Growing Food on a Changing Planet

Roles for Biomimicry
The Garden of Secrets Debut
San Francisco Design Week
San Francisco, CA

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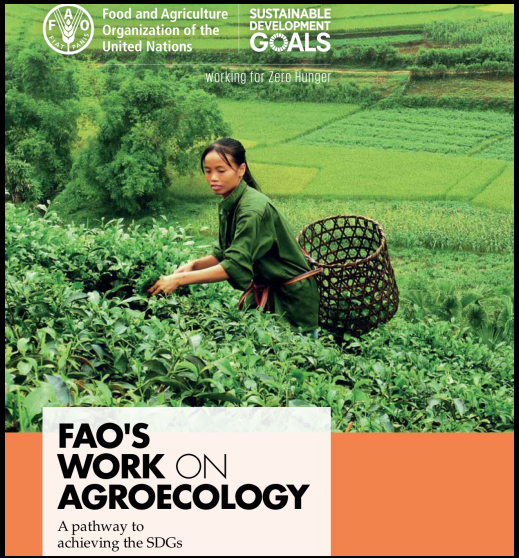
How?

Farm in Nature's Image



- regenerative, not extractive (low/no external inputs)
- minimize soil disturbance (no till)
- keep soil covered (cover crops, etc.)
- foster biodiversity, above & below ground
- "use meat to grow vegetables" —D. Miller

What?

- outcompete
- no/low input
- long season
- edible root to fruit
- promiscuous and fecund

- outcompete
- no/low input
- long season
- edible root to fruit
- promiscuous and fecund

I.e., **edible weeds!**

C.f., H.G. Baker, 1965. Characteristics and modes of origin of weeds.

Top 10 World's Worst Weeds

The chart displays the 10 most serious weed in the approximate order in which they are troublesome to the world's agriculturalist. The bowl with grain icon represents the reported number of different crops that weed affects, and the flag represents the number of countries that consider the weed a pest. It is important to mention that the water hyacinth only affects paddy crops and is a weed of the tropics and subtropics. There is no calculable data.

1.	2.	3.	4.	5.
				
Purple Nutsedge *Cyperus rotundus L.*	**Bermuda grass** *Cynodon dactylon*	**Barnyardgrass** *Echinochloa crus-galli*	**Junglerice** *Echinolchloa colona*	**Indian goosegrass** *Eleusine indica*
52	40	36	32	46
92	80	80	60	60

6.	7.	8.	9.	10.
				
Johnsongrass *Sorghum halepense*	**Cogongrass** *Imperata cylindrical*	**Water Hyacinth** *Eichhornia crassipes*	**Purselane** *Portulaca oleracea*	**Lambsquarters** *Chenopodium album*
30	35	1	45	40
53	73	no # data	81	47

Holm, L.G., Plucknett, D.L., Pancho, J.V., Herberger, J.P.; (1977). The World's Worst Weeds: Distribution and Biology. Honolulu, HI: University Press of Hawaii.

USDA National Resource Conservation Service: Plant Database. [Pictures from Internet]. Retrieved October 12, 2012, from http://plants.usda.gov/java/

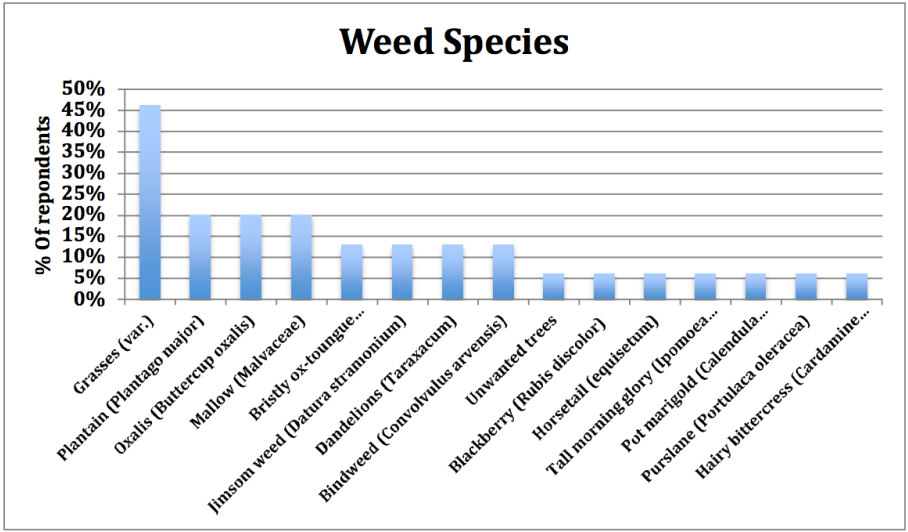


Fig 1.7 Weed species

Altieri et al., 2014. Survey of 21 urban farms in the East Bay.

MALLOW

(foraged)

Nutrition Facts	
Serving Size 1/2 cup (68g)	
Servings Per Container	
Calories	35
Total Fat	0 g
Sodium	30 mg
Potassium	240 mg
Total Carbohydrate	5 g
Dietary Fiber	5 g
Sugar	0 g
Protein	3 g
Calcium 20%	**Iron** 15%

**Comparison of total polyphenols awaiting lab results*

(Source: SCSglobalServices.com)

SPINACH

(conventional)

Nutrition Facts	
Serving Size 1 cup (30g)	
Servings Per Container	
Calories	7
Total Fat	0 g
Sodium	24 mg
Potassium	167 mg
Total Carbohydrate	1 g
Dietary Fiber	1 g
Sugar	0 g
Protein	1 g
Calcium 3%	**Iron** 4%

(Source: USDA)

OXALIS

(foraged)

Nutrition Facts	
Serving Size 1/2 cup (84g)	
Servings Per Container	
Calories	25
Total Fat	0 g
Sodium	25 mg
Potassium	110 mg
Total Carbohydrate	4 g
Dietary Fiber	3 g
Sugar	0 g
Protein	1 g
Calcium 4%	**Iron** 8%

**Comparison of total polyphenols awaiting lab results*

(Source: SCSglobalServices.com)

SPINACH

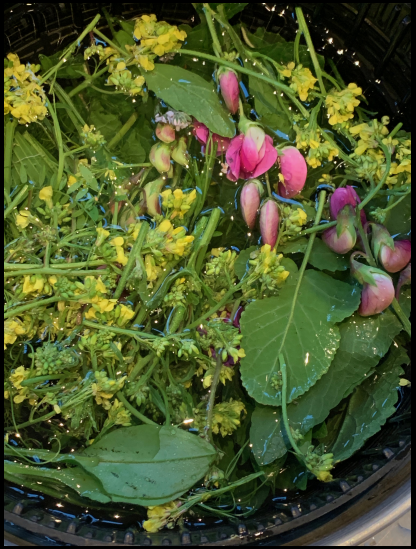
(conventional)

Nutrition Facts	
Serving Size 1 cup (30g)	
Servings Per Container	
Calories	7
Total Fat	0 g
Sodium	24 mg
Potassium	167 mg
Total Carbohydrate	1 g
Dietary Fiber	1 g
Sugar	0 g
Protein	1 g
Calcium 3%	**Iron** 4%

(Source: USDA)

	chickweed *Stellaria media*	dandelion *Taraxacum officinale*	dock *Rumex crispus*	mallow *Malva sylvestris*	nasturtium *Tropaeolum majus*	oxalis *Oxalis pes-caprae*	kale *Brassica oleracea*
cal (Kcal)	29.09	34.86	33.37	52.14	46.91	27.52	35.0
fat cal (Kcal)	2.40	3.47	2.47	3.58	6.39	2.52	13.41
fat (g)	0.27	0.39	0.27	0.40	0.71	0.28	1.49
saturated fat (g)	0.01	0.01	0.02	0.01	0.04	0.01	0.18
TFA (g)	0	0	0	0	0	0	0
cholesterol (mg)	0	0	0	0	0	0	0
carbohydrates (g)	5.19	5.55	4.79	7.81	6.90	5.27	4.42
dietary fiber (g)	3.64	5.26	3.39	7.20	3.10	2.99	4.10
total sugars (g)	0	0	0	0	0.37	0	0.99
protein (g)	1.43	2.27	2.63	4.10	3.23	0.98	2.92
Vitamin A (IU)	2282	6577	5396	4637	8182	2369	4812
Vitamin C (mg)	10.66	4.49	36.19	8.65	1.49	9.40	93.40
Na (mg)	45.17	52.34	101.04	42.87	39.97	28.85	53.0
Ca (mg)	65.96	95.90	68.47	273.39	148.46	48.69	254.0
Fe (mg)	1.54	2.73	1.31	3.35	1.18	1.87	1.60
K (mg)	439.82	440.08	310.24	357.09	297.97	128.29	348.0
total phenolics (mg/g)	0.77	0.49	2.77	1.29	2.82	1.68	NA
oxalic acid–soluble (mg/g)			0.18		10.94		
oxalic acid–total (mg/g)			0.39		15.42		

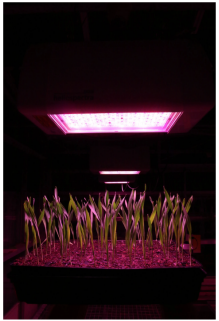
Table 8. Nutritional tests of wet plant tissue (performed by SCS Global Services in Emeryville, CA) collected by Berkeley Open Source Food in West Oakland, CA, and USDA National Nutrient Database values for raw kale. Results are per 100g of wet tissue except total phenolics and oxalic acid, which are concentrations (mg/g) See table 6 for sample locations.



The New York Times

Grow Faster, Grow Stronger: Speed-Breeding Crops to Feed the Future

Plant breeders are fast-tracking genetic improvements in food crops to keep pace with global warming and a growing human population.



Fast-growing plants in the crop-speed breeding facility at The University of Queensland. The plants featured are barley plants. The University of Queensland

By Knvul Sheikh

June 17, 2019

Tomorrow's crops are today's weeds.