REDEFINING THE CONCEPT OF WEEDS

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Abstract: The term weed is negatively perceived by many if not all. We tried to read literature and examined why this is so. It was found out that society has a bias and we argued on this and presented a utilitarian context highlighting the many economic and environmental benefits of weeds. We propose that no plant species should be tagged or branded as weed on a fixed status. The presented contexts aptly justify our stand that weeds should not be abhorred by anyone. Rather, everyone should live harmoniously with this group of plants.

Keywords: ecosystem, farm, food, medicine, plants, weeds

Introduction:

Much of our present perception and understanding of weeds are anchored on the context of their noxious and harmful effects to humans, crops and livestock, environment and others. Weeds, whether growing in the upland or lowland, and aquatic or terrestrial, are commonly described as plants out of place, or plants growing where they are not wanted. Such definitions suggest the least acceptance, or none at all, of these species in that particular time and space. While we recognize their noxious and harmful effects, we would like to argue on this and we would like to embrace another context to look through them in the lens of their benefits and advantages to humans and the ecosystem. Having been raised to a life in the farm, our present concept of weeds was founded on our experiences and observations that they are not entirely negative but also important resource for our day-to-day subsistence. Such concept was enhanced through immersion or exposure to weedy, underexplored plant species in our work on plant genetic resources conservation and management. This paper will present the two sides of the scenario - the good and bad, but we would like to make a strong stand for a new, utilitarian concept of weeds permeating the noxious and harmful context with which they are traditionally accorded.

Materials and methods:

Literature review of papers from scientific journals in English related to weeds was done. Literature research followed a structured

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keyword search. Major databases were also searched for related materials such as those stored and made available by major publishers, i.e. Elsevier (www.sciencedirect.com) and Springer (www.springerlink.com) as well as library services. Literature were reviewed, critically analyzed and synthesized. Additionally, the International Plant Names Index was consulted for the valid names of the mentioned plant species.

Results and discussion:

The Paradox of Weeds – The Good Bad

Weed is a pejorative term usually associated with descriptions such as enemy in an unending war, green death, and ecological imperialist (Martin 2003 In: Wegner 2017; Crosby 2004). Both terminologies attributed to them, such as “invasion” (rather than the more neutral term transfer) and ”colonize” (a militaristic language implying the inevitable view of weeds as invaders in competition with desired plants) suggest bias judgement skewed to their negative effects.

An anthropocentric definition of weeds is plants that are in some way deleterious to humans and human activities. Some authors consider them as plants that require some form of action to reduce their harmful effects on the economy, the environment, human health and activities, and amenity. Meanwhile, Holzner’s definition (Holzner 1982) had wider scope to include not only those plants that are nuisance for some reason but also those that are simply ‘unsightly’ or ‘just good for nothing’ since the latter are considered as undesirable.

Weed as Culprit

Among the negative effects of weeds include the serious losses on agricultural production due to them, estimates of which vary across countries and among crop species (Tab. 1).

Table no. 1 Estimated loss in crop yields due to weeds

Crop	Reduction in yields due to weeds (%)	Crop	Reduction in yields due to weeds (%)
Rice	41.6	Groundnut	33.8
Wheat	16.0	Sugarcane	34.2
Maize	39.8	Sugar beet	70.3
Millets	29.5	Carrot	47.5
Soybean	30.5	Cotton	72.5
Gram	11.6	Onion	68.0
Pea	32.9	Potato	20.1

(Source: http://eagri.org/eagri50/ AGRO304/pdf/lec01.pdf).

The highest loss in crop production is reported in the least developed countries (25%), followed by less developed countries (10%) and the least in most developed countries (5%) (http://eagri.org). Weeds compete with crops for water, soil, nutrients, light, and space, and thus reduce crop yields. They deprive crops in their nutrient uptake by an estimate of 47% of nitrogen, 42% phosphorous, 50% potassium, 39% calcium and 24% magnesium (http://eagri.org).

Additionally, they act as alternate hosts that harbour insects, pests and diseases and other micro-organisms (Tab. 2) and are detrimental to human health, i.e. causing hay fever and asthma, dermatitis, itching, inflammation, African sleeping sickness, and malaria and encephalitis caused by mosquitoes.

Other negative effects of weeds on agriculture are as follows:

- downgrade quality and reduce consumer acceptability of

agricultural produce mixed up with weed seeds due to the possible harm to human health, odd odour imparted and inconvenience in eating;
- interfere with agricultural operations such as land preparation, mechanical sowing and harvesting, leading to increased expenditure on labour, equipment and chemicals for their removal;
- poison risk to livestock, or if edible, may taint meat, milk, eggs;
- impede livestock movement or entangle animals.

Table no. 2 Alternate hosts of some important pests and diseases

Crop	Pest	Alternate host
Red gram	Gram caterpillar	*Amaranthus*, *Datura*
Castor	Hairy caterpillar	*Crotalaria* sp.
Rice	Stem borer	*Echinochloa*, *Panicum*
Wheat	Black rust	*Agropyron repens*
Pearl millet	Ergot	*Cenchrus ciliaris*
Maize	Downy mildew	*Saccharum spontaneum*
Tobacco	TMV, CMV	*Chromolaena odorata*

(Source: http://agropedia.iitk.ac.in).

In aquatic environment, weed effects include:
- blocking the flow of water in canals, water-transport system and drainage system, rendering navigation difficult (http://eagri.org);
- dense growth of aquatic weeds on water surface render it hypoxic, which kill the fishes, and impede fishery activities.

As environmental weeds, the effects include:
- nuisance and fire hazard along roadsides, idle lands and forests;
- allelopathic effects, producing chemicals which discourage growth of other plants (i.e. *Imperata cylindrica*);
- outcompete native plants and reduce biodiversity, or threaten endangered species.

On the other side, much advantage could also be said of weeds thus, they can be considered of ambivalent status. Not all weeds are detrimental. There are numerous cases of weeds being detrimental on some species, people or communities; but beneficial on others. Still, there are also cases of being weeds at one time but useful on some other point in time. Next we shall examine the many uses of weeds.

Weed as food

Weeds by definition are unwanted but what others may not know is that many of these culprits are actually edible and nutritious (Tab. 3). So, “eat your weeds” and enjoy their advantage. Growing among the desired field crops, in open idle soil or a place in the garden, they just grow themselves, and offer “natural grocery”. This is a common scenario in many rural communities in the Philippines where people are food-resourceful and freely “forage” on weedy and wild plant species (Fig. 1). For definition, we refer to weedy species here as those plants – either commercial or underutilized, encroaching an ecosystem where they are not supposed to be in. They are important plant resource that diversifies our food at the table, alleviating hunger and malnutrition. Malten (2010) refers to the Amaranth weed as an unexpected or gratuitous benefit, which he termed as manna from heaven. Biblically, manna is described in Exodus 16:31 (The Good News Bible, Today’s English Version) as food which looked like a small white seed and tasted like

thin cakes made with honey. Manna is a substance miraculously supplied as food to the Israelites in the wilderness.

Table no. 3 Weed and weedy species utilized for food (as vegetable or as raw material in food processing), and other uses

Species	Preparation	Source
Amaranthus viridis L.	Tops for salad and other viands Boiled feedstuff for hogs	pers. comm.
Amorphophallus paeoniifolius Denst. Nicholson	Young petiole for sautéed dish	Antonio et al. (2018) Antonio et al. (2011)
Centella asiatica (L.) Urb.	For vegetable viand Has medicinal properties	pers. comm.
Clitoria ternatea L.	Tops for viand	pers. comm.
Coccinia grandis (L.) Voigt	Tops for viand	pers. comm.
Corchorus olitorius L.	For various vegetable dishes	pers. comm.
Crassocephalum crepedioides (Benth.) S. Moore	Tops blanched for salad Cooked with other leafy vegetables Good for anemia	Antonio et al. (2018) Antonio et al. (2011)
Ipomoea triloba L.	Tops for viand	pers. comm.
Mollugo verticillata L	Tops blanched for salad	Antonio et al. (2018) Antonio et al. (2011) Maghirang et al. (2018)
Nasturtium officinale W.T. Aiton	Tops blanched for salad mixed in mungbean viand	Antonio et al. (2018) Antonio et al. (2011)
Portulaca oleracea L.	Shoots for vegetable Boiled feedstuff for hogs	pers. comm.
Rubus rosifolius Sm.	Ripe fruits eaten raw Processed into wine, jams	Antonio et al. (2018) Antonio et al. (2011)
Solanum americanum Mill.	Tops for chicken 'tinola' or fish stew Blanched for salad	Antonio et al. (2018) Antonio et al. (2011)
Talinum triangulare Willd.	For vegetable dish 'adobo'	Sopsop and Buot (2009)
Tetrastigma harmandii Planch.	Souring ingredient in meat and fish dishes	Antonio et al. (2018) Antonio et al. (2011)
Trianthema portulacastrum L.	Tops for viand Boiled feedstuff for hogs	pers. comm.
Wild *Dioscorea*	Processed into various food products	Legaspi et al. (2018)

One of the weed species, which is an important vegetable in Ilocos Norte, Cagayan, Pampanga, Tarlac and Palawan, among others, is *Mollugo verticillata* L., a member of Molluginaceae family (see Tab. 3). Locally called papait and salsalida (carpetweed, Engl.), it is a widespread weed in the Ilocos Province, growing in corn fields after rice harvest, in ponds upon drying up in summer months (February to May), or in potted ornamentals. Loving its moderate to extremely bitter taste, the people blanch the shoots and young leaves for vegetable salad, and mix tomato and fish paste to taste

(Antonio et al. 2018). In addition, many rural folks, especially in Paoay, Ilocos Norte where the plant remains a weed in cornfields (Fig. 2c), earn additional farm income by wild-collecting or gathering and selling. While it is a weed by growth in Ilocos Norte, *M. verticillata* is a cash crop in the provinces of Pampanga and Tarlac, serving as an important source of family income (Fig. 2d-f) (Oraye, pers. comm.).

Figure no. 1 A farm family in Ilocos Norte, Philippines depending on wild weedy species for vegetable (Photo by M.A. Antonio)

Figure no. 2 *Mollugo verticillata*, a crop weed utilized for vegetable.
a-growth habit; b-vegetable dis; c-as weed in cornfields; d÷f-commercial growing and marketing in Tarlac, Philippines. Photo by M.A. Antonio (Fig 2a÷c) and C.D. Oraye (Fig 2e÷f).

a

b

c

d


e


f

Another weed species utilized as vegetable is *Nasturtium officinale* W.T. Aiton (Brassicaceae), locally called tapsuy (Ilk.) or watercress (Engl.) (see Tab. 3; Fig. 3). It is a semi-aquatic to aquatic floating weed growing wild in riverbanks, pond borders and aquic soil conditions. According to the local folks in Adams, a municipality in Ilocos Norte, the weed thrives well only in clean bodies of water, but rot in polluted or dirty water. The tops are blanched for salad, mixed with tomato or vinegar and fish paste, or mixed as vegetable topping in mungbean viands (Antonio et al. 2018). The plant has peppery, tangy taste. It is also reported rich in Vitamin C, B1, B6 and E, potassium, iron, calcium, magnesium, manganese and zinc.

Figure no. 3 *Nasturtium officinale* (Photo by M.A. Antonio)
a-growth habit; b-habitat

a

b

The wayside weeds *Rubus rosifolius* and wild *Dioscorea* are also utilized as raw materials for processing of wine, jam and fruit preserve; and delicacies and processed products, respectively (see Tab. 3). Fruits of *R. rosifolius* are also eaten raw when ripe. Meanwhile, Legaspi et al. (2018) have processed various food items out of tubers of wild yams. The products include choco-chip cookies, lengue de cerda, peanut-raisin bar, kroepeck, guipang, cheesecake, pacencia, cake and macaroons, and are now sold under the trade name yam d'elites.

Weed as Medicine

Many weed species offer a "natural pharmacy" so "cure your ailments with weeds". They are rich in phytochemicals or other secondary metabolites, which exhibit various biological activities. Thus, they have potential for medicine, herbal, nutraceutical and pharmaceutical. Several weedy species from Ilocos Norte were found rich in phytochemicals (Tab. 4) such as alkaloid, coumarin, flavonoid, tannin, terpenoid, xanthoprotein, saponin, (Agngarayngay et al. 2015). The phytochemicals exhibit different biological activities. Flavonoid is a known anti-oxidant, anti-virus, anti-microbial, anti-inflammatory, anti-cancer and anti-tumor. Meanwhile, phenol is responsible for color and sensory attributes of plants, and a potent anti-oxidant, anti-cancer and anti-tumor. Steroid likewise is anti-inflammatory, sedative and insecticidal. Terpenoid gives flavor and aroma to plants and a main component of essential oil, used in food and cosmetics, antioxidant, anti-carcinogenic, anti-malarial, anti-ulcer, hepaticidal and antimicrobial. Lastly, coumarin is used in food, cosmetics and agrochemical industries, and an anti-coagulant, immuno-stimulatory, anti-inflammatory, antibacterial, anti-tumor and anti-cancer. In addition to the food value and phytochemical components of *M. verticillata* has been reported also to exhibit

antioxidant property through its DPPH scavenging activity (Antonio and Vivit 2017).

Table no. 4 Phytochemical components of common weed species from Ilocos Norte

Species	Plant Part	Phytochemical Content
Amorphophallus paeoniifolius Denst. Nicholson	immature shoots	coumarin, flavonoid, tannin, terpenoid, xanthoprotein
	corm	terpenoid, xanthoprotein
Nasturtium officinale W.T. Aiton	stem and leaves	terpenoid, xanthoprotein
Tacca leontopetaloides	tuber	saponin and terpenoid
	stem and leaves	coumarin, flavonoid, terpenoid and xanthoprotein
Mollugo verticillata L.	stem and leaves	coumarin, flavonoid, saponin, terpenoid and xanthoprotein
Rubus rosifolius Sm.	fruit	alkaloid, coumarin, flavonoid, saponin, terpenoid, xanthoprotein
	stem and leaves	coumarin, flavonoid, saponin, tannin, terpenoid, xanthoprotein
Smilax sp.	stem and leaves	coumarin, flavonoid, terpenoid, xanthoprotein
Solanum americanum	fruit	alkaloid, flavonoid, saponin, terpenoid, xanthoprotein
Tetrastigma harmandii Planch.	leaftops	coumarin, flavonoid, saponin, xanthoprotein

(Source: Agngaryngay et al. 2015)

Weed as Raw Material for Construction and Handicrafts

Weeds are “natural hardware” providing locally-available and easily-accessible raw materials for various applications i.e. construction and handicraft (Tab. 5). A good example of weed species used for such purposes are *Imperata cylindrica* L. and *Eichhornia crassipes*, respectively, *I. cylindrica*, locally called ”cogon”, is used as roofing material in rural communities, cottages and nipa hut-inspired landscapes and gardens. Meanwhile, *E. crassipes* (waterlily) is now a common raw material for handicrafts i.e. bags and baskets. The latter is also used as substrate for *Pleurotus* mushroom production.

Weed as Environment Restorer

The fourth of the many uses of weeds is environmental in nature (Tab. 5). Weeds help to conserve soil moisture and prevent erosion. A ground cover of weeds will reduce the amount of bare soil exposed helping to conserve nutrients, particularly nitrogen which could otherwise be leached away, especially on light soils. *Chrysopogon zizanioides* (L.) Roberty, commonly called vetiver grass, has been utilized for low-cost soil and water conservation, on-and off-farm land and water sources stabilization and remediation of polluted soils, and enhancement of water quality for irrigation purposes (Oshunsanya and Aliku 2017). A densely tufted bunch grass, *C. zizanioides* plays a vital role in watershed protection by slowing down and spreading runoff harmlessly on the farmland, recharging ground water, reducing siltation of drainage systems and water bodies, reducing agro-chemicals loading into water bodies and for rehabilitation of degraded soils (Oshunsanya and Aliku 2017).

Weeds also provide food and shelter for natural enemies of pests. The actual presence of weed cover may be a factor in increasing effectiveness of biological control of pests and reducing pest damage. Some weeds can also be valuable indicators of growing conditions in a field, i.e. water levels, compaction and pH. Additionally, some species are deep divers and feeders, absorbing water and nutrients from the soil. Through capillarity movement, they provide moisture to companion crops growing on the soil surface (Coannouer 1950).

Table no. 5 Other benefits derived from weeds

Use	Species	Feature	Source
Medicine, herbal, nutraceutical, pharmaceutical	*Mollugo verticillata* L.	Rich in phytochemical	Antonio and Vivit (2017)
	Mimosa pudica L.	Has antioxidant activity	
	Abrus precatorius L.		
	Phyllanthus niruri L.		
Housing and handicraft industry	*Imperata cylindrica* (L.) P. Beauv.	Roofing material	
	Eichhornia crassipes Mart. Solms	Raw material for bags and other handicrafts	
	Cyperus sp.	Raw material for woven mats	
	Agave cantula	Raw material for rope	
	Blue grass	Raw material for soft broom	
Ecological	*Chrysopogon zizanioides* (L.) Roberty	For erosion control	Oshunsanya and Aliku (2017)
	Paspalum conjugatum Berg.	Phytoremediation	De los Angeles and Cuevas (2018)
	Alternanthera sessilis		Napaldet and Buot (2017)
	Pennisetum purpureum		
	Amaranthus spinosus		
	Amarnthus viridis		
	Cynodon dactylon		
	Various species	Conserve soil moisture	
		Enhance soil microclimate	
		Biological control of pests	
		Capillarity movement of water for companion crops	
		Carbon sequestration	
Other Uses	*Mollugo verticillata* L.	Income supplement (Sold on small scale)	Antonio et al. (2018)
	Nasturtium officinale		Antonio et al. (2011)
	Schismatoglottis calyptrata (Roxb.) Zoll. & Moritzi		
	Amorphophallus - paeoniifolius Denst. Nicolson	Silage, boiled feedstuff for hogs	Antonio et al. (2018)
	Amaranthus spp.		Antonio et al. (2011)
	Althernanthera sp.		
	Various species	Fodder for ruminants	

Weed as Feeds

Weeds are food for many animals. Many grass species, i.e. *Brachiaria*, *Echinochloa*, *Eleusine*, *Cynodon*, *Paspalum*, *Panicum*, *Axonopus*, etc., are used as fodder for ruminants; while other species, i.e. *Amorphophallus paeoniifolius* Denst. Nicolson, *Amaranthus* spp. and *Althernanthera* sp., are for silage or mixed in swill or cooked feedstuff for hogs (Antonio et al. 2018; Antonio et al. 2011).

With all these evidences supporting the many uses of weeds, we now make a strong stand that the term weed is contextual, and would like to argue the current bias outlook on them. The definition of weed varies depending on time, place, people doing the defining or on prevailing contexts. The term is subjective in nature; in the same manner that it is also subjective which weed to consider a threat, or which species can be given a weed status. We have dubbed the World's 10 worst weeds, and we also have harmful weeds list, noxious weeds list, etc. in many countries. So we now propose to no branding, labeling or tagging of any particular plant species as weed on a fixed status. It would not be good to attribute the name weed to any plant species because they have a lot of good benefits. The economic and environmental values presented above could speak well for them not to be branded or labeled exclusively or entirely as weed.

Crosby (2004) positively described weeds as the Red Cross of the Plant World owing to their role as ruderal species, which quickly colonize disturbed lands (due to ecological disasters), preventing erosion, providing food for animals and rebuilding an ecosystem in the process of ecological succession. The author likewise suggested the use of the adjective opportunistic instead of noxious or invasive. But the term has also been opposed by one of us (Dr. I.E Buot Jr.) because the former term has negative connotation too; thus the term could be resourceful rather than Crosby's opportunistic. Lastly, Ralph Waldo Emerson described weeds "as plants whose virtues have not yet been discovered" (Crosby 2004). Emerson's definition resonates in the many uses presented above.

Weeds are not intentionally sown or propagated; they just grow by themselves. They became weed because we were not prepared for their upsurge. Effective and efficient weed management is therefore a must to prevent them from interfering with crop, livestock, human and the environment. Farmers, agriculturists, development planners and the general public should have sufficient knowledge and openness of mind on the possible upsurge and corresponding actions to be taken. Actions to be taken with possible shifts in weed flora, and threats associated with buried with seeds should be integrated in management plans. Exploring the potential contributions in various facets of life and the environment as suggested by Emerson's definition should also be integrated in any weed management program. Thus, a pro-active search for their potential should be done. When they proved useful, a shift from 'weed' status to 'plant' status' follows and they will become important resources for food sufficiency, health and nutrition, industry, income generation, and environmental nurturing. An excellent initiative exploring the health potential of many plants, which include many weed species, is the Department of Science and Technology's (DOST) Tuklas Lunas Program (http:// pchrd.dost.gov.ph). The Philippine Council for Health Research and Development is the DOST council implementing the Tuklas Lunas Program. This drug discovery program has established several Tuklas Lunas Development Centers (TLDC) based in higher education and research institutions in the country.

Conclusions:

Weeds do harm but many of them have numerous benefits to humans and the environment. The data presented are hoped to elevate our current outlook on them from pejorative and noxious plants to beneficial

and promising plants. Efficient weed management programs should be implemented to minimize their becoming noxious and invasive. Well-informed and pro-active populace will help manage these plants properly and make use of their potential sustainably. Weeds should not be abhorred as a species but should be lived in harmony with instead.

Rezumat:

REDEFINIREA CONCEPTULUI DE BURUIENI

Termenul de buruiană este perceput negativ de majoritatea oamenilor, dacă nu de toți. Noi am încercat să citim literatura de referință și să analizăm de ce este așa. S-a descoperit că oamenii au anumite prejudecăți și am argumentat în acest sens. Am prezentat un context utilitar care evidențiază numeroasele beneficii economice și de mediu ale buruienilor. Propunem ca nici o specie de plantă să nu fie etichetată sau marcată ca buruiană cu un statut fix. Contextele prezentate justifică în mod adecvat ideea că buruienile nu trebuie să fie detestate de nimeni. Mai degrabă, toată lumea ar trebui să trăiască armonios cu acest grup de plante.

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