =$	7800.97		
5									
6	Subject size in mm	Distance in mm	Distance in metres		Distance in cm	Smallest subject in mm		Field of view mm	Subj in mm
7	10	78010	78.01		1000	1.282		56160	10
8	5	39005	39.00		500	0.641		28080	5
9	1	7801	7.80		250	0.320		5616	1
10	0.9	7021	7.02		100	0.128		5054	0.9
11	0.8	6241	6.24		90	0.115		4493	0.8
12	0.7	5461	5.46		80	0.103		3931	0.7
13	0.6	4681	4.68		70	0.090		3370	0.6
14	0.5	3900	3.90		60	0.077		2808	0.5
15	0.4	3120	3.12		50	0.064		2246	0.4
16	0.3	2340	2.34		40	0.051		1685	0.3
17	0.2	1560	1.56		30	0.038		1123	0.2
18	0.1	780	0.78		20	0.026		562	0.1
19	0.08	624	0.62		15	0.019		449	0.08
20	0.05	390	0.39		10	0.013		281	0.05
21	0.04	312	0.31		9	0.012		225	0.04
22	0.03	234	0.23		8	0.010		168	0.03
23	0.02	156	0.16		7	0.009		112	0.02
24	0.01	78	0.08		6	0.008		56	0.01
25	0.008	62	0.06		5	0.006		45	0.008

Actual sizes of small things

Calibrate microscope for each objective lens and trace image



Compute sizes from lens and measures



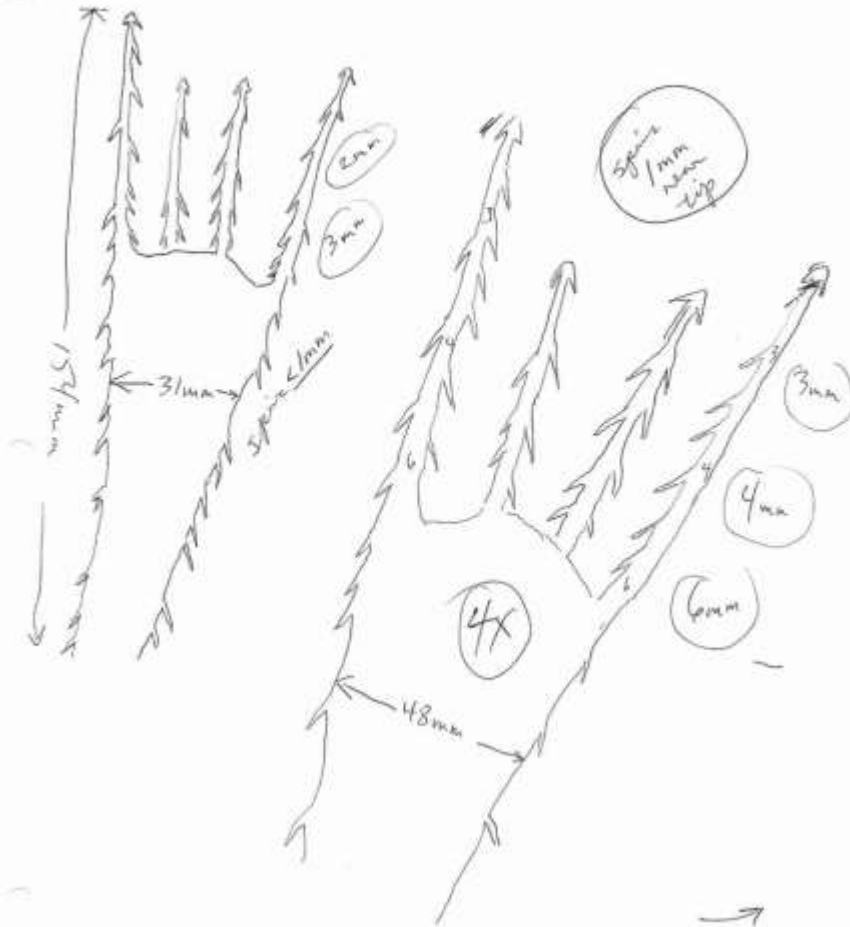
Objective lens	Magnify factor	Measure on paper in mm	Real size in mm
2.5X	0.0381	154	5.867
4X	0.024	1	0.024
6.3X	0.0152	75	1.140
10X	0.0095	7	0.067
40X	0.0024	5	0.012

Typical results

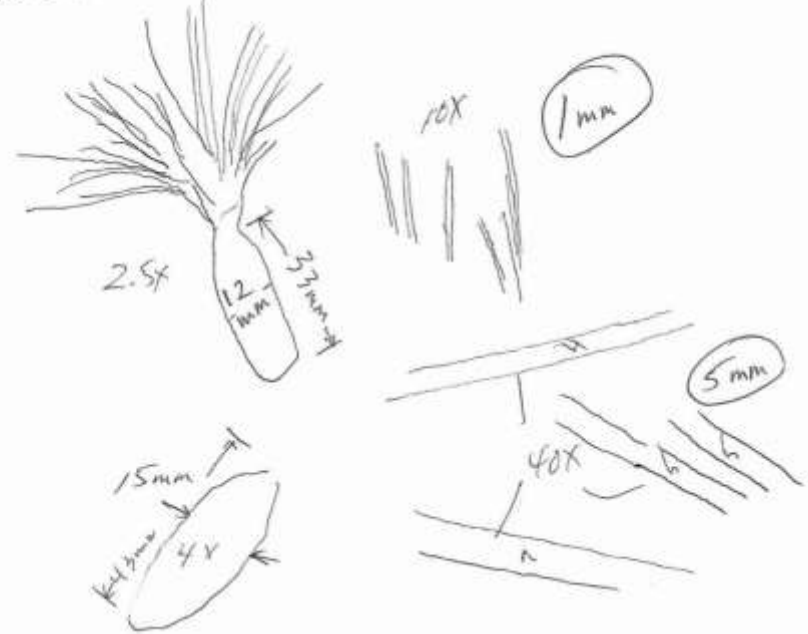
Fireweed seed with fine parachute fibres

Burdock from WFF
2.5x sticks

Burdock seed



down from fire weed + seed



Sizes of some small things

Subject	Size in mm
Fine hair on knee	0.02
Tip of eyelash	0.02
Tip of nose hair	0.01
Hook on burdock seed	0.02
Spine on thistle leaf	0.04
Fine hairs on blackberry stem	0.01
Parachute fibres on fireweed seed	0.01